

know what the real decision situation is. For example, if the models are right and the polar bears will die, then the policy that maximizes social welfare is to hunt them and eat them before they drown from lack of sea ice. If global-warming decisions are to be made solely for the preservation of polar bears, then we must address the reality that fossil fuels have been essential in holding off the Malthusian outcome of mass starvation. Are the authors just members of the global-warming tribe who are using polar bears as another vehicle to beat up on an energy-consuming world where there is no real decision that can change this situation other than addressing global warming head on? Then listing the bears as endangered has only symbolic value and no bears will be saved. If the cost of a bear-preserving solution is cheap, then

the forecast errors will not cost much if the solution is implemented.

The real decision problem needs to be articulated before the forecasts are made. The tribal assumptions must be vetted. At the same time, we should be aware that it is easier to pick apart the details of an explicitly stated analytical model than a mental model. Going after specified models has the unintended consequence of giving more credence to untestable mental models.

#### Reference

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## What Is the Appropriate Public-Policy Response to Uncertainty?

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Scientific forecasting methods can help to inform decisions by providing forecasts and prediction intervals about the costs and benefits of *alternative policies*. We believe that this is an underlying message in the commentaries of Professors Goodwin and Murphy.

We have a minor point to add to Professor Murphy's commentary. In discussing mental models, he might also have mentioned the importance of judgmental bootstrapping for revealing how decision makers and forecasters think about a situation (Armstrong 2001). Two of this paper's authors were recently involved in a study that showed that people tend to vote for competent-looking presidential candidates (Armstrong et al. 2008). We suspect that if polar

bears were ugly, there would be no mass movement to support them. In Senator Boxer's hearings, the only exhibits presented to support the listing were attractive photographs of polar bears.

Professor Cochran provides a good summary of the process involved in the listing of polar bears. However, he characterizes our contribution as *ex post*. In fact, we made considerable efforts to ensure that our analysis was available to decision makers prior to the time that they made their decisions. Dr. Armstrong presented testimony at Senator Boxer's US Senate Hearing on the listing of polar bears on January 30, 2008. The website, [www.theclimatebet.com](http://www.theclimatebet.com), includes a video of this testimony; [www.publicpolicyforecasting.com](http://www.publicpolicyforecasting.com) made available draft versions of our paper prior to the

testimony. We kept officials at the Department of Interior, as well as authors of the administrative reports, informed of our work as it progressed. This is especially important because our forecast, which we based on evidence-based methods, is that the polar bear population will continue to grow slowly, whereas the government reports forecast a large and rapid decline in the population.

Professor Cochran is wrong to suggest that the petition that the Center for Biological Diversity (CBD) filed is solely for polar bear protection. In fact, the CBD is using the polar bear listing as a means to reduce emissions of carbon dioxide from fossil fuels (Center for Biological Diversity 2007).

We also have the following issues with Professor Cochran's logic:

(1) He chooses to use standard practice rather than scientific procedures as a basis for judging the scientific basis for the forecasts. In other words, if previous endangered species studies have failed to follow scientific procedures (and we suspect that he is correct in this assumption) then, he implies, it is appropriate to ignore scientific procedures when forecasting polar bear populations.

(2) He claims that the US Department of the Interior's administrative reports did not have a position on this policy. He argues that the heading of each report ("to support US Fish and Wildlife Service Polar Bear Listing Decision") does not imply a position.

(3) He refers to our principle for forecasting, "Be conservative in situations of high uncertainty or instability," as being equivalent to his position, which

is effectively the "precautionary principle." To the contrary, we believe the positions are diametrically opposed. Our principle refers to forecasting small changes when uncertainty is high. Important changes should be based on a scientific study of the costs and benefits of alternative policies; to the extent that there is uncertainty, one should avoid major policy changes. The precautionary principle argues that uncertainty is a basis for action; if one lacks knowledge, then some action should be taken—just in case. This happens when interest groups identify an issue that can help them to achieve their ends. If the interest group is successful in lobbying for an issue, politics replaces science, and government dictates follow. It brings to mind the slogan on the Ministry of Truth building in George Orwell's 1984: "Ignorance is Strength."

We believe that proper scientific principles will lead to better decisions than will political principles, and that people will be better off if politicians have the courage to resist calls to action when uncertainty is high.

## References

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