

# FEDERAL INVESTMENT IN ALGAL BLOOM RESEARCH

***Increase federal investment in R&D for algal blooms and global ecology to protect coastal communities, economies, and natural resources.***

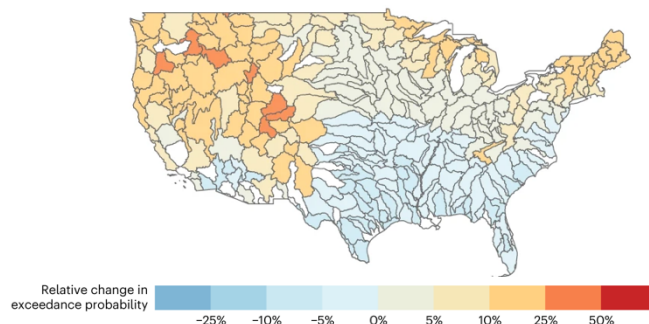
Harmful Algal Blooms (HABs) are a symptom of **climate change** and **excess nutrients** dumped into aquatic environments from human waste mismanagement and agricultural runoffs. These blooms lead to overgrowth of algae which release **deadly cyanotoxins** that kill local wildlife, collapse fisheries, harm nearby agriculture, and poison valuable drinking water. HABs in the U.S. is estimated to cost **\$10-100 million** in damages per year. A single major HAB event can cost local governments upwards of **ten of million dollars**.

## HARMFUL AGAL BLOOMS ARE AFFECTING LOCAL ECONOMIES, PUBLIC SAFETY, AND PROPERTY VALUES



*Algal bloom in Lake Erie in September 2017. Figure from United States National Oceanographic and Atmospheric Administration.*

Relative change in HAB probability  
Continental USA: 2019 versus 1950

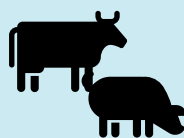


*50,000 fish killed from Karlodinium venificum bloom. Damaged commercial fishing of Menhaden and Blue Catfish. Source: Maryland Department of Environment, Corsica River.*

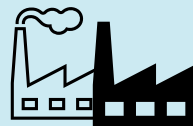


### Human contributions to algal blooms

**Agriculture:**  
Feces and fertilizers



**Industry:**  
Chemical waste



**Urban Life:**  
Human sewage



### Damages of Harmful Algal Blooms in the U.S.:

#### 2011 Indian River Lagoon, Florida

- ◇ \$235-470 million loss in local economy
- ◇ Lasting fishery industry collapse due to 60% loss of seagrass from algal tides

#### 2015 West Coast - California, Oregon, and Washington

- ◇ \$97.5 million in damage to Dungeness crab fishing
- ◇ \$40 million lost in tourism spending

#### 2011-2014 Lake Erie - Toledo, Ohio

- ◇ 500,000 residents lost access to clean drinking water
- ◇ \$5.58 million in estimated lost fishing expenditures due to summer-long algal blooms
- ◇ \$10 million lost in shoreline property value services

Source: National Oceanographic and Atmospheric Administration

### Current NSF Funding for Algal Blooms

2023 FY NSF Division of Environmental Biology (DEB) was allocated \$100 M, only a fraction supported algal bloom research. This is not enough to support innovative solutions to combat this worsening problem.

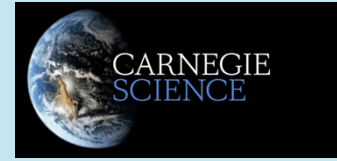
### Necessary Federal Investments in Algal Bloom Research

- ◇ Algal blooms are an annual disaster necessitating specific funding projects such as the \$30 M joint NSF-NIEH grant in 2018
- ◇ Support NSF and NOAA algal bloom research efforts for developing early detection systems and preventatives for algal blooms
- ◇ U.S. borne tools to combat algal blooms in foreign fisheries to boost the global economy

**Carnegie Institution for Science is a multidisciplinary research institute invested in studying global ecology, fundamental biology, physics, and engineering.**

Carnegie Institute for Science Dept. of Global Ecology and Dept. of Biospheres and Engineering contains leading labs in algal bloom research. Carnegie Science employs high resolution satellite data and field samples from a 2800 Lake dataset of the continental United States to solve unanswered questions surrounding algal blooms.

Traditional field ecology methods and modern genomic techniques are uniquely combined to better understand the linkage between algal genetics and the environmental triggers of blooms. This science aims to drive the development of novel genetic based techniques to detect blooms before they happen and guide the creation of new policies to mitigate the human drivers of algal blooms.



<https://carnegiescience.edu/>

Carnegie Scientists collaborate with Universities and Institutions to solve the ever-growing problems associated with climate change. Long-term efforts are supported by:

- ◇ Leveraging existing US federally funded efforts in data collection from aquatic ecosystems
- ◇ Developing sophisticated mathematical models of global weather and temperature data to predict HABs
- ◇ Applying modern genetic techniques and sequencing technologies to mine the genomes of algae for HAB-associated genes

The Carnegie Institute has been historically supported by federal funding from the NIH and NSF.

## Invest in Research Institutes like Carnegie Science

### STEM outreach and youth development

"The future competitiveness of the United States in an increasingly interconnected global economy depends on the nation fostering a workforce with strong capabilities and skills in science, technology, engineering, and mathematics (STEM). STEM knowledge and skills enable both individual opportunity and national competitiveness, and the nation needs to develop ways of ensuring access to high-quality education and training experiences for all students at all levels and for all workers at all career stages."

-National Academies, 2016 report on Developing a National STEM Workforce Strategy

Carnegie Science and Johns Hopkins University support the successful NSF-funded K-12 BIOEYES (<https://www.bioeyes.org/>) outreach program in Maryland. In collaboration with non-profit education group Baltimore Under Ground Science Space (BUGSS) (<https://bugssonline.org/>), environmental microbiology is brought to the classroom of middle school children where they gain experiential learning of microbes in their environment and algal blooms. Carnegie Science staff and students have continuously volunteered for the past 20 years to bring exciting hands-on science to students in public schools. Carnegie Science is committed to promoting STEM education and inspiring scientific interest in American children.



### International relevance of global ecology

Climate change is disturbing economies around the world. Algal blooms and coral bleaching events are disrupting fisheries in all coastal economies. Carnegie Science collaborates with renowned Institutions around the world to develop solutions to these problems. Fisheries around the globe generate \$246 Billion dollars in revenue, but the lucrative natural resource is fragile and susceptible to collapse from human driven causes. Algal blooms directly disrupt fisheries and can permanently harm fishing-based economies by introducing **dead zones**. The **second largest dead-zone** is in the **Gulf of Mexico** spanning **3,058 square miles** and has **persisted since 1999**. **Protection of fish as a natural resource requires unified global effort and policy based on important data generated by institutes such as Carnegie Science.**

"The United States is missing out on both short- and long-term strategic opportunities to engage internationally and is being left behind as a result. The United States spearheads a limited number of ambitious, large-scale international S&T research collaborations for specific topics. Foreign governments are increasingly supportive of multinational research consortia, and they are willing to spend billions of dollars to participate; the United States has no similar science diplomacy initiatives."

-National Science and Technology Council, 2022 Biennial report to Congress on International Science and Technology Cooperation