

SHORT REPORT

Protecting the planet and sustainable development

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Abstract

The United Nations has made a commitment for sustainable development. An important component of this is a healthy environment. But what exactly is a healthy environment? Environmental health specialists typically focus on occupational exposures in workers; the field mainly addresses the abiotic (i.e. non-living) aspects of environments. Ecosystem health addresses biotic (i.e. living) aspects of environments. Merging these two realms is essential for sustainable development but will be challenging because the fields are so different. The United Nations, individual countries, and schools of public health could do much to help merge these realms by implementing environmental/ecosystem health into their missions and curriculums.

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Expanding the definition of environmental health

The definition of environmental health must be expanded. The twenty-first century presents many challenges to global health. A growing human population, estimated to reach approximately 9 billion by 2050 if estimated growth rates continue, will require food, water, and other natural resources to survive. Meeting humanity's demands for natural resources threatens the environment including worsening deforestation, land degradation and contamination, water contamination, diminishing biodiversity, and spreading vector-borne and other zoonotic diseases. A warming climate with extreme weather conditions including drought and floods threatens agriculture and food security, the foundation of civilization. In the midst of all of these developments, a healthy environment seems almost impossible. But, the need for a healthy environment is imperative for life to continue, and the need to educate the next generation on the importance of sustainable development in a habitable world is essential (1,2). The question is: "*what exactly is a healthy environment and how should it be defined?*"

The National Environmental Health Association (NEHA) defines environmental health as "*the science and practice of preventing human injury and illness and promoting well-being by identifying and evaluating environmental sources and hazardous agents and limiting exposures to hazardous physical, chemical, and biological agents in air, water, soil, food and other environmental media or settings that may adversely affect human health*"(3). This definition focuses primarily on the hazards that affect humans. From a One Health perspective, however, it leaves out animals and the environment, itself.

One Health is the concept that human, animal, and environmental health are linked, and because they are linked, complex subjects such as emerging diseases, food safety and security, antimicrobial resistance, and waterborne illnesses must be examined and addressed in an interdisciplinary, holistic way. The term is relatively new, but the concept is ancient. Nevertheless, environmental health has been difficult to integrate into One Health for a variety of reasons.

First, those who work on environmental health, such as occupational and environmental physicians, nurses, and environmental health specialists, focus their work primarily on abiotic (i.e. non-living) contaminants, pesticides, and toxic waste exposures in occupational settings that affect workers. While this is extremely important, it is not the only aspect of what constitutes a healthy environment.

Ecosystem health focuses on the biotic (i.e. living) components of an environment and their interactions. Many scientists and other professionals from a variety of academic disciplines work on ecosystem health such as wildlife veterinarians, biologists, geologists, ecologists, plant pathologists and others. They study the web of life, complex interactions between many interconnecting systems.

Man-made alterations to entire ecosystems have many consequences, both intentional and unintentional, potentially harming the health of current and future generations (4). Environmental/ecosystem health would address the inter-action between the biotic (i.e. living) and abiotic components of environments and ecosystems. Unchecked development, including the destruction of ecosystems for agricultural or other purposes, potentially jeopardizes the health of regions, including the health of animals and humans. The challenge is integrating both the environmental and ecosystem health realms into a unified field that incorporates the One Health paradigm. A new inclusive term should be developed to reflect the expanded mandate.

Efforts are underway to establish new integrated environmental/ecosystem health fields. One is called "planetary health" (5). Advocates for planetary health seek to educate a new cadre of individuals (6). The challenge with this strategy is that it focuses primarily on humans and the

environment, minimizing the importance of animal health and zoonotic diseases. Also, planetary health is a broad, general term; it's not entirely clear what exactly its practitioners would do, or who would hire them. One Health recognizes the vast breadth of knowledge and skills needed for human, animal, and environmental/ecosystem health and seeks to increase communication and collaboration between medical, veterinary medical, and public health professionals and scientists to achieve these goals.

A global international body and environmental protection

A global, coordinating international body must be in charge of environmental monitoring and protection. Currently, there is no United Nations Environmental Protection Organization, but there is an Environment Programme that was established in 1972 with the mission to promote wise use of the environment and assess global trends (7). For the fiscal year 2014-2015, its total planned budget, from voluntary contributions from member states, was approximately \$619 million, which was a 134 percent increase from the previous fiscal year(8). To put this budget into perspective, the World Health Organization's budget for 2014-2015 was almost \$4 billion (9) (WHO has an environmental health section that addresses sanitation and water and air pollution but not necessarily ecosystems). The 2014-2015 budget for the Food and Agriculture Organization (FAO) was approximately \$2 billion (10). FAO focuses primarily on food safety and security. In contrast, the 2014-2015 budget for the World Organization for Animal Health (OIE) was €2 million (approximately \$17.2 million in 2014 USD) (11,12). The OIE's mission is to ensure healthy food animals for food safety.

Vast disparities in international funding between human, animal, and environmental health makes implementing a global One Health strategy extremely difficult, if not impossible. If world leaders were serious about protecting the environment/ecosystems of the planet, they should consider establishing a World Environment/Ecosystem Protection Organization with a mandate to examine and address environmental/ecosystem alterations and their resulting outcomes; the organization should have a budget at least comparable to the FAO, and it should have enough power to influence nations to act in the best interest of humanity to ensure planetary habitability and survival.

Countries' commitments

Countries must make commitments to study and protect their environments/ecosystems. Analogous to the international level, many nations such as the U.S., allocate little for analyzing, managing, and protecting their environments/ecosystems. In the U.S., responsibilities for environmental/ecosystem health are split between government agencies, which can dilute the overall effectiveness of efforts. The U.S. Department of the Interior oversees the U.S. Fish and Wildlife Service, which has the responsibility to manage biological resources and enforce laws like the Marine Mammal Protection Act and the Endangered Species Act (13). In the fiscal year 2012, its budget was \$1.48 billion, a two percent decrease from the previous year (14).

The Environmental Protection Agency (EPA), established in 1970 because of public concern about environmental pollution, conducts monitoring, standard-setting, research, and enforcement activities to protect the public from environmental contaminants, toxic wastes, and other health hazards (15). In the fiscal year 2015, its budget was \$7.89 billion, a 4 percent decrease from the fiscal year 2014 (16). President Donald Trump has vowed to eviscerate, and possibly eliminate, the EPA (17).

The US Geological Survey, under the aegis of the Department of the Interior, was created in 1879 to provide scientific information to understand the Earth and to manage the nation's water, biological, energy, and mineral resources in order to protect life (18). The USGS

monitors, collects, and analyzes data concerning natural resources. They provide scientific information to policy makers, planners, and others (18). In the fiscal year 2012, the U.S. Fish and Wildlife Service's budget was approximately \$ 1.48 billion, an approximate 2 percent decrease from the previous year (19). These entities do work together, but funding is tight, and efforts might not necessarily be coordinated. The Trump Administration and the Republican-controlled Congress threaten to undo many of the conservation and environmental/ecosystem protection efforts over the past sixty years (20).

The role of Schools of Public Health

Schools of Public Health should offer interdisciplinary courses in conjunction with Geological Sciences and Agriculture and Forestry on environmental and ecosystem health, sustainable agriculture and biodiversity, food safety and security, water management and others. Schools of public health traditionally teach subjects such as biostatistics, epidemiology, health policy and management, socio-medical sciences, population and family health, and environmental health. Environmental health concentrates primarily on reducing carcinogens, toxic waste exposures, and other harmful chemicals.

However, the health threats we face in the 21st century extend well beyond traditional public health subject areas. Massive waste production from megacities and large animal production facilities threatens water and land quality as run-off from sludge seeps into soils and groundwater. Sanitation and hygiene will become one of the most important fields of public health, particularly in an era of worsening antimicrobial resistance. Preventing disease by lowering microbial burdens must be a global priority. Contaminated land and water contributes to food and water-borne illnesses. Severe droughts, floods, and unpredictable weather threaten food security as well as food safety. Arthropod-borne diseases are spreading, and will continue to do so with on-going deforestation, upending delicate ecosystems.

The curricula of schools of public health need to change to meet the challenges of the 21st century. Much more emphasis should be given to emerging zoonotic diseases, entomology, parasitology, virology, and bacteriology. Food safety and security should be taught along with sanitation and hygiene, environmental and ecosystem health, climate and health. One Health policy should be taught to examine the intersection between public health, agriculture, and environmental/ecosystem health.

The importance of agriculture is rarely discussed outside of agriculture and animal husbandry courses. This must change. With worsening climate change, agriculture will be threatened in unprecedented ways. Food security and its impact on civil society will be an increasingly important subject in the decades ahead.

One Health education should be team-based (analogous to business schools) and should be focused on researching and analyzing national and international government infrastructures relevant to human, animal, and environmental health. Most health policy courses focus on healthcare delivery such as in hospitals and clinics. Health insurance coverage is another common area of study. But, policy education must be expanded to examine the larger issues such as biodefense, food safety and security, and disaster preparedness. The world needs creative thinkers and problem solvers who can conduct fieldwork projects at local, regional, national, and international levels to improve global One Health.

Conclusion

In conclusion, environmental/ecosystem health must be better defined to meet the challenges of the 21st century. Expanding human populations, deforestation, land degradation, water contamination, massive human and animal manure production, crumbling sanitation

infrastructures, the growth of megacities, diminishing biodiversity, food safety and security, agriculture and animal husbandry, emerging zoonotic diseases are all tied together and adversely impact the world's environments/ecosystems, and ultimately, global health. These subjects must be examined and taught using an integrated One Health framework to adequately understand and address them.

United Nations member states have already made a commitment for sustainable development. At a United Nations Sustainable Development Summit meeting in September 2015, world leaders adopted 17 Sustainable Development Goals for the 2030 Agenda for Sustainable Development. World leaders recognize the importance of setting goals for leaving future generations a habitable planet. Expanding the definition of environmental health to include ecosystems and integrating it into a holistic, interdisciplinary One Health framework would be an important first step forward.

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