Global warming? It's a forecasting problem

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ICCC Ten, Washington, D.C.

Golden Rule Checklist
(With evidence on error reduction, and number of comparisons)
Software and Checklist available from goldenruleofforecasting.com

		Guideline	Comparisons* N	Error reduction n	%
1.		**Problem formulation**			
1.1		Use all important knowledge and information by…			
1.1.1	☐	selecting evidence-based methods validated for the situation	7	3	18
1.1.2	☐	decomposing to best use knowledge, information, judgment	17	9	35
1.2		Avoid bias by…			
1.2.1	☐	concealing the purpose of the forecast	–		
1.2.2	☐	specifying multiple hypotheses and methods	–		
1.2.3	☐	obtaining signed ethics statements before and after forecasting	–		
1.3	☐	Provide full disclosure for independent audits, replications, extensions	1		
2.		**Judgmental methods**			
2.1	☐	Avoid unaided judgment	2	1	45
2.2	☐	Use alternative wording and pretest questions	–		
2.3	☐	Ask judges to write reasons against the forecasts	2	1	8
2.4	☐	Use judgmental bootstrapping	11	1	6
2.5	☐	Use structured analogies	3	3	57
2.6	☐	Combine independent forecasts from judges	18	10	15
3.		**Extrapolation methods**			
3.1	☐	Use the longest time-series of valid and relevant data	–		
3.2	☐	Decompose by causal forces	1	1	64
3.3		Modify trends to incorporate more knowledge if the…			
3.3.1	☐	series is variable or unstable	8	8	12
3.3.2	☐	historical trend conflicts with causal forces	1	1	31
3.3.3	☐	forecast horizon is longer than the historical series	1	1	43
3.3.4	☐	short and long-term trend directions are inconsistent	–		
3.4		Modify seasonal factors to reflect uncertainty if…			
3.4.1	☐	estimates vary substantially across years	2	2	4
3.4.2	☐	few years of data are available	3	2	15
3.4.3	☐	causal knowledge is weak	–		
3.5	☐	Combine forecasts from alternative extrapolation methods, data	1	1	16
4.		**Causal methods**			
4.1	☐	Use prior knowledge to specify variables, relationships, and effects	1	1	32
4.2	☐	Modify effect estimates to reflect uncertainty	1	1	5
4.3	☐	Use all important variables	5	4	45
4.4	☐	Combine forecasts from dissimilar models	5	5	22
5.	☐	**Combine forecasts from diverse evidence-based methods**	15	14	15
6.	☐	**Avoid unstructured judgmental adjustments to forecasts**	4	1	64
		Totals and **Unweighted Average**	109	70	**31**

* **N**: Number of papers with findings on effect direction.
n: Number of papers with findings on effect size. **%**: Average effect size (geometric mean)

Long-range climate and public policy forecasting: The evidence

Global warming: Forecasts by scientists versus scientific forecasts
Kesten C. Green & J. Scott Armstrong
Energy & Environment 18 (7+8), 997–1021, 2007

The IPCC predicted dramatic increases in average world temperatures. Using forecasting principles as our guide we asked: Were proper forecasting methods used?

We audited the forecasting processes described by the IPCC to assess the extent to which they complied with scientific forecasting principles. We found enough information to make judgments on 89 out of a total of 140 forecasting principles. 72 of the 89 principles were violated.

The IPCC "forecasts" are, in effect, the opinions of scientists transformed by mathematics and obscured by complex writing.
http://www.forecastingprinciples.com/files/WarmAudit31.pdf

Polar bear population forecasts: A public-policy forecasting audit
J. Scott Armstrong, Kesten C. Green, & Willie Soon
Interfaces 38 (5), 382–405, 2008

Calls to list polar bears as a threatened species under the U.S. Endangered Species Act are based on forecasts of substantial long-term declines in their population. Government reports were written to support US Fish and Wildlife Service in their efforts to list polar bears as a threatened species. We assessed their two reports that forecast the effects of this policy. Neither referred to scientific forecasting methods. On average, we found that 46 percent of relevant forecasting principles were clearly violated and 23 percent were apparently violated.
http://www.kestencgreen.com/armstrong-green-soon-2008---public-policy-and-uncertainty.pdf

Validity of climate change forecasting for public policy decision-making
Kesten C. Green, J. Scott Armstrong, & Willie Soon
International Journal of Forecasting 25, 826–832, 2009

An inspection of global temperature data suggests that temperature is subject to irregular variations, and that variations during the late 1900s were not unusual. In such a situation, a "no change" extrapolation is an appropriate benchmark. We used the UK Met Office annual average thermometer data from 1850 through 2007 to examine the performance of the benchmark method. The accuracy of forecasts from the benchmark is such that even perfect forecasts would be unlikely to help policymakers. For example, mean absolute errors for the 20- and 50-year horizons were 0.18°C and 0.24°C respectively. For the years 1851 to 1975, the errors from the IPCC projections were more than seven times greater than the errors from the benchmark method.
http://www.kestencgreen.com/gas-2009-validity.pdf

The global warming alarm: Forecasts from the structured analogies method *SSRN Working Paper* 1656056
Kesten C. Green & J. Scott Armstrong

What happens when governments cry "wolf"? To answer this, we forecasted effects and outcomes of the current global warming alarm using a structured analysis of analogous situations. We identified 26 analogies that met our criteria that the alarm be: (1) based on forecasts of human catastrophe due to human activity on the environment, (2) endorsed by experts, politicians and media, and (3) accompanied by calls for strong action. None of the 26 alarms were based on scientific forecasting procedures. None of the alarming forecasts were accurate. Governments took action in 23 of the analogous situations and those actions proved to be harmful in 20 and uncertain in 3. The government programs remained after the predicted disasters failed to materialize. The global warming alarm movement appears to be a common social phenomenon.
http://www.kestencgreen.com/green&armstrong-agw-analogies.pdf

Forecasting global climate change
Kesten C. Green & J. Scott Armstrong
In *Climate Change: The Facts 2014*, IPA: Melbourne

We tested the predictive validity of the global warming hypothesis (+0.03°C per year with increasing CO2) against a relatively conservative global cooling hypothesis of -0.01°C per year, and against the even more conservative simple no-change hypothesis (0.0°C per year). The errors of forecasts from the global warming hypothesis for horizons 11 to 100 years ahead over the period 1851 to 1975 were nearly four times larger than those from the global cooling hypothesis. Findings from our tests using the latest data and other data covering a period of nearly 2,000 years support the predictive validity of the no-change hypothesis for horizons from one year to centuries ahead.
http://www.kestencgreen.com/G&A-Skyfall.pdf

Golden Rule of Forecasting: Be conservative
J. Scott Armstrong, Kesten C. Green, & Andreas Graefe
Journal of Business Research, 2015

The Golden Rule of Forecasting is to *be conservative*. This means that the forecasts should be consistent with cumulative knowledge about the situation and about proper forecasting methods. Twenty-eight guidelines were logically deduced from the Golden Rule. A review of evidence identified 105 papers with experimental comparisons. Ignoring a typical guideline increased forecast error by more than two-fifths on average. Ignoring the Golden Rule is especially likely to harm accuracy in uncertain and complex, and when bias is likely.
http://www.kestencgreen.com/GoldenRule.pdf

This document is available online at http://www.kestencgreen.com/A&G-ICCC-10-flyer.pdf