'Deadly dozen' reports diseases worsened by climate change

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Health experts from the Wildlife Conservation Society today released a report that lists 12 pathogens that could spread into new regions as a result of climate change, with potential impacts to both human and wildlife health and global economies. Called The Deadly Dozen: Wildlife Diseases in the Age of Climate Change, the new report provides examples of diseases that could spread as a result of changes in temperatures and precipitation levels. The best defense, according to the report's authors, is a good offense in the form of wildlife monitoring to detect how these diseases are moving so health professionals can learn and prepare to mitigate their impact.

The report was released at the IUCN World Conservation Congress, held in Barcelona, Spain.

"The term 'climate change' conjures images of melting ice caps and rising sea levels that threaten coastal cities and nations, but just as important is how increasing temperatures and fluctuating precipitation levels will change the distribution of dangerous pathogens," said Dr. Steven E. Sanderson, President and CEO of the Wildlife Conservation Society. "The health of wild animals is tightly linked to the ecosystems in which they live and influenced by the environment surrounding them, and even minor disturbances can have far reaching consequences on what diseases they might encounter and transmit as climate changes. Monitoring wildlife health will help us predict where those trouble spots will occur and plan how to prepare."

The "Deadly Dozen" list—including such diseases as avian influenza, Ebola, cholera, and tuberculosis—is illustrative only of the broad range of infectious diseases that threaten humans and animals. It builds upon the recommendations included in a recently published paper titled "Wildlife Health as an Indicator of Climate Change," which appears in a newly released book, Global Climate Change and Extreme Weather Events: Understanding the Contributions to Infectious Disease Emergence, published by the National Academy of Sciences/Institute of Medicine. The study examines the nuts and bolts of deleterious impacts of climate change on the health of wild animals and the cascading effects on human populations.

In addition to the health threats that diseases pose to human and wildlife populations, the pathogens that originate from or move through wildlife populations have already destabilized trade to a large extent and caused significant economic damage. For instance, several livestock diseases that have reemerged since the mid-1990s (including avian influenza) have caused an estimated $100 billion in losses to the global economy.

WCS's Global Health Programs currently leads an international consortium that helps to monitor the movements of avian influenza through wild bird populations around the world. The GAINS program (Global Avian Influenza Network for Surveillance) was created in 2006 with support from the United States Agency for International Development (USAID) and now involves dozens of private and public partners that monitor wild bird populations for avian influenza around the world.

"Emerging infectious diseases are a major threat to the health and economic stability of the world," said Congresswoman Rosa L. DeLauro (D-CT3), a champion for the GAINS Program "What we've learned from WCS and the GAINS Program is that monitoring wildlife populations for potential health threats is essential in our preparedness

and prevention strategy and expanding monitoring beyond bird flu to other deadly diseases must be our immediate next step."

"The monitoring of wildlife health provides us with a sensitive and quantitative means of detecting changes in the environment," said Dr. William Karesh, Vice President and Director of WCS's Global Health Programs. Wildlife health monitoring provides a new lens to see what is changing around us and will help governments, agencies, and communities detect and mitigate threats before they become disasters."

THE DEADLY DOZEN

Many wildlife pathogens have been the focus of monitoring efforts, but few data exist on how diseases will spread in response to climate change. The following list includes those pathogens that may spread as a result of changing temperatures and precipitation levels. Monitoring efforts for these diseases need to be examined in tandem with meteorological data to uncover climate-related trends. The list is not a comprehensive one, and subsequent studies may eliminate pathogens from the list of those enabled by climatic factors.

-- Avian influenza: Like human influenza, avian influenza viruses occur naturally in wild birds, though often with no dire consequences. The virus is shed by infected birds via secretions and feces. Poultry may contract the virus from other domestic birds or wild birds. A highly pathogenic strain of the disease—H5N1—is currently a major concern for the world's governments and health organizations, specifically because it has proven deadly to domestic and wild birds, as well as humans, and has the potential to evolve into a strain that can spread from human to human. Current data indicate that the movement of H5N1 from region to region is largely driven by the trade in poultry, but changes in climate such as severe winter storms and droughts can disrupt normal movements of wild birds and can bring both wild and domestic

bird populations into greater contact at remaining water sources.

-- Babesiosis: Babesia species are examples of tick-borne diseases that affect domestic animals and wildlife, and Babesiosis is an emerging disease in humans. In some instances, Babesia may not always cause severe problems by themselves but when infections are severe due to large numbers of ticks, the host becomes more susceptible to other infectious diseases. This has been seen in large die-offs of lions in East Africa due to canine distemper. Climate factors fostered heavy infestations of ticks on wild buffalo and subsequent spill-over infection of lions. The lions then became more susceptible to infections with the distemper virus. In Europe and North America, the disease is becoming more common in humans, also linked with tick distributions. Diseases that have previously been thought to have limited impact, such as babesiosis, must be watched closely in a changing climate to assess how environmental conditions may tip the scale and cause more significant impacts on ecosystems, animals, and people.

-- Cholera: Cholera is a water-borne diarrheal disease affecting humans mainly in the developing world. It is caused by a bacterium, Vibrio cholerae, which survives in small organisms in contaminated water sources and may also be present in raw shellfish such as oysters. Once contracted, cholera quickly becomes deadly. It is highly temperature dependent, and increases in water temperature are directly correlated with occurrence of the disease. Rising global temperatures due to climate change are expected to increase incidence of this disease.

-- Ebola: Ebola hemorrhagic fever virus and its closely related cousin—the Marburg fever virus—easily kill humans, gorillas, and chimpanzees, and there is currently no known cure. Scientists continue to work on finding the source of the disease and to develop vaccines for protection. There is significant evidence that outbreaks of both diseases are related to unusual variations in rainfall/dry season patterns. As

climate change disrupts and exaggerates seasonal patterns, we may expect to see outbreaks of these deadly diseases occurring in new locations and with more frequency. WCS's work on Ebola in Central Africa has been supported by the US Fish and Wildlife Service.

-- Intestinal and external parasites: Parasites are widespread throughout terrestrial and aquatic environments. As temperatures and precipitation levels shift, survival of parasites in the environment will increase in many places, infecting an increasing number of humans and animals. Many species of parasites are zoonotic, spread between wildlife and humans. The nematode, Baylisascaris procyonis, is spread by the common raccoon and is deadly to many other species of wildlife and humans. A close relative, Baylisascaris schroederi, causes death in its natural host—the critically endangered giant panda. Monitoring of parasite species and loads in wildlife and livestock help us identify transmission of these infections between domestic and wild animals and humans.

-- Lyme disease: This disease is caused by a bacterium and is transmitted to humans through tick bites. Tick distributions will shift as a result of climate change, bringing Lyme disease into new regions to infect more animals and people. Although effects of the disease on wildlife have not been documented, human-induced changes in the environment and on population patterns of species such as white-tailed deer that can carry infective ticks greatly affect the distribution of this disease. Monitoring of tick distributions will be necessary to assess the impacts of climate change on this disease.

-- Plague: Plague, Yersinia pestis—one of the oldest infectious diseases known—still causes significant death rates in wildlife, domestic animals, and humans in certain locations. Plague is spread by rodents and their fleas. Alterations in temperatures and rainfall are expected to change the distribution of rodent populations around the globe, which would impact

the range of rodent-born diseases such as plague.

-- "Red tides": Harmful algal blooms off global coasts create toxins that are deadly to both humans and wildlife. These occurrences—commonly called "red tides"—cause mass fish kills, marine mammal strandings, penguin and seabird mortality, and human illness and death from brevetoxins, domoic acid, and saxitoxins (the cause of "paralytic shellfish poisoning"). Similar events in freshwater are caused by a species of Cyanobacteria and have resulted in animal die-offs in Africa. Altered temperatures or food-web dynamics resulting from climate change will have unpredictable impacts on the occurrences of this worldwide phenomenon. Effects of harmful algal blooms on sea life are often the first indicators that such an event is taking place.

-- Rift Valley Fever: Rift Valley fever virus (RVFV) is an emerging zoonotic disease of significant public health, food security, and overall economic importance, particularly in Africa and the Middle East. In infected livestock such as cattle, sheep, goats and camels, abortions and high death rates are common. In people (who can get the virus from butchering infected animals), the disease can be fatal. Given the role of mosquitoes in transmission of the virus, changes in climate continue to be associated with concerns over the spread of RVFV.

-- Sleeping sickness: Also known as trypanosomiasis, this disease affects people and animals. It is caused by the protozoan, Trypanosoma brucei, and transmitted by the tsetse fly. The disease is endemic in certain regions of Sub-Saharan Africa, affecting 36 countries, with estimates of 300,000 new cases every year and more than 40,000 human deaths each year in eastern Africa. Domestic cattle are a major source of the disease, but wildlife can be infected and maintain the disease in an area. Direct and indirect effects (such as human land-use patterns) of climate change on tsetse fly distributions could play a role in the distribution of this deadly disease.

-- Tuberculosis: As humans have moved cattle around the world, bovine tuberculosis has also spread. It now has a global distribution and is especially problematic in Africa, where it was introduced by European livestock in the 1800s. The disease infects vital wildlife populations, such as buffalo and lions in Kruger National Park in South Africa, where tourism is an integral part of local economies. The disease also infects humans in southern Africa through the consumption of un-pasteurized milk. Human forms of tuberculosis can also infect wild animals. Climate change impacts on water availability due to drought are likely to increase the contact of wildlife and livestock at limited water sources, resulting in increased transmission of the disease between livestock and wildlife and livestock and humans.

-- Yellow fever: Found in the tropical regions of Africa and parts of Central and South America, this virus is carried by mosquitoes, which will spread into new areas as changes in temperatures and precipitation levels permit. One type of the virus—jungle yellow fever—can be spread from primates to humans and vice-versa via mosquitoes that feed on both hosts. Recent outbreaks in Brazil and Argentina have had devastating impacts on wild primate populations. In some countries in South America, monitoring of wild primates has resulted in early detection of disease activity and allowed vaccination programs to be rapidly implemented to protect humans.

Source: Wildlife Conservation Society

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