Medical Xpress

Human-wrought environmental changes impacting crops, pollinators could harm millions

July 15 2015

Changing environmental conditions around the globe caused by human activity could negatively impact the health of millions of people by altering the amount and quality of key crops, according to two new studies from Harvard T.H. Chan School of Public Health. One study found that decreasing numbers of food pollinators such as bees—falling in part due to pesticide use and destruction of habitats—could lead to declines in nutrient-rich crops that have been linked with staving off disease. A second study found that increasing levels of atmospheric carbon dioxide (CO2) could lead to lower levels of zinc in food and thus to greatly expanded zinc deficiency.

The study about pollinators will appear in *The Lancet*; the study about zinc will appear in *Lancet Global Health*. Both studies will be published July 16, 2015 in conjunction with the Rockefeller Foundation-Lancet Commission on Planetary Health report, Safeguarding Human Health in the Anthropocene Epoch, which broadly assesses the scale of the threats to health, development, and civilization posed by the multiplicity of environmental changes brought on by human activity.

"This is the first time that the global health community has come out in a concerted way to report that we are in real danger of undermining the core ecological systems that support human health," said Samuel Myers, senior research scientist in the Harvard Chan School's Department of Environmental Health, who is senior author of the pollinator study and

lead author of the zinc study. Myers, a Commissioner and co-author of the report, will speak at a panel on environmental change, its drivers, and health impacts at a Planetary Health Commission launch event on July 16 at the Rockefeller Foundation in New York City.

"All of human civilization has taken place during a very stable set of biophysical conditions, but we are now changing those conditions at a rate that's never been seen before," Myers explained. "Whether we're talking about land use, deforestation, degradation of global fisheries, disruption of the climate system, biodiversity loss, appropriation of fresh water, changes to aquatic systems—all of the changes are profound and they're accelerating, and they represent a significant challenge to global health."

Pollinators and nutrient-rich crops

In the study of pollinators, Myers and his colleagues looked at people's dietary intake data for 224 types of food in 156 countries around the globe to quantify total per capita intake of vitamin A, folate, fruits, vegetables, and nuts and seeds under various pollinator decline scenarios. They then estimated the potential health impacts of declines in pollinators—mostly bees and other insects.

Pollinators play a key role in roughly 35% of global food production and are directly responsible for up to 40% of the world's supply of micronutrients such as vitamin A and folate, which are vital for children and pregnant women. Over the past decade, there have been significant declines in animal pollinators worldwide.

The researchers found that the complete loss of animal pollinators globally would push an additional 71 million people into vitamin A deficiency and 173 million more into folate deficiency, and would lead to about 1.42 million additional deaths per year from non-communicable

diseases (NCDs) and malnutrition-related diseases—a 2.7% increase in total yearly deaths. A 50% loss of pollination would result in roughly half that impact, the researchers found.

Most of this burden of disease would result from reduced consumption of foods that protect against NCDs like heart disease, stroke, and certain cancers and, unlike the populations frequently impacted by environmental degradation, many of the most vulnerable populations reside in relatively developed countries. Researchers found that those most vulnerable would be in eastern Europe and in central, eastern, and Southeast Asia, where risks of NCDs are high and intake of fruits, vegetables, nuts, and seeds is highly dependent on pollinators.

The study also found that most of the estimated pollinator-related disease burden had to do with locally produced crops—not imported ones. "This means that most countries can benefit greatly by managing their own pollinator populations, protecting both their public health as well as crop yields," said lead author Matthew Smith, research fellow in the Department of Environmental Health.

Increased zinc deficiency estimated

For the study on zinc, the authors modeled how much zinc would be available to people through diet in 188 countries, under both current and elevated levels of CO2. They noted that zinc is a key nutrient for maternal and child health—without enough, there is increased risk of premature delivery, reduced growth and weight gain in young children, and decreased immune function. Roughly 17% of the global population was estimated to be at risk of zinc deficiency in 2011, according to recent studies.

Citing previous research that found that elevated concentrations of atmospheric CO2 lowers the content of zinc and other nutrients in

important food crops such as wheat, rice, barley, and soy, the authors estimated that CO2 emissions caused by human activity could place between 132 million and 180 million people at new risk of zinc deficiency by around 2050. Those most likely to be affected live in Africa and South Asia, and nearly 48 million people in India alone—populations already burdened with the world's highest levels of zinc deficiency, and reliant on crops for most of their dietary zinc.

The authors suggested possible interventions for those at highest risk for zinc deficiency, such as zinc supplementation, fortification of staple foods with additional zinc, the application of zinc-containing fertilizers to crops, or the development of bio-fortified strains of crops such as rice and wheat.

Other Harvard Chan School authors of the zinc study included Joel Schwartz, professor of environmental epidemiology; and Itai Kloog, former visiting scientist, and Antonella Zanobetti, senior research scientist, both in the Department of Environmental Health.

In releasing the Rockefeller Foundation-Lancet Commission on Planetary Health report, Dr. Richard Horton, Editor-in-Chief of *The Lancet* and one of the report authors, said that the Commission "aims to put the health of human civilizations, and their special relationship with the larger biosphere, at the center of concerns for future planetary sustainability. Our civilization may seem strong and resilient, but history tells us that our societies are fragile and vulnerable. We hope to show how we can protect and strengthen all that we hold dear about our world."

Dr. Judith Rodin, President of the Rockefeller Foundation, said that the Commission "has issued a dire warning: Human action is undermining the resilience of the earth's natural systems, and in so doing we are compromising our own resilience, along with our health and, frankly, our

future. We are in a symbiotic relationship with our planet, and we must start to value that in very real ways. Just as Foundation leaders 100 years ago took a holistic view and launched the field of public health, the Commission's report marks a paradigm shift for a new era of global public health, one that must be integrated with broader policy decisions."

More information: "Effect of decreases of animal pollinators on human nutrition and global health: a modelling analysis," Matthew R. Smith, Gitanjali M. Singh, Dariush Mozaffarian, Samuel S. Myers, *The Lancet*, online July 16, 2015, DOI: 10.1016/S0140-6736(15)61085-6

"Effect of increased concentrations of atmospheric carbon dioxide on the global threat of zinc deficiency: a modelling study," Samuel S. Myers, K. Ryan Wessells, Itai Kloog, Antonella Zanobetti, Joel Schwartz, *Lancet Global Health*, online July 16, 2015, DOI: 10.1016/S2214-109X(15)00093-5

Provided by Harvard School of Public Health