

**Effects and outcomes of the global warming alarm:  
A forecasting project using the structured analogies method**

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**NOTE: This is a study in process. We seek peer review from others, especially with evidence that would challenge our findings or conclusions.**

**ABSTRACT**

We summarize evidence showing that the global warming alarm movement has more of the character of a political movement than that of a scientific controversy. We then make forecasts of the effects and outcomes of this movement using a structured analysis of analogous situations—a method that has been shown to produce accurate forecasts for conflict situations. This paper summarizes the current status of this “structured analogies project.”

We searched the literature and asked diverse experts to identify phenomena that could be characterized as alarms warning of future disasters that were endorsed by scientists, politicians, and the media, and that were accompanied by calls for strong action. The search yielded 71 possible analogies. We examined objective accounts to screen the possible analogies and found that 26 met all criteria. We coded each for forecasting procedures used, the accuracy of the forecasts, the types of actions called for, and the effects of actions implemented.

Our preliminary findings are that analogous alarms were presented as “scientific,” but none were based on scientific forecasting procedures. Every alarming forecast proved to be false; the predicted adverse effects either did not occur or were minor. Costly government policies remained in place long after the predicted disasters failed to materialize. The government policies failed to prevent ill effects.

The findings appear to be insensitive to which analogies are included. The structured analogies approach suggests that the current global warming alarm is simply the latest example of a common social phenomenon: an alarm based on unscientific forecasts of a calamity. We conclude that the global warming alarm will fade, but not before much additional harm is done by governments and individuals making inferior decisions on the basis of unscientific forecasts.

Key words: DDT, decision making, evidence-based forecasts; global cooling; lobby groups; popular movements; precautionary principle; public policy; scenarios; scientific method.

## Introduction

To date, no scientific forecasts support the alarm over dangerous manmade global warming. Improper procedures were used to forecast dangerous warming, and there has been no validation to support their use (Green and Armstrong 2007a; Green, Armstrong and Soon 2009). The basic claim by those who promote alarming predictions of dangerous manmade global warming is that nearly all scientists agree that it will occur. However, voting by scientists on what will happen in the future is not a proper approach to science. Moreover, the claim that nearly all scientists agree has been shown to be false by surveys and by petitions signed by identified scientists with relevant qualifications (e.g., Bray and von Storch 2007; Robinson, Robinson and Soon 2007). Despite published and verifiable evidence that the claim of scientific consensus is false, global warming alarmists continue to repeat this claim.

### Basis of the global warming forecasts

In 1896 the Swedish Nobel Prize winner in chemistry, Svante Arrhenius, speculated about the effect of increases in atmospheric carbon dioxide (CO<sub>2</sub>) and concluded that it would cause warming. He appears to have extrapolated his conclusion from limited observational data<sup>1</sup>.

Sawyer (1972) summarized what was known about the role of CO<sub>2</sub> in the atmosphere, and forecast that the 25% increase predicted to occur by 2000 would lead to an increase of 0.6 °C in world temperature. As best as can be judged from the paper, the prediction was based primarily on Sawyer's unaided judgment.

Climate change is a complex phenomenon about which there is a great deal of uncertainty. The extent of the uncertainty about the situation can be seen in recently published books and papers that examine the physical evidence, such as Idso and Singer (2009) and Soon (2009). In such situations, empirical research on forecasting has led to a surprising conclusion: scientists' judgments of what will happen are useless as forecasts (e.g., see Armstrong 1985; Tetlock 2005).

There is no evidence to suggest that accuracy could be improved by coding scientists' judgments into computer models, as was done when the Club of Rome revisited Malthus's speculations about the relationship between population and resources. Indeed, at least one of the key people responsible for such models of climate admits that they produce scenarios (stories about the future), not forecasts (Trenberth 2007).

### An audit of global warming climate models

As with any other science, say medicine, forecasting calls for evidence about which procedures will work best given the conditions. This means that proposed forecasting procedures need to be validated by empirical tests that compare their performance with that of other procedures.

Scientific knowledge about forecasting draws upon a large body of validation research from many fields in the social and physical sciences since the 1930s. This knowledge has been summarized in the form of 140 principles in a handbook edited by Armstrong (2001) and also on the Internet at [forecastingprinciples.com](http://forecastingprinciples.com). An example of a principle is "Obtain all of the important data: For time series, use all available time periods unless a strong *a priori* case can be made that a discontinuity has occurred."

We (Green and Armstrong 2007a) used these scientific (evidence-based) forecasting principles to audit the procedures used by the United Nations' Intergovernmental Panel on

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<sup>1</sup> See description on Wikipedia and original paper at <http://www.globalwarmingart.com/images/1/18/Arrhenius.pdf>

Climate Change (IPCC) to derive their scenarios. We found that they violated 72 out of the 89 principles that were relevant to the situation—such as the requirement for full disclosure of data and methods. In an important situation, where expensive policy changes are being called for, there is no reason why policy makers, political leaders, or voters should tolerate any violations of scientific principles. Think of the checklists used before large commercial airplanes take off: All proper procedures must be followed.

### **Assessing predictive validity**

The accuracy of forecasts from evidence-based scientific forecasting methods should be tested in the situation of interest. Curiously, many organizations that we have dealt with do not understand the importance of validation tests and instead claim that “things have changed” or “our problem is different” and that evidence from the past or from other situations is therefore not relevant for them. This refutes a basic assumption of scientific forecasting which is that we can only predict the future by the past. Thus, proposed forecasting methods should always be tested for predictive validity against out-of-sample data. No such testing was done by the IPCC, neither was it done by those governments and lobby groups that adopted the IPCC’s forecasts.

In order to validate forecasting procedures for a new problem, it is necessary to choose an appropriate benchmark method. In complex and uncertain situations, such as global climate change, the conclusion from prior research (Armstrong 2001) is that simple methods are best. In the case of climate, simple extrapolations are likely to perform well compared to other methods. But this conclusion is counter-intuitive for those who are unfamiliar with the research.

An inspection of historical temperature data reveals that temperatures went up and down over short and long periods and reversed direction without obvious pattern. Thus, for climate change, we proposed the no-change model for our initial tests. There are other evidence-based models that might be considered, but it seemed sensible to start with the simplest. The no-change model violates some principles, such as “use all relevant data,” thus we expect that further improvements could be made should we be able to obtain funding for a more ambitious test.

We conducted a forecasting method validation using global mean temperature data from 1850 through 2008 (Green, Armstrong, and Soon 2009). Although we had found that the IPCC’s procedures were not valid, we nevertheless compared their predictive validity with that of the no-change model. The validation is compromised by questions about the validation data—for example, much of the apparent broadly upward trend in the data may be due to the heat island effects, changes in instrumentation, measurement errors, and even falsification (e.g., Johnson 2009). The selection of the time period favors the IPCC forecasts in that the models were developed based on data collected since the start of the industrial revolution around 1850. In particular, the models were calibrated using temperature data that show an upward trend over this time period. In contrast, the no-change model ignores data about trends.

We started with year 1851 making annual forecasts for 1- to 100-year horizons. By stepping through the data one year at a time, we obtained a sample of 7,550 forecasts for the period up through 2008. For the IPCC method, we used their 1992 report projection of temperature increasing at a rate of 0.03°C per year consequent upon exponentially increasing human greenhouse gas emissions. Given that the IPCC approach violates many scientific forecasting principles, we hypothesized that the no-change model, which violates few principles, would provide forecasts that were substantially more accurate.

Each forecast was compared with the temperature record and we calculated absolute errors. Overall, the IPCC forecast errors were 7.7 times larger than those from the no-change model. The longer the forecast horizon, the worse was the relative accuracy of the IPCC forecasts. For example, for 305 long-term forecasts (91-100 years ahead), the average IPCC forecast error was 12.6 times that of the no-change model forecasts. The no-change model

forecasts were so accurate that improved accuracy would be unlikely to be of practical value. For example, the mean absolute error for forecasts made for 50-years in the future averaged 0.24°C.

Contrary to commonly held beliefs assessments of how well a model can fit historical time-series data are not relevant to assessing predictive validity. For example, atmospheric carbon dioxide (CO<sub>2</sub>) concentration correlates 0.86 with global mean temperature measurements from 1850-2008. In contrast, the no-change forecasts we just described are, of course, not correlated with temperatures.

If proper forecasts of warming did in fact exist, it would also be necessary, in order to make rational decisions, to forecast the *effects of global warming*. There is much concern in alarmist quarters that there might be net harm from warmer global average temperatures (dangerous warming). In contrast, in 1896, Svante Arrhenius speculated global warming would be beneficial. However, there are to date no scientific forecasts available on the net effects of global warming.

To assess forecasts of the one effect of global warming, we had audited the forecasting procedures that were used in two government reports that the Department of the Interior relied upon for forecasts on how global warming would affect polar bears (Amstrup, et al. 2007; Hunter, et al. 2007). The reports' authors forecast that there would be substantial declines in the population of polar bears. These forecasts used improper methodology; overall they clearly violated 46% of the relevant principles and apparently violated another 23%. No validation studies were done on the forecasting procedures used in the preparation of these government reports. The resulting forecast of a sharp decline in the polar bear population stands in contrast to our evidence-based method, which forecasted that the polar bear population would continue to grow. We considered doing a validation, but the government agencies refused to provide the data that they claimed to have used for polar bear populations (Armstrong, Green and Soon 2008).

Finally, forecasts are required of the costs and benefits of any *steps taken to control climate change*. Here again, we were unable to find any scientific forecasts to show that procedures could reduce global temperatures in a cost-effective manner.

Various estimates have suggested that the U.S. and other governments are spending billions of dollars (Nova 2009) on “research” to support forecasts of manmade global warming and its dangers. Despite these expenditures, there appears to be no interest in applying scientific methods to the problem.

Given the lack of scientific forecasts and lack of interest in scientific forecasting procedures among global warming alarmists<sup>2</sup> and the evidence from opinion polls that the tendency of people to believe the alarm is associated with their party affiliation, we have concluded that it is essentially a political movement in the U.S. (Pew Research Center 2008) and elsewhere (Klaus 2009).

Leaders and followers of political movements are typically immune from evidence that challenges their beliefs. This occurs not only because they currently hold strong beliefs (e.g., see Batson 1975), but also because many people do not use rational “cost-benefit” decision-making procedures (Larrick et al. 1993).

To predict the outcome of this political movement, we used a forecasting method that has been shown to be useful for forecasting decisions in conflict situations: structured analogies (Green and Armstrong 2007b).

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<sup>2</sup> <http://blogs.telegraph.co.uk/news/jamesdelingpole/100017393/climategate-the-final-nail-in-the-coffin-of-anthropogenic-global-warming/>

## **Structured analogies: An evidence-based method for making forecasts about conflicts**

Analogies are often used to support favored forecasts. Unfortunately, while analogies are useful for persuasion, they have not contributed to the accuracy of forecasts because people tend to be biased in their search for analogies, their selection of analogies, and the way that they make use of information from analogies. We reasoned that analogies do contain useful information about how people have behaved in the past and that the information would be useful for forecasting if analogies were selected and analyzed in an objective manner.

We tested the structured analogies procedure for predicting decisions in eight conflict situations. We presented descriptions of actual, but disguised or obscure situations, and asked experts, working individually, to think of analogies to the “target” situations. Then for a given situation we asked the experts to rate how similar the analogous situation is to the target situation. We used a predetermined mechanical rule to make the forecasts; namely we used the outcome of the analogy the expert rated as most similar to the target as the forecast. If they recognized the situation their responses were excluded. As part of the experiment’s design, we also obtained predictions about the situations from experts who used their unaided judgment. That is, they were not given any instructions on how to make their predictions.

We found that unaided experts’ forecasts were, at 32% accurate, little better than chance at 28%<sup>3</sup>. In contrast, 46% of structured-analogies forecasts were accurate. Among experts who were able to think of two or more analogies and who had direct experience with their best analogy, 60% of forecasts were accurate. The use of a mechanical rule was crucial to accuracy (Green and Armstrong 2007b).

### **Applying structured analogies to the global warming alarm movement**

The structured analogies procedure we used for this study was as follows:

1. *Identify possible analogies* by searching the literature and by asking experts with different viewpoints to nominate analogies to the target situation: alarm over dangerous manmade global warming.
2. *Screen* the possible analogies to ensure they meet the stated criteria and that the outcomes are known.
3. *Code* the relevant characteristics of the analogous situations.
4. *Forecast target situation outcomes* by using a predetermined mechanical rule to select the outcomes of the analogies.

### **Identifying possible analogies**

Our search for analogies to the alarm over dangerous manmade global warming started in January 2009. We reviewed literature about previous alarms. We also sought suggestions by sending personal requests to diverse experts, to formal email lists<sup>4</sup>, and to an informal list of 148 experts including those scientists skeptical of the alarm over dangerous manmade global warming<sup>5</sup> and the IPCC Working Group 1 authors (Randall, et al. 2007). We also handed out questionnaires at conferences we attended, and posted requests on websites.

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<sup>3</sup> There were between three and six possible decisions in these situations.

<sup>4</sup> Climate Science Google group, Climate Science Coalition Yahoo group, CMDNET, ELMAR, IIF-discussion, JDM Society, PSRT-L, Scientific Study of International Processes (SSIP), speakers at the 2009 International Conference on Climate Change in New York

<sup>5</sup> [http://en.wikipedia.org/wiki/List\\_of\\_scientists\\_opposing\\_global\\_warming\\_consensus](http://en.wikipedia.org/wiki/List_of_scientists_opposing_global_warming_consensus)

Here is how we posed the question to the experts:

“The Intergovernmental Panel on Climate Change and other organizations and individuals have warned that unless manmade emissions of carbon dioxide are reduced substantially, temperatures will increase and people and the natural world will suffer serious harm. Some people believe it is already too late to avoid some of that harm.

Have there been other situations that involved widespread alarm over predictions of serious harm that could only be averted at considerable cost? We are particularly interested in alarms endorsed by experts and accepted as serious by relevant authorities.”

By October 2009 we had a list of 71 proposed analogies of varying merits. We received formal responses to our email appeal from 11 experts who between them proposed 24 unique analogies, and informal responses from a further four experts whose contributions brought the total to 39 unique analogies proposed by experts. We acknowledge the individual experts who responded with proposed analogies. The rest of the proposed analogies were situations that we were familiar with or which we identified in our review of the literature.

### **Screening the possible analogies**

We screened the proposed analogies to find those for which the outcomes were known and that met the criteria of similarity to the global warming alarm. Our criteria for similarity were that the situations must have involved alarms that were:

1. based on forecasts of material human catastrophe arising from effects of human activity on the physical environment,
2. endorsed by scientists, politicians, and media, and
3. accompanied by calls for strong action

We independently assessed whether the proposed analogies met the three criteria for selection by searching for and reviewing descriptions of the situations, mostly found on the Internet. The findings in this draft are based on our initial selection of 26 analogies, which are listed in Exhibit 1.

## Exhibit 1: Analogies to the alarm over dangerous manmade global warming

	<b>Analogy</b>	<b>Year</b>
1	Population growth and famine (Malthus)	1798
2	Timber famine economic threat	1865
3	Uncontrolled reproduction and degeneration (Eugenics)	1883
4	Lead in petrol and brain and organ damage	1928
5	Soil erosion agricultural production threat	1934
6	Asbestos and lung disease	1939
7	Fluoride in drinking water health effects	1945
8	DDT and cancer	1962
9	Population growth and famine (Ehrlich)	1968
10	Global cooling; through to 1975	1970
11	Supersonic airliners, the ozone hole, and skin cancer, etc.	1970
12	Environmental tobacco smoke health effects	1971
13	Population growth and famine (Meadows)	1972
14	Industrial production and acid rain	1974
15	Organophosphate pesticide poisoning	1976
16	Electrical wiring and cancer, etc.	1979
17	CFCs, the ozone hole, and skin cancer, etc.	1985
18	Listeria in cheese	1985
19	Radon in homes and lung cancer	1985
20	Salmonella in eggs	1988
21	Environmental toxins and breast cancer	1990
22	Mad cow disease (BSE)	1996
23	Dioxin in Belgian poultry	1999
24	Mercury in fish effect on nervous system development	2004
25	Mercury in childhood inoculations and autism	2005
26	Cell phone towers and cancer, etc.	2008

### Coding the analogies

We coded the analogies on the following items:

1. Forecasting method.
2. Did the proposed action involve substantive government intervention?
3. Accuracy of forecasts was rated on a -1 to +1 scale  
(-1 =wrong direction, 0=no, or minor, effect; +1=accurate)
4. Actual government intervention as to whether it occurred or not
5. Outcome of government policies to date on the value of their net benefit on a -1 to +1 scale
6. Persistence of government policies, to-date, on a 0 to 2 scale  
(0=reversed; 1=no or little change; 2=strengthened)

## Describing the analogies

In order to facilitate peer review by experts on the analogous situations, we are preparing brief descriptions of each (this task is still in the early stages). The descriptions include the following elements and references to sources of information (we will post the descriptions and our key sources at [publicpolicyforecasting.com](http://publicpolicyforecasting.com)):

1. Forecasts of impending catastrophe
2. Methods used to forecast the catastrophe
3. Actions called for (actions by government or by others)
4. Salient endorsements of the forecast by scientists and politicians
5. Challenges to the forecast
6. Outcomes of each conflict over the alarming forecast and calls for action, including forecast accuracy

**Exhibit 2** provides an example of the description of one of the analogies:

### Exhibit 2: Example analogy description

*Title:* DDT and cancer

*Date:* Started in 1962 based on a book, Rachel Carson's *Silent Spring*

*Forecast of impending disaster:* DDT was claimed to be a dangerous cancer-causing chemical. Publication of the book was followed by what some called a national hysteria. The alarm over forecasts of DDT's harmful effects combined concerns about the health and wellbeing of people with concerns about other species. Papers by scientists purported to demonstrate harmful effects on people from DDT exposure.

*Forecasting method:* A scenario based on the author's speculations from various pieces of information about the effects of DDT. There was no direct evidence that DDT harmed people.

*Actions called for:* Governments were asked to ban exports of DDT and World Bank loans would be banned to countries that used DDT.

*Endorsements of and challenges to the forecast:* Leading scientists from institutions (such as Stanford University), politicians (such as Senator Al Gore,) and a report by a commission appointed by President Carter. The reports of the dangers were widely covered by the mass media.

*Outcomes of the conflict:* The U.S. Environmental Protection Agency (EPA) banned the use of DDT following an 80-day hearing in 1972. Europe and Africa, under pressure from international agencies, did too. No actual harmful effects on humans have been found to result from DDT. Millions of people have died from mosquito-born diseases such as malaria. The EPA decision was based on two studies of animals: the first could not be replicated and the second used a flawed experimental design.

*Source:* Edwards (2004); Waite (1994)

## Findings

### Nature of the forecasting methods

Recall that one of the criteria for selecting an analogy was that it must have been an alarm based on forecasts of a catastrophe that has not yet occurred. We could not find any situations where it was clear to us that scientific forecasting procedures had been used. Instead, we found that the alarming forecasts were experts' judgments, unaided by evidence-based forecasting methods. They could each be characterized as coming from one of three types of judgmental process, namely: (1) unrealistic mathematical models, (2) extrapolation to a near-zero dose of a genuine effect from a large dose, and (3) extrapolating that a hypothesized weak effect might become important over time or for a large population.

An example of the first judgmental process is Thomas Malthus's unsupported mathematical model of human population and resources. Malthus stated that human population would tend to increase at an exponential rate if unchecked, but that food production would increase only arithmetically. This led him to forecast that without measures to curb population growth, people would be faced with forced population reduction via famine and disease. Our initial analysis suggests that 3 of the analogous alarms were based on forecasts that could be characterized as coming from such a process.<sup>6</sup>

Extrapolating the effects of smoking on lung cancer and heart disease to second hand smoke is an example of the second judgmental process. Although the link between smoking and lung cancer is well established, we were unable to find evidence that exposure to second-hand tobacco smoke leads to increases in these diseases. Our initial analysis suggests that 7 of the analogous alarms were based on forecasts that could be characterized as resulting from extrapolation to a very small dose from the effect of a large dose.

Finally, the third judgmental process is a kind of speculation: "What *if* there is even just a small effect that might accumulate or that might be important when considered across a large population?" Speculation that low levels of toxins in the environment might be responsible for breast cancer when there was no evidence for this or any plausible biological mechanism could be characterized as coming from such a process. Our initial analysis suggests that extrapolation of a hypothesized weak effect was the most common forecasting procedure, with 16 of the alarms apparently based on this procedure.

### Role of government

Government action was called for in 25 of the 26 analogous situations.

### Coding of outcomes

We coded the outcomes. For example, the Administrator of the EPA banned DDT in the U.S. in 1972. The U.N. and W.H.O. withheld financial aid from developing countries to force them to stop using DDT. There has been no evidence found of any link between DDT and cancer in people but—without DDT and with substitute insecticides being more toxic and less effective—

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<sup>6</sup> These initial findings may change as we gain additional information on the analogies and as we obtain peer review.

insect-borne diseases have increased leading to millions of additional deaths and widespread sickness. Government policies have, as a consequence, been very expensive without any benefits accruing. Some restrictions and bans on DDT use continue to this day (Persistence = 1). This description draws heavily on Edwards (2004).

Inevitably, with such controversial situations as important alarms that were endorsed by senior scientists and political leaders, there may be differences of opinion even after the horizons of the forecasts behind the alarms have passed. As a consequence, we invite peer review on this paper and also ask people to post their ratings of the situations on [publicpolicyforecasting.com](http://publicpolicyforecasting.com).

The calls for action were followed by the implementation of government policies intended to address the alarm in 23 of the analogous situations. Among the analogous situations in which government action was taken, our initial assessment is that harm was caused by the government policies in 20 (as with DDT, the cost of the policies exceeded benefits) or policies were ineffective or the net effect was uncertain in 3. In none of the analogous situations were the policies clearly effective.

### **Accuracy of the alarming forecasts**

None of the 26 alarming forecasts that we examined was accurate. Based on analyses to date, 19 of the forecasts were categorically wrong (the direction of the effect was opposite to the alarming forecast), and the remaining 7 of the forecast effects were wrong in degree (no effect or only minor effects actually occurred).

### **Forecasts from structured analogies**

Our impression from analyzing the analogies is that global warming alarm is just another example in a long history of calamity forecasts similar to those described in *Extraordinary Popular Delusions And The Madness Of Crowds* (MacKay 1841), such as the “Thames Flood of 1 February 1524.”

The media give much attention to alarmists, but little to those who are skeptical of their claims. Alarms tend to fade out of the media as alarming forecasts fail to come true. The global warming movement has persisted despite failed forecasts that dangerous warming will happen quickly. In fact, temperatures have been flat to declining for more than a decade.

The analogies to global warming give the impression that the rate of alarms is increasing over time. Worrying (anticipating threats) is an advantageous trait when it leads to taking action to avoid real threats. We speculate that the increasing ease with which the latest alarms can be disseminated, and the increasing prosperity that provides many people with more time to worry about non-existential threats and to devote their energies to causes of their choosing, has led to an increase in alarms in recent years.

### **Forecasts about the dangerous manmade global warming movement**

Our analysis of the 26 analogies leads us to the following forecasts about the global warming movement:

1. The predicted disasters will not occur.
2. Costly government policies will continue to be implemented in response to the alarm.
3. The manmade global warming political movement will dissipate over the years.
4. Many government programs will remain in place.

## Discussion

To date, our broad findings have been insensitive to which of the 71 proposed analogies we include in our analysis. Of the 26 analogous alarms that met our criteria, all were based on forecasts derived from forecasting procedures that violated scientific forecasting methods. Not surprisingly, then, none of the forecasts were correct and all of the actions were harmful. We invite others to review our coding and to propose new analogies. The descriptions of the analogous situations will all be posted at [publicpolicyforecasting.com](http://publicpolicyforecasting.com). We are still in the early stages of this paper and we seek peer review, especially if it challenges or corrects our analyses.

Global warming alarmists appear to start with observations (e.g., winters have not been so severe in the Northeastern U.S. recently as they were when we were kids) then write stories about what might happen if the trend continues. More cynically, we speculate that some alarmists may start not with misplaced concern based on limited observation, but with ambitions to further their careers, achieve a political end, or become wealthy. The alarm is just a means to an end for them. Whatever the motivation, the story, or “scenario,” becomes their forecast.

Scenarios are not a scientific forecasting method and are not therefore a proper basis for public policy decisions.<sup>7</sup> Indeed, when we looked at alarms that were analogous to the alarm over dangerous manmade global warming, we found that they were all scary scenarios that turned out to be false alarms, rather than scientific forecasts.

Although the alarmists claim that their position is based on science, they do not follow the scientific methods when forecasting. For example, they do not provide full disclosure of methods and data, they do not consider competing hypotheses, and they draw conclusions that go beyond the evidence. There are also documented cases of alarmists falsifying data and of ignoring relevant data in their analyses. Corrections to their errors are not accepted and the alarmists resist citing contrary findings. The public release of hacked email correspondence between leading IPCC authors provides evidence of these behaviors (e.g., see Johnson 2009).

Extraordinarily, many leading alarmists claim that there is no need for them to follow scientific principles. For example, Stanford University biology Professor Stephen Schneider said, “each of us has to decide what is the right balance between being effective and being honest.” He also said “we have to offer up scary scenarios” (October 1989, *Discover Magazine* interview). Similarly, Al Gore stated, “I believe it is appropriate to have an over-representation of factual presentations on how dangerous it [anthropogenic global warming] is, as a predicate for opening up the audience to listen to what the solutions are” (May 9, 2006, *Grist* interview).

Stephen Schneider was active in the efforts to ban DDT, to get governments to act to prevent global cooling and, in recent years, to get the government to act to prevent global warming. In 2009, a filmmaker interviewed Professor Schneider about climate change for the documentary “Not Evil Just Wrong” and asked him why he had switched from global cooling in the 1970s to global warming currently. Stanford University, on Schneider’s behalf, prohibited the filmmakers from using the audio and video of the interview ([Lee 2009](#)). A number of other people who worked for government action to prevent global cooling are now active in the global warming movement, for example John Holdren and Paul Ehrlich ([Tierney 2009](#)). Going back a century, the first to alert the world to the possibility of global warming, Svante Arrhenius, was also a key figure in the eugenics movement, which was an alarmist movement concerned that the human race was threatened by the uncontrolled breeding of the “wrong” people.

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<sup>7</sup> Scenarios enhance the perceived likelihood that an event will occur. The more specific and detailed they are, the more likely people are to judge that the events portrayed will occur. This occurs despite the fact that, as more details that are added to a forecast, it is logically less likely that the forecast will be correct. (See Gregory and Duran, 2001, for a summary of evidence on the use of scenarios.)

We are not the first to say that alarmists are motivated by political rather than scientific objectives (see e.g. Simon 1992). Simon's claim that doomsayers were always wrong and that, in fact, the environment keeps getting better were unbelievable to many people who asked "But what about the other side's data?" Simon's answer: "There are no other data. I invite you to test for yourself that the conditions of humanity have gotten better." Following in Simon's footsteps, we invite you to find any scientific forecasts that support a manmade global warming catastrophe. We have been unable to find any.

In their efforts to support expensive interventions, alarmists point to the "precautionary principle." The precautionary principle is a political principle that is antithetical to the scientific approach (Green and Armstrong 2008). It is used as a way to win an argument over values while sidestepping a proper analysis of costs and benefits.

The burden of proof for government intervention should fall upon the advocates of intervention. In making a case, they would be expected to provide evidence that forecasts of all costs and benefits are based on proper scientific methods that have been validated. To ensure that a scientific approach was used in making the forecasts, each member of the research team should be required to sign an ethical statement that they have expertise in the relevant areas and that they have adhered to the highest scientific standards.

## **Conclusions**

We first provided evidence that those advocating actions to stop predicted global warming violate scientific principles of forecasting. As a result, their forecasts are unfounded. We showed that forecasts that adhere more closely to scientific forecasting procedures provide forecasts that are much more accurate.

Our research has led us to conclude that people can learn more effectively from history if historical knowledge is analyzed in a structured manner. The structured analogies method provides evidence-based procedures for doing so.

Using structured analogies, we forecast that the global warming movement, like the previous alarmist movements that we were able to identify and analyze, will continue to produce poor forecasts and harm people. Resources will be used inefficiently, and most people will be worse off than they would have been had the alarm never been raised.

We found that alarms based on unscientific forecasts are a surprisingly common social phenomenon. Alarms are used to support political movements. Dissent is punished. Expensive government interventions are frequently recommended and often implemented. Once in place they continue even when the alarming forecasts prove to be groundless, perhaps because a large sector of the economy depends on jobs created to "protect" against the predicted catastrophe.

The dangerous manmade global warming alarmist movement will ultimately fail, but we can look forward to other such phenomena in the future. Many people will be ready to expound on and believe in forecasts of new disasters.

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## REFERENCES

- Amstrup, S. C., B. G. Marcot, D. C. Douglas. 2007. Forecasting the rangewide status of polar bears at selected times in the 21<sup>st</sup> Century. Administrative Report, USGS Alaska Science Center, Anchorage, AK.
- Armstrong, J. S. (1985). *Long-range Forecasting: From Crystal Ball to Computer*. New York: John Wiley.
- Armstrong, J. S. (2001). *Principles of Forecasting*. Kluwer Academic Publishers (Springer).
- Armstrong, J.S., K. C. Green & W. Soon (2008), "Polar bear population forecasts: A public-policy forecasting audit," *Interfaces* 38, No. 5, 382–405. See also the authors' response: Amstrup, S. C. et.al (2009), "Rebuttal of ``Polar bear population forecasts : A public - policy forecasting audit," *Interfaces*, 39, 353-369. (We were not invited to respond; you can draw your own conclusions).
- Batson, C. Daniel (1975), "Rational processing on rationalization: The effect of disconfirming evidence on a stated religious belief," *Journal of Personality and Social Psychology*, 32 (1), 176-184.
- Bray, D. & von Storch, H. (2007). Climate scientists' perceptions of climate change science. GKSS – Forschungszentrum Geesthacht GmbH.
- Edwards, J. Gordon (2004), "DDT: A case study in scientific fraud," *Journal of American Physicians and Surgeons*, 9 (3), 83-88.
- Green, K. C. & Armstrong, J. S. (2007a), "Global warming: forecasts by scientists versus scientific forecasts," *Energy and Environment*, 18, No. 7+8, 995-1019. Available at <http://www.forecastingprinciples.com/files/WarmAudit31.pdf>
- Green, K. C. & Armstrong J. S. (2007b), "Structured analogies in forecasting," *International Journal of Forecasting*, 23, 365-376. Available at [http://www.forecastingprinciples.com/files/pdf/INTFOR3581\\_Publication15.pdf](http://www.forecastingprinciples.com/files/pdf/INTFOR3581_Publication15.pdf)
- Green, K. C. & Armstrong J. S. (2008), "Uncertainty, the precautionary principle, and climate change," (<http://prubicpolicyforecasting.com>)
- Green, K. C., Armstrong, J. S., & Soon, W. (2009). "Validity of climate change forecasting for public policy decision making," *International Journal of Forecasting*, forthcoming. Available at <http://kestengreen.com/naiveclimate.pdf>
- Gregory, W. L. & Duran, A. (2001), Scenarios and acceptance of forecasts. In J. S. Armstrong, *Principles of Forecasting*. Kluwer Academic Publishers (Springer).
- Hunter, C. M., H. Caswell, M. C. Runge, S. C. Amstrup, E. V.Regehr, I. Stirling (2007), "Polar bears in the Southern Beaufort Sea II: Demography and population growth in relation to sea ice conditions." Administrative Report, USGS Alaska Science Center, Anchorage, AK.
- Isdo, C. & Singer, S. F. (2009). *Climate Change Reconsidered: The Report of the Nongovernmental International Panel on Climate Change*. Chicago: The Heartland Institute.
- Johnson, K. (2009). Hacked emails show climate science ridden with rancor. *The Wall Street Journal*, 21 November.
- Klaus, V. (2009). Speech at the Washington Times Climate Change Policy Conference. Washington Briefing: Advancing the Global Debate over Climate Change Policy, The Willard Hotel, Washington D.C., November 4. Available at <http://www.klaus.cz/klaus2/asp/clanek.asp?id=G2mBVPC6Q3ik>
- Larrick, Richard P., Richard E. Nisbett & James N. Morgan (1993), "Who uses the cost-benefit rules of choice? Implications for the normative status of microeconomic theory," *Organizational Behavior and Human Decision Processes*, 56, 331-347.
- Lee, J. (2009). Filmmaker, prof. in spat over film rights. *The Stanford Daily*, 13 October. Available at <http://www.stanforddaily.com/cgi-bin/?p=1034262>
- MacKay, Charles (1841), *Extraordinary Popular Delusions & the Madness of Crowds*. New York: Three Rivers Press.
- Nova, J. (2009). Climate Money: The Climate Industry: \$79 billion so far – trillions to come. SPPI Original Paper. Available from [http://scienceandpublicpolicy.org/originals/climate\\_money.html](http://scienceandpublicpolicy.org/originals/climate_money.html)
- Oreskes, N. (2004). the scientific consensus on climate change. *Science*, 306, 1686.

- Pew Research Center (2008) “A deeper partisan divide over global warming” News release, May 8. (Downloaded from <http://people-press.org/reports/pdf/417.pdf>)
- Peiser, B. (2005). The letter *Science Magazine* refused to publish. Available at <http://www.staff.livjm.ac.uk/spsbpeis/Scienceletter.htm>
- Randall, D.A., et al.. eds. *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK and New York, NY, USA: Cambridge University Press,
- Robinson, A.B, Robinson, N.E., and Soon, W. (2007). Environmental effects of increased carbon dioxide. *Journal of American Physicians and Surgeons*, 12, 79-90.
- Sawyer, J. S. (1972). Man-made carbon dioxide and the “greenhouse” effect. *Nature* 239, 23–26.
- Schneider, S. H. (1989). As quoted in an interview in *Discover Magazine*, October. Available at [http://stephenschneider.stanford.edu/Publications/PDF\\_Papers/DetroitNews.pdf](http://stephenschneider.stanford.edu/Publications/PDF_Papers/DetroitNews.pdf)
- Schulte, K. M. (2008). Scientific consensus on climate change? *Energy & Environment*, 19, 281-286.
- Simon, J. L. (1992), Scarcity or Abundance? A Debate on the Environment, <http://www.juliansimon.com/writings/Norton/>.
- Soon, W. (2009). Solar Arctic-mediated climate variation on multidecadal to centennial timescales: Empirical evidence, mechanistic explanation, and testable consequences. *Physical Geography*, 30, 144-184.
- Tetlock, P. E. (2005). *Expert political judgment: How good is it? How can we know?* Princeton, NJ: Princeton.
- Tierney, J. (2009), “Holdren’s Ice Age Tidal Wave,” *The New York Times: TierneyLab*, 29 September. Available at <http://tierneylab.blogs.nytimes.com/2009/09/29/dr-holdrens-ice-age-tidal-wave/>
- Tierney, J. (1990), “Betting on the planet,” *The New York Times*, 2 December, 6, 52. Available at <http://www.nytimes.com/1990/12/02/magazine/betting-on-the-planet.html?pagewanted=all>
- Trenberth, Kevin E. (2007), <http://blogs.nature.com/climatefeedback/2007/06/>
- Waite, Donald E. (1994), “Myths and facts about DDT,” in D. E. Waite, *Environmental Health Hazards*, Environmental Health Consultant; Columbus, Ohio.