THE ROLE OF ENVIRONMENT IN ONE HEALTH AND NATIONAL HEALTH SECURITY

Across the world, ministries of environment and natural resources and/or environmental protection agencies have different mandates and missions, but many of them focus on the protection of the environment with the goal of protecting public health. Environmental health practitioners monitor food safety from farm to table; are responsible for vector and vermin monitoring and control; and monitor microbial and chemical pollution of the land, water, and air. Natural resource managers monitor ecosystems and landscapes, and the creatures that occupy them. They often see trends in the natural world before they are seen in the urban world. For example, unusual wildlife morbidity and mortality can indicate presence of pathogenic or toxic agents that could potentially be detrimental to human health. The environment sector is a valuable contributor in the promotion of population health and well-being, particularly in "health security" efforts to prevent and prepare for endemic, epidemic, and pandemic threats.

LINKS BETWEEN ENVIRONMENT AND HEALTH

The links between biodiversity, ecosystems, and public health are well documented in recent publications (e.g., WHO-CBD *State of Knowledge Review on Biodiversity and Human Health* 2015; WHO *Millennium Ecosystem Assessment* 2005). These links range from ecosystem services that contribute to human health—provision of food, water, and medicines—to pollution remediation, to pathogen regulation. Particularly relevant connections for health security include:

PHOTO BY CHRISTINE JOHNSON

- The majority of known pathogens infectious to humans have animal origins ("zoonotic diseases"). Of these, approximately three-quarters emerged from wildlife, such as HIV/AIDS, Ebola, and SARS;
- The drivers of biodiversity loss, ecosystem degradation, and disease emergence, including changes in land use/habitat or hunting and trade, overlap, which modifies disease ecology dynamics and puts humans and wildlife into new or increasing contact.

Under broad guidance from the World Health Organization, on the requirements of the International Health Regulations (IHR 2005), *countries are currently undertaking national action planning for health security, a process intended to promote multi-sectoral partnerships to prevent, prepare, and respond to disease threats*. The environmental community can play a crucial role in this process, and seek to inform and support animal and human health partners in identifying synergies. National Biodiversity Strategies and Action Plans and other land use planning tools provide important information for health security planning.

In 2014 parties to the United Nations Convention on Biological Diversity agreed to recognize "the value of the 'One Health' approach to address the cross-cutting issue of biodiversity and human health, as an integrated approach consistent with the ecosystem approach (decision V/6) that integrates the complex relationships between humans, microorganisms, animals, plants, agriculture, wildlife and the environment."

VALUE OF THE ENVIRONMENTAL AND NATURAL RESOURCE SECTOR TO THE PUBLIC HEALTH SECTOR

The environment sector plays an essential role in public health, yet, to date, it has been an under-utilized partner for health security in most countries. While authorities from the human health, animal health, and environment sectors may not be aware of the benefits of collaboration with one another, the "One Health" concept recognizes the connections between human, animal, and ecosystem health, which will hopefully allow the concept to reach its full potential in practice at local, national, and global levels. By utilizing data, expertise, and management approaches in the environment and natural resource sector, we can enhance our understanding of the root causes of diseases, better account for complexity of environmental factors, and ultimately encourage protection of natural resources to benefit health.

Involving environmental and natural resource professionals, and the data that they collect, will result in a more comprehensive picture of the factors that affect human health. Data includes:

- Climate/weather forecasting to predict and inform vaccination campaigns, particularly for climate-sensitive vector-borne diseases.
- Water quality monitoring for bacterial, algal, and inorganic contaminants that can cause human and animal illness.
- The linkages between environmental contamination and animal and human health, including waste management practices and dissemination of anti-microbials, pesticides, and insecticides.
- Dynamics (ecological) and drivers (anthropogenic) leading to zoonotic and vector-borne disease emergence.
- Sentinel monitoring of wildlife to identify diseases before potential spillover to domestic animals and/or humans (e.g., for the predictive value of Ebola virus in great apes).

The environmental sector plays a key role in early warning, detection, and identifying disease risk, as well as in response. For example in:

Egyptian Fruit Bats, *Rousettus aegpyticus*, during sampling by PREDICT staff in a cave at Belinga, Gabon PHOTO BY MATTHEW LEBRETON AND BRAD SCHNEIDER

- Identifying appropriate control strategies to balance immediate public health concerns and potential long-term damages to ecological systems and associated ecosystem services that may result from control measures (e.g. insecticide spraying, wildlife culling). For example, environmental health professionals in Liberia were responsible for dead body management during the Ebola crisis.
- Assessing outcomes from ecosystem modification (e.g. land use change for agriculture or extractive industries, invasive species introductions) and likely consequences (positive or negative) for human and animal health that may be associated with declining species habitat, changing presence of "generalist" species along fragmented landscapes, animal migration, suitable habitat for disease vectors, food chain, etc.
- Conducting risk assessments for known and novel disease presence and/or introduction/establishment, based on species range and ecological niche, behavior, and inter-species spillover potential.

Environmental authorities may also detect and monitor diseases in wildlife that do not pose a direct threat to humans. However, even non-zoonotic diseases may have implications for the health and functioning of ecosystems in ways that can indirectly affect humans (e.g. via pest control, pollination, etc.).

Expertise and infrastructure from environmental services are valuable components of health security, and should be included in national processes to maximize protection of the public's health.

For more information, please visit: www.preparednessandresponse.org and www.predict.global
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