



# Despite Deep Scientific Uncertainty, Long-Term Problems Can Be Tackled

Our nation and the world often have a difficult time addressing long-term problems. In part, such problems are so complex and contingent that scientists cannot make definitive predictions about them. Facing such deep uncertainty, how can leaders avoid becoming paralyzed by it?

RAND researchers have been fundamentally rethinking the role of analysis under conditions of deep scientific uncertainty and have constructed rigorous, systematic methods for dealing with that uncertainty. Their basic approach involves the use of computer programs to help frame strategies that will work well across a wide range of plausible futures. Rather than seeking to eliminate uncertainty, the approach highlights it and finds ways to manage it.

An article by RAND Corporation researchers focuses on how this approach can be used to identify near-term actions that can help to ensure both economic development and environmental quality over the 21st century—one of the leading examples of how difficult it is to use science to inform long-term decisionmaking.

The authors use a simplified version of an existing simulation model that incorporates the dynamics of the global economy, demographics, and the environment. In the simulation, population and wealth over time increase pollution, but technological innovation over time reduces it. The approach uses the model to determine which strategies are most robust in the face of diverse future scenarios.

In an illustrative example using this approach, researchers tested near-term strategies that included a market-based, cap-and-trade pollution-trading system over a large number of computer-generated futures, each of which included various combinations of key demographic, economic, environmental, and technological trends. These “futures” included discontinuous, surprising changes in technology and human values. The approach produced groups of futures—or key scenarios—in which the initially proposed policy was vulnerable. The authors use the scenarios to incrementally test and then suggest improvements to the proposed policy, thereby sketching a potentially robust approach to sustainable development for the 21st century.

This approach is applicable to a wide range of other challenges: bringing new products to market, managing the nation’s entitlement programs, and even defeating terrorism. Science and technology cannot change the inherent unpredictability of the future, but they can help to answer a fundamentally different question: Which actions today can best usher in a desirable future? When the future is most ill defined and unpredictable, new computer tools can still help policymakers to take actions today that can positively shape the longer-term future.

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This fact sheet describes work done within the RAND Pardee Center and documented in Steven W. Popper, Robert J. Lempert, and Steven C. Bankes, "Shaping the Future," *Scientific American*, April 2005.

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