I'm Samuel Myers, senior research scientist at the Harvard T.H. Chan School of Public Health. I study how our global transformation of Earth's natural systems impacts human health and nutrition. AMA!

HarvardChanSPH [1] and r/Science AMAs[1]

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Abstract

Hello, reddit! I'm Samuel Myers, a senior research scientist in the Department of Environmental Health at the Harvard T.H. Chan School of Public Health and I'm here to talk about Planetary Health. As part of my Planetary Health research, I lead five multidisciplinary research teams investigating 1) the global nutritional impacts of rising concentrations of CO2 in the atmosphere; 2) the health impacts of land management decisions in SE Asia associated with forest fires and particulate air pollution; 3) the nutritional impacts of reduced access to wildlife (bushmeat) in the diet in Madagascar; 4) the local (in Madagascar) and global consequences of fisheries decline for human nutrition and health; and 5) the impact of animal pollinator declines on human nutrition at a global scale. Planetary health is a growing field focused on understanding the many ways that human transformation of all of Earth's natural systems—the climate, oceans, land use, freshwater systems, and other ecosystems—impacts human health. I recently authored two studies in The Lancet that showed 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. 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. You can read an article about both of these studies here. If you are interested, you can find some of my research articles, radio interviews (Living on Earth, Morning Edition, Quirks and Quarks) and talks here. I'll be here at 1:00 p.m. EST to answer your questions; ask me anything! Edit 2:45 p.m.: Unfortunately, I have to sign off now. Thank you so much for your questions! I enjoyed chatting with you about this important topic. You can always visit my website to stay up to date on the latest research from me and my team.

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Science AMA Series: I'm Samuel Myers, senior research scientist at the Harvard T.H. Chan School of Public Health. I study how our global transformation of Earth's natural systems impacts human health a

HARVARDCHANSPH R/SCIENCE

ABSTRACT

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I'm Samuel Myers, a senior research scientist in the Department of Environmental Health at the Harvard T.H. Chan School of Public Health and I'm here to talk about Planetary Health. As part of my Planetary Health research, I lead five multidisciplinary research teams investigating 1) the global nutritional impacts of rising concentrations of CO2 in the atmosphere; 2) the health impacts of land management decisions in SE Asia associated with forest fires and particulate air pollution; 3) the nutritional impacts of reduced access to wildlife (bushmeat) in the diet in Madagascar; 4) the local (in Madagascar) and global consequences of fisheries decline for human nutrition and health; and 5) the impact of animal pollinator declines on human nutrition at a global scale. Planetary health is a growing field focused on understanding the many ways that human transformation of all of Earth's natural systems—the climate, oceans, land use, freshwater systems, and other ecosystems—impacts human health.
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Hello from BU Dr. Myers! What would you encourage us as individuals to do in terms of helping create a sustainable global food system?

Thanks for all your hard work! The human dimensions of global change is a fascinating and critical field that has so many intersections with other disciplinary fields.

jrp162

Hi jrp162, This question connects to several other questions about our global food production system and how we can make it more sustainable. As individuals, most of our ability to impact the food production system is through the dietary and purchasing decisions we make. There has been

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enormous growth in consumer awareness about how our dietary decisions impact a broad variety of issues from worker rights to preserving local landscapes to gender equity to health and to a host of environmental issues from climate change to water scarcity to biodiversity loss. From the standpoint of planetary health and trying to support the nutritional needs of a growing human population without destroying the biosphere in the process, our dietary decisions do make a difference. The strongest data supports reducing our consumption of meat, particularly beef and pork. Because most meat production involves feeding grain to livestock, and because the conversion of calories from grain to calories from meat is very inefficient--on the order of 8-10: 1--global meat consumption drives an enormous use of arable land, fossil fuels producing greenhouse gases, water consumption, fertilizer use, etc. If we were to switch to an entirely vegetarian diet, we would increase global caloric supply by 50%, allowing us to feed many more people without increasing our use of resources. Incidentally, reducing consumption of meat, particularly red meat, would provide immediate and significant global health benefits. We can also be cognizant of which fish we eat, using tools like the Monterey Bay Aquarium Seafood Watch tool to avoid threatened species. And being aware of *how* our food is produced matters as much as which foods we choose to eat. In addition to what we can do as individuals, there is the broader set of questions about how we, as a global society, can manage to feed several billion more people nutritious diets without destroying the biosphere (and ourselves) in the process. Put simply, we need to produce more nutritious food with fewer environmental inputs. In addition to consuming less meat, we need to waste less food. Roughly 40% of food produced is never consumed. In the developing world, this is because of pre-consumer losses from agricultural pests, spoilage, etc. In the developed world, most of the losses are post-consumer—food that is prepared but not consumed, food that spoils before it gets eaten etc. Both problems have solutions and implementing them would make an enormous difference in reducing the ecological footprint of global food production. In addition, we need to produce food with fewer inputs. It is important that we try to freeze the total land footprint of food production while increasing productivity—a process called agricultural intensification. This means producing more food on less arable land, with less water, fertilizers, and pesticides, and using less fossil fuel. There have been some excellent strides in this regard including the growth of the area of precision agriculture. This will also require closing yield gaps, the difference between the potential yield of a crop on a hectare of land and the actual yield. For more discussion on these topics, I recommend David Tillman's excellent writing on agricultural intensification. I also recommend Jon Foley's work in this field and his excellent Scientific American cover article: "Can we feed the world and sustain the planet" from November, 2011. In addition, he has an excellent Ted talk worth listening to.

This is fantastic, thank you for doing this! I enjoyed reading some of your research.

What do you think are some ways communities can promote a positive impact on local pollinator populations and steps individuals and communities can take to reverse that trend? Also, if you had to predict a rough timeline of a "point of no return" and ways to not get there, what would you say?

Thanks again for doing this!

branchout

Hi branchout, There is not an absolutely clear scientific consensus on the causes of pollinator declines, and it is likely that the causes are different in different parts of the world. That said, it is clear that a combination of loss of habitat, loss of forage (food for the pollinators), the use of insecticides, particularly a group called neonicitinoids, and possibly infectious diseases impacting pollinator species are all likely to have a role. In that light, what communities can do to promote pollinators is avoid the use of insecticides as much as possible and try to maintain forage and habitat. Recently the U.S. government announced a significant new program to increase forage and habitat for pollinators providing millions of hectares of for these purposes. Banning neonicitinoid pesticides would be another positive step. Citizens need to be vocal advocates for measure like these at the local, state, and

country level. Hopefully, understanding that there are very significant human health dividends in preserving populations of pollinators will also be motivating. One of the things we did in our recent paper in The Lancet was to analyze and quantify the health benefits in every country of protection of endemic pollinator species. Our goal was to make it clear to policy makers that there are very real health benefits of maintaining robust populations of pollinators within their country. You and several others have asked when do we reach the point of no return or how long do we have? Or when do we reach threshholds where it is too late. In general, I don't find this to be a particularly useful or accurate construct. Certainly, there are some instances of positive feedback loops that are alarming. For example, as polar ice melts, the albedo of the Earth surface goes up and increases the amount of heat that can be absorbed, accelerating further the ice melting. But in general, there is scant evidence that we will cross a particular boundary and be instantly trapped in irreversible degradation. To my mind, the more we damage and destabilize natural systems like the climate, fisheries, fresh water systems, etc, the greater the consequences. Certainly it is possible, that there are non-linear, catastrophic effects that we don't fully understand and the most conservative and sensible thing we could do as a global society is to protect and conserve these systems since they, collectively, underpin the habitability of the only habitable planet we know. But it is certainly not too late to make enormous progress in putting humanity on a more sustainable course.

I remember reading something about how warming oceans and over fishing are sky rocketing jellyfish populations which out compete fish leading to even faster depletion of fish stocks. Is this still a thing, can you elaborate some on it? Thanks.

PHealthy

Hi Phealthy This is not my area of expertise, although I have read similar work showing that once a trophic layer has been replaced by a different one, it can be hard for the intial species that were in that layer to recover. More generally, fisheries are having a tough go of it with over 90% of global fisheries being harvested at, or beyond, their maximum capacity. Yesterday's paper describing the failure of the Gulf of Maine cod fishery to recover in part because of climate change and ocean warming was sobering in this regard. Our group, led by my colleague, Chris Golden, is embarking on a several year project to connect the dots between environmental drivers like ocean warming and acidification associated with climate change; over fishing; and pollution to their consequences with respect to all the major fisheries in the world. We will then model how changes in fisheries will lead to changes in catch and consumption and, ultimately to nutritional impacts for different populations around the world. In this way, we hope to connect these global environmental drivers with their health consequences for the first time. This is really the crux of planetary health—quantifying the complex and sometimes indirect health impacts of changes in the structure and function of natural systems and allowing policy makers to understand how different management strategies might protect those ecological systems and also produce significant public health dividends.

To what extent do you believe these effects will be felt in developed nations? Even though developed countries have a much larger dependency on animal based food sources, it seems poorer nations will still be facing the brunt of these trends due to fewer resources and technological workarounds. I'm worried it might be another case of the rich nations exploiting the land and not even realizing the poorer ones are paying the price.

CCMerp

Hi CCMerp, You raise an excellent question. This question of who is vulnerable to health impacts of global environmental change is one that we addressed in a paper called Emerging Threats to Human Health from Global Environmental Change. It can be found on my website. Certainly, it is the case that

poorer populations in the developing world are likely to have much greater vulnerability to many of the impacts we study in Planetary Health. We found, for example, that the nutritional impacts of falling nutrients in staple food crops in response to higher levels of atmospheric CO2 are likely to be most strongly experienced by populations in sub-Saharan Africa and South Asia. But this is not always the case. For example, we are seeing very significant morbidity and mortality in the highly developed and wealthy city state of Singapore in response to biomass burning in less wealthy parts of Sumatra and Kalimantan. In our pollinator paper, we found that pollinator declines would have very significant health impacts in developed country populations because they already have fairly high baseline risks of heart disease, stroke, and certain cancers, and pollinator declines would further increase these risks because of reduced dietary intake of fruits, vegetables, and nuts and seeds. And certainly risks of natural hazards (think of Hurricane Katrina, Hurricane Sandy, and this year's wildfires across the western part of the United States) do not spare developed countries and have very significant health impacts.

Hi I am currently in graduate school for an MPH. How do you suggest getting into research like what you are doing? It seems like Public Health is such a vast field it is sometimes intimidating trying to find a niche like the one you are focusing on.

turdninja

Hi turdninja, There are a few questions here about how to learn about or train in planetary health. This is a relatively new field and you won't find a "planetary health" track in any schools of public health. My advice to students and graduate students is to get strong skills in basic epidemiology and statistics and become comfortable working with large datasets and modeling approaches. I'm not sure focusing on Nutrition is necessary. Planetary health has many dimensions--it is the study of the human health impacts of global environmental change, mostly anthropogenic change. These impacts take many forms from increased cardiorespiratory disease associated with particulate exposure from biomass burning to exposure to new infectious diseases as a result of climate change, land use change, or wildlife exposure, to nutrient deficiencies from changes in the quality or quantity of food we produce in the context of climate change, to increased risks of NCDs from loss of pollinators, to mental health impacts of reduced exposure to Nature. And there are myriad additional types of impacts, most of which have not been well characterized. Gaining strong skills in epidemiology and following the literature in planetary health to see not only the emerging findings but also the methodologies being used to answer questions will give you the necessary tools and, just as important, help you identify tractable and interesting questions to address in this field.

I'm probably misquoting, but there's a theory out there that suggests as climate change kicks into a higher gear, the struggle for diminishing natural resources globally will lead to increased acts of aggression. As you study public health at the global scale, are you coming across any data that relates to this? e.g. Any populations where violence has followed decades of air/water/land quality decline?

drarch

Hi drarch,

You are right that climate change, in conjunction with all the other types of global environmental change that are accelerating, has been implicated as a destabilizing influence that could lead to conflict. In fact the United States Military has been a leader in analyzing and publicizing this threat to security. There have been some analyses suggesting that conflict correlates with extreme weather but it is still an area of active research.

Your question touches on an important area of planetary health. In addition to direct health impacts of

global environmental change, an extremely important topic is how will multiple types of change alter the habitability of certain regions. For example, how will the combination of growing water scarcity, increased risk of drought from climate change, soil erosion and nutrient depletion, population growth, and higher incidence of natural hazards alter the habitability of parts of sub-Saharan Africa in ways that mean certain populations are, at least temporarily, forced to migrate away. And if a suite of interacting environmental change drives increased migration (which seems quite likely) how will resource-poor populations moving into new areas be received? Will this lead to conflict? In addition to the trauma associated with conflict, we know that migration itself carries significant health burdens from malnutrition, infectious disease epidemics, and psychological and physical trauma. This is an area urgently in need of further work.

Hello, Dr. Myers. I'm a lab technician at HSPH myself. I have read that indoor farms utilizing hydroponics and the like can be more efficient and produce more crops than traditional farming methods, as well as reduce shipping costs due to their proximity to urban areas. Why aren't we starting to see more of these types of farms in cities and areas subject to frequent drought? Is it only a matter of time before we start to see more of these farms, or is something standing in their way?

tordek1265

Hi tordek1265, Good to see a colleague here! I think this is an interesting question and am actually advising an undergraduate who is working on developing an aquaponic system in Cincinnati akin to what you are describing. I don't know that there are really good data showing how these systems compare with traditional systems with respect to inputs of energy, water, fertilizer, pesticides, or waste, but the argument has definitely been made that they are more efficient in these areas. We are working on using his system as a laboratory to study these issues and quantify both the inputs and outputs. While such systems could be an important source of produce and fish (in mixed systems) they clearly will not be a viable approach to producing staple grains which make up over 50% of global caloric intake. Another attractive aspect of them is that they can address the issue of "food deserts" in poorer urban areas where access to fresh produce can be limited. My guess is that we will continue to see a proliferation of these systems with benefits in terms of urban employment, nutrition, and ecological footprint.

Hi dr. Myers!

Here in Italy agriculture is in big decline. I think that many european nations have similar problems. Therefore I was thinking... What if we just put very large fees on importing food and animal feed from outside the EU? Would this reduce carbon emission from transportation and farming/forest destructions in countries where this is not sustainable?

lucaxx85

Hi lucaxx85,

This is probably not the best approach. Interestingly, there is strong data from life-cycle analyses that eating locally is not always the best way to reduce carbon emissions. For example, a study in Great Britain showed that choosing to eat lamb raised in New Zealand actually has a lower carbon footprint than eating lamb produced in Great Britain. The reason is that the lamb in New Zealand grazes on grass, whereas the lamb produced in GB is fed grain. The carbon footprint associated with producing all of the grain fed to the lambs more than offset the carbon footprint associated with transporting the lamb from NZ to GB.

There would also be significant consequences to relatively poor farmers producing food in other parts

of the world for the European market of instituting such high tariffs. But coming up with certain kinds of food production standards (think shade-grown coffee or cocoa, or fair-trade coffee) could be another way of addressing these concerns.

Very interesting research fields. I'm intrigued by the absence of a team investigating the deficiencies caused by impoverished soils by erosion, lack of biological activity and availability of micronutrients (a common belief among organic and permaculture enthusiasts). Would you say there's not enough serious scientific evidence to warrant such an investigation and that the effects of industrialized farming on soil nutrition is neglectable, or is it just not your focus currently?

luizedu91

Hi luizedu91,

To the contrary, I think these are important and interesting questions. There is a lot of dogma in the world of food and sustainable agriculture, and strong research to support or refute the kinds of claims that are out there is needed. More broadly, the question of massive nutrient depletion in soils like those in sub-Saharan Africa and the consequences for human nutrition is important and worthy of more research, as is the corrolary question of how addition of nutrients with fertilizers would generate health benefits for local populations. The fact that these are not questions I am researching is only a reflection of our limited capacity to address all the interesting questions. There are so many important, tractable questions in planetary health and we need more investigators to address them!