Climate Variability and the Global Harvest: Impacts of El Niño and Other Oscillations on Agroecosystems


As is commonly known, climate and weather have major impacts on agroecosystems and subsequent harvests and food production. If patterns of temperature and precipitation were constant or at least consistent from year to year, farmers could make the proper decisions to optimize production and profits. However, even with the best of plans, unexpected droughts or excessive rainfall can cause havoc on yields, and the farmer, his or her family, and society suffer. If such deviations from normal could be predicted reliably, then the farmers and society as a whole could make better management decisions that mitigate the damage and soften the blow.

Earth’s weather system is highly chaotic. Nevertheless, certain recurring oscillations or patterns have been recognized, as listed and characterized by Rosenzweig and Hillel in Chapter 1, “Climate variability in the context of climate change: El Niño and other oscillations.” These include the well-known El Niño/La Niña (or El Niño–Southern Oscillation, ENSO), the Pacific Decadal Oscillation (PDO), the Madden–Julian Oscillation (MJO), the Pacific/North American pattern (PNA), the Arctic Oscillation (AO), the North Atlantic Oscillation (NAO), the Tropic Atlantic Variability (TAV), the West Pacific pattern (WP), and the Indian Ocean Dipole (IOD). I found the descriptions of these phenomena to be clear and informative.

As indicated by the title, the impacts of these natural oscillations of Earth’s climate system on agriculture are the main focus of this book by Rosenzweig and Hillel. They also discuss the prospects for achieving greater predictability and the value of such predictive knowledge. They present the information within the context of relating climate variability to climate change. The latter may be manifested as changes in frequency or amplitude with or without a changing trend of the mean.

Following the descriptions of the oscillations in Chapter 1, Chapter 2, “Impacts of El Niño/La Niña cycles: systems and sectors,” focuses on the impacts of the El Niño/La Niña (ENSO) oscillation. Because it apparently is the strongest, most predictable, and most well-known, much more space in the book is devoted to it compared to the other oscillations. El Niño (“the child”) was first recognized and named by fishermen from Ecuador and Peru in the 19th century who noticed that fish were less abundant near Christmas time. However, this ENSO oscillation propagates to many other places around the globe, some of which gain more or less rainfall than average. Gaining more rainfall is often beneficial to managed and natural ecosystems, but excessive rain can lead to flooding, and of course, if the lowered rainfall leads to droughts, it can be devastating. Besides marine ecosystems, the authors also address hydrology, hydro-power, and water management, as well as disasters and human health. Then in Chapter 3, “Links to agroecosystems: processes and productivity,” the authors focus on the often profound impacts on agroecosystems, both positive and negative. Chapter 4, “Recent El Niños and their manifestations: evolving understanding,” covers rather detailed aspects of consequences arising from the particularly severe recent El Niños of 1972–1973, 1982–1983, and 1997–1998.

In Chapter 5, “Analysis of El Niño and related variables for multifaceted climate change studies,” the authors provide a framework for analyzing El Niño’s impacts on agriculture and food security.