

Benjamin I. Cook. *Drought: An Interdisciplinary Perspective*. New York: Columbia University Press, 2019. 232 pp. \$40.00, paper, ISBN 978-0-231-54890-8.

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Antonia Sohns on Benjamin I. Cook, *Drought: An Interdisciplinary Perspective*

Benjamin Cook's *Drought: An Interdisciplinary Perspective* is a timely contribution that offers important insights into the many causes and complexities of drought both today and throughout history. Cook is a research scientist at the NASA Goddard Institute for Space Studies and at the Lamont-Doherty Earth Observatory of Columbia University, where he also teaches on drought and climate science. As such, Cook bases his examination of drought in climate science, but argues that it is critical to consider the phenomenon of drought from an interdisciplinary perspective, emerging from the intersection of climatology, meteorology, hydrology, ecology, agronomy, and economics. From this interdisciplinary perspective it is easier to identify biased interpretations or misunderstandings based on different definitions of drought.

The book is composed of eight chapters. The first chapter provides a background on drought and the hydrologic cycle. Cook notes how water is

not evenly distributed and that various processes affect the availability of water for people and ecosystems across seasons, regions, and time periods. This chapter importantly defines drought and explains how drought events are categorized as meteorological drought, agricultural drought, or hydrological drought. At the end of the chapter, Cook briefly describes drought impacts. Those include wide-reaching effects of drought such as widespread tree mortality events, agricultural losses, decline in hydropower production, and related health impacts.

In the introduction, it might have been interesting to discuss differences in social and political perspectives regarding drought between different countries. For example, in the United States drought is often perceived as a crisis whereas in Australia drought is perceived as a part of the normal climate and hydrologic processes. The first chapter also describes drought monitors, with a focus on the United States. It could have been

helpful to briefly discuss how drought is monitored differently worldwide, or to highlight regions where there may be a lack of data due to a lack of resources.

The second chapter offers a broad survey of the processes in the earth's climate system that control the geographic and seasonal variation of moisture availability. In this chapter, Cook highlights transboundary river basins in his discussion of water scarcity. While the map (p. 44) shows international transboundary river basins, it might have been interesting to include more regional or localized maps that highlight transboundary river basins within a country but between states, provinces, or territories, such as the Murray-Darling basin in Australia, which is the source of much competition and collaboration.

Given the multicausal nature of drought, the third chapter describes drought in the climate system, describing drought dynamics in relation to oceans, atmosphere, and land surfaces. Having established this background, Cook details drought and hydroclimate in the Holocene in chapter 4, and the relationship between climate change and drought in chapter 5. These chapters help readers understand how droughts in the paleoclimate record compare to more contemporary drought events, and how climate change may impact the water cycle and its associated processes.

One of the major strengths of the book is that it comprehensively looks at drought and how drought has been studied over time. Not only does Cook highlight examples such as the early researcher who recognized the importance of vegetation and the process of land degradation in drought dynamics, but he also describes the importance of a historical perspective to understanding drought. Through the field of paleoclimatology, we can better understand climate variability and how it has changed over time. Cook discusses the increased availability of annually to decadal resolved climate proxies (e.g., tree rings, corals, and ice cores), historical records, and archaeological

data in the Common Era (two thousand years ago to the present day), which helps resolve estimates of the paleoclimate. Highlighting this information enables readers to better understand where information on drought events comes from and how our knowledge of drought continues to evolve over time.

Cook's discussion of climate change in chapter 5 centers on global climate models and hydrology. In the discussion of climate modeling, Cook describes some of the factors of uncertainty in the models such as temperature, humidity, soil moisture, runoff, and precipitation. He also discusses how, from an impacts perspective, there is an inherent trade-off between mitigation to reduce greenhouse gas emissions and associated warming, and adaptation to deal with the ultimate impacts of climate change.

Given that Cook is discussing such a complex and multidisciplinary subject, it is helpful that he links back to important qualifications of his discussion. For example, in the climate modeling discussion, Cook highlights that the projections described in the chapter were focusing on the mean state, or the long-term shifts in multidecadal average precipitation, soil moisture, runoff, and other variables.

Cook often mentions the connection between drought and society. In the discussion of megadroughts, Cook moves from the scientific definition of megadrought to the societal implications of megadroughts, such as social upheaval, migration, and famine. In chapter 5, Cook provides examples of drought in recent decades, such as in Syria and California. While these examples highlight the historic nature of the droughts due to their intensity, the chapter could have been strengthened by more detail on the societal impacts of drought.

Chapter 6 details two case studies of drought events that are notable for their intensity and devastating impacts, the US Dust Bowl of the 1930s and the Sahel drought in the late twentieth century. These case studies help readers understand

the factors that contributed to the droughts and their respective impacts on the environment. Importantly, Cook details the connection between land degradation and drought, as well as the role of anomalies in sea surface temperature in the case of the Sahel drought. In this chapter as well, more explicit discussion of the impacts of these droughts on society would have improved readers' understanding of their pernicious effects.

Forward looking, Cook describes land degradation and desertification in chapter 7, seeking to highlight the many causes of land degradation, from loss of vegetation to declines in soil fertility. In chapter 8, Cook details human contributions to drought through exploitation of water resources in order to increase agricultural productivity through irrigation, and to meet increasing demand for water through the unsustainable practice of groundwater pumping. Cook discusses how the water supplying irrigation systems is largely drawn from fossil aquifers and is effectively non-renewable on timescales for human activities. The withdrawal rate of these groundwater resources is resulting in the collapse of groundwater aquifers, so profoundly that groundwater depletion is being identified by Gravity Recovery and Climate Experiment (GRACE) satellites measuring the changes in local gravitational anomalies related to mass changes at the surface.

In chapter 8, it could have been helpful to explicitly call out the connection between water, food, and energy. Cook makes reference to the connection between these resources throughout the book, especially here, where he details the connection between groundwater resources and food production, but it might have furthered readers' understanding of the complexities of water and drought had he explained that groundwater pumping is energy-intensive and the three resources are integrally connected.

After this final chapter, the book ends with a glossary and references. A conclusion could have been helpful to bring together the most important

points from the book, propose future research areas, or highlight several of the proposed questions that are included in different chapters. Overall, however, this book is an important contribution to the literature on drought and provides a vital interdisciplinary perspective on the subject. Cook is an expert on drought and very clearly describes its background and methods of study. People from all disciplines would benefit from reading this book to learn more about drought.

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