frontiers in Ecology and Evolution

EDITORIAL
published: 26 November 2021
doi: 10.3389/fevo.2021.799590

Editorial: Environmental Threats to the State of Florida—Climate Change and Beyond

*Frank S. Gilliam**

Department of Biology, University of West Florida, Pensacola, FL, United States

Keywords: climate change, global warming, environmental threats, marine ecosystems, Florida

Editorial on the Research Topic

Environmental Threats to the State of Florida—Climate Change and Beyond

There is an ancient legacy of human alteration of natural ecosystems on a global scale, with an anthropogenic signature indelibly etched on many natural systems (Gilliam, 2016). Ecosystems of Florida are no exception, wherein human occupation by indigenous people dates back to >12,000 years BCE (Hine, 2013; Milanich, 2017). In the 16th century, watercourts—sub-rectangular constructions of shell and sediment for fish storage—were created by the Calusa, a fisher-gatherer-hunter society that managed surpluses of aquatic resources (Thompson et al., 2020).

Although human activities of previous millennia exerted lasting effects on terrestrial and aquatic ecosystems, more recent anthropogenic changes are more profound. The period from the latter part of the 20th century to the new millennium has witnessed unprecedented ecosystem degradation. Some of this has been mitigated via federal environmental legislation and international cooperation, whereas others, especially anthropogenic climate change, are becoming increasingly more serious.

Although effects of climate change are not is unique to Florida, the state is uniquely susceptible to many of them because of several interactive factors. Among the 10 most populated states in the USA, Florida has the highest current growth rate. Florida is second only to Alaska in absolute distance of marine shoreline, but has a far higher ratio of shoreline to surface area. Florida has the second lowest mean elevation among states—30.5 m—with a high relative surface area <5 m in elevation (Hine, 2013). Thus, Florida comprises a distinct confluence of environmental concerns: a large, rapidly growing human population with high connectivity to and reliance on marine ecosystems, all increasingly vulnerable to effects of climate change.

This Research Topic addresses seven widely-varied issues, all with ties to climate change. These include tropical cyclones and longleaf pine ecosystems, microplastics in marine environments, sea level rise and mangrove ecology, harmful algal blooms, seagrass ecosystems, *Vibrio* bacteria, and coral reef restoration and survivorship.

Gilliam reported a long-term climate-mediated increase in both frequency and intensity tropical cyclones in the North Atlantic Ocean. Historically, these make landfall more often in Florida in any other state, especially in the southern extreme of the Florida Peninsula. The more intense storms have a long-lived influence on the structure and function of Florida's longleaf pine ecosystems. Although the connection may not be immediately apparent, increases in tropical cyclones also contribute to enhancing microplastics in the environment. Kleinschmidt and Janosik examined microplastic concentrations in waters and snail tissue within the Gulf of Mexico, focusing on two predatory species—*Stramonita haemastoma* (red-mouth rock snail) and *Melongena corona* (crown conch)—common in food webs of the Gulf. They found notable concentrations of microplastics,

Edited and reviewed by:
Peter Convey,
British Antarctic Survey (BAS),
United Kingdom

***Correspondence:**
Frank S. Gilliam
fgilliam@uwf.edu

Specialty section:
This article was submitted to Biogeography and Macroecology, a section of the journal Frontiers in Ecology and Evolution

Received: *21 October 2021*
Accepted: *08 November 2021*
Published: *26 November 2021*

Citation:
Gilliam FS (2021) Editorial: Environmental Threats to the State of Florida—Climate Change and Beyond. Front. Ecol. Evol. 9:799590. doi: 10.3389/fevo.2021.799590

virtually all microfibers, in water and snail tissue samples, confirming the ubiquitous nature of microplastics. Sklar et al. estimated impacts of sea level rise on a variety of site types in southern Florida using three scenarios (increases of 0.27, 0.76, and 1.13 m by 2070) made by NOAA and the IPCC. Predictably, projected impacts were directly related to degree of increase. For the lower two scenarios, however, mangrove accretion and migration was able to mitigate effects of sea level rise on coastal wetland ecosystems. Harmful algal blooms (HABs) are occurring at increasing frequencies in coastal areas globally. Heil and Muni-Morgan provided a state-of-the-science review and synthesis of HABs as they affect human, environmental, and economic health of impacted regions of Florida. Although several microorganisms and the numerous toxins they produce cause HABs, the dinoflagellate *Karina brevis* is principally responsible for more serious events and the brevetoxins they produce can become widespread in the environment. Climate change can exacerbate effects of HABs, suggesting challenges for the future. Numerous factors, many related to climate change, interact to threaten the structure and function of another critical component of the ecology of coastal Florida—seagrass ecosystems. Rodemann et al. combined satellite imagery and field measurements to monitor two distinct disturbances on seagrass communities of Florida Bay, Florida, namely, a drought-induced die-off in 2015 and a hurricane (Irma) in 2017. Massive loss of seagrasses from both events resulted in a persistent sediment plume. Among the more immediate threats to the health and safety of human populations is the pathology of two species of waterborne *Vibrio* bacteria: *V. vulnificus*, which causes necrotizing fasciitis, and *V. parahaemolyticus*, which causes gastrointestinal illness. To establish a critical baseline, Potdukhe et al. extensively surveyed water, sediments, and biofilms around Perdido and Pensacola Bays in Florida, finding notable occurrence of both *Vibrio* species that correlated with wind and suggesting resuspension as an important driver and establishing a connection with climate change via tropical cyclones and increases in water temperature. Coral reefs, with their impressive biodiversity, are declining globally, resulting from thermal stress, disease, and pollution. Restoration efforts are underway to mitigate these declines. Banister and van Woesik assessed the efficacy of restoration for the Florida reef tract, from the coast of extreme southeast Florida and extending southwest around the Florida Keys, using outplanted colonies of *Acropora cervicornis*. The success of such efforts appears promising. On the other hand, they found that survivorship of these outplants was highly spatially variable, with low survivorship often associated with high wave energy.

The articles in this Research Topic comprise sharply contrasting environmental threats, of both regional relevance (i.e., Florida) and global significance, pointing to the complexity of ecological processes and recalling the classic quote from plant ecologist, Frank Egler (Egler, 1977): "Ecosystems are not only more complex than we think, but more complex than we can think." These studies also emphasize the current and future challenges we face in mitigating the most damaging effects of these threats, as well the seriousness of directly addressing the cause of climate change by shifting from fossil fuel consumption to sustainable, renewable non-fossil fuel alternatives, such as wind and solar power.

AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

ACKNOWLEDGMENTS

I would like to thank members of the editorial staff of *Frontiers in Ecology and Evolution* for their time and effort with this Research Topic.

REFERENCES

Egler, F. (1977). *The Nature of Vegetation: Its Management and Mismanagement*. Norfolk, CT: Aton Forest.

Gilliam, F. S. (2016). Forest ecosystems of temperate climatic regions: from ancient use to climate change. *New Phytol.* 212, 871–887. doi: 10.1111/nph.14255

Hine, A. C. (2013). *Geologic History of Florida: Major Events That Formed the Sunshine State*. Gainesville, FL: University Press of Florida.

Milanich, J. T. (2017). *Archaeology of Precolumbian Florida*. Gainesville, FL: University Press of Florida.

Thompson, V. D., Marquardt, W. H., Savarese, M., Walker, K. J., Newsom, L. A., Lulewicz, I., et al. (2020). Ancient engineering of fish capture and storage in southwest Florida. *Proc. Nat. Acad. Sci. U.S.A.* 117, 8374–8381. doi: 10.1073/pnas.1921708117

Conflict of Interest: The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.