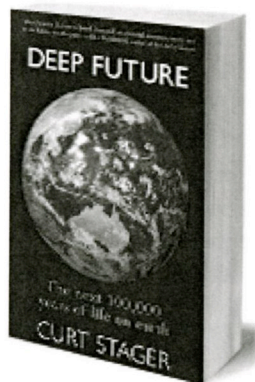


# Curt Stager, 2010, *Deep Future: The Next 100,000 Years of Life on Earth*

Reviewed by BRIAN F. CHABOT

*Deep Future* by Curt Stager should be essential reading for anyone interested in what future environments will be like on planet Earth, which I hope is everyone. You will not find another book as comprehensive or as well-written about past and future climate change. The author brings an extensive knowledge of environments over millions of years of Earth's history. He uses this to help the reader understand the current climate warming processes and the long-term effects that can be anticipated. Long-term means many thousands of years, as the 100,000 years of the title conveys.

I started this book already convinced by the evidence that climate warming is occurring and I have educated others about climate change processes. Even with an extensive technical background on the topic, I was drawn in by the author's skill in explaining complex processes using non-technical prose. It easily could have been otherwise. This book has a lot of detail and depth on topics such as sources of climate variation, climate cycling associated with glaciations, what the "super-greenhouse environment" 55 million years ago was like, carbon isotope chemistry, ocean carbon chemistry and its consequences, what an ice-free arctic would be like, and much more. The author displays considerable patience in not employing the shorthand



of technical jargon that tends to make scientific literature hard to read by the non-specialist. It makes this book useful to a broad audience, including technical specialists.

The broad environmental history of the Earth is an especially useful aspect of the book. Many texts are available that review data on how recent human use of fossil carbon has changed atmospheric chemistry and physics, how CO<sub>2</sub>, methane, and nitrous oxides affect heat balance, how heat balance influences water vapor and movement of air masses, and the processes of ocean acidification. What is less common is how these relationships played out well before

the human species ever significantly impacted Earth's environment, which is a very recent event. Climate change deniers often point to the fact that there have been major climate changes in the past—warm periods when atmospheric CO<sub>2</sub> was very high before photosynthesis sequestered carbon in geological formations. These large changes in earlier environments are described and related to the basic physics operating to warm Earth's climate today. Stager reviews evidence from fossils for the great rearrangements of biological communities in the past. The existence of warming and cooling climates during recorded history provides evidence that climate changes can have significant impacts on human health and economic well-being.

Increasingly sophisticated computer models can project climate change for the next 100 years with increasing certainty. One hundred years seems distant, but Stager challenges short-term thinking by describing what the "deep future" might be. We are still in the "early days of human-driven climate change." If we

reduce our fossil carbon appetite soon, atmospheric CO<sub>2</sub> will peak between 2100–2200 CE and temperatures will increase for another 550 years. Sea levels will rise by 6–7 m. If we do not reduce our use of fossil carbon, which seems likely, temperatures will peak in 5,000 years and will not decrease to current temperatures for 100,000 years. Polar ice caps will melt, raising sea levels 70 m. Ocean beaches will be closer to the Blue Line. Adirondack forests will be transformed. These projections of the changed world we are creating are sobering.

*Deep Future* is not focused on the Adirondacks, but it does draw on Stager's research in the region. The book begins during the ice age when the Adirondacks were under huge, continental-scale glaciers. In the final chapter, "Bringing It Home," the author describes how he became convinced that global warming is occurring through analysis of Adirondack temperature records. Through this personal story, he effectively addresses a line of evidence used by climate skeptics that some local environments may not follow regional and global changes. It took careful analysis of weather records for the Adirondacks to average out differences due to a complex landscape and difference due to very local warming or cooling periods for the author to become convinced that the climate of our region has indeed been warming over a period of decades. This and many other personal stories throughout the book engage the reader, encourage reflection on the evidence, and allow the reader to participate. This is an engaging read with much information not easily found elsewhere. The prose engages much as does listening to a master storyteller or a knowledgeable friend across the dinner table. If *Deep Future* causes even one person to reduce their use of fossil carbon, it will have justified the author's efforts.

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