Wild Health Net

Overview

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Why WildHealthNet?

Human activities and anthropogenic changes to the planet's ecosystems over the past two centuries have resulted in wildlife, domestic animals, and humans increasingly coming into contact with each other and with each other's microbes and pathogens. Direct consequences of these processes on wildlife include the global decline and extinction of amphibian species due to the Chytrid fungus and the extirpation of North American bats affected by a fungal disease. Such declines can trigger cascading ecological impacts devastating not only for biodiversity conservation and nature-based solutions but also rural livelihoods. At the wildlife-livestock interface, outbreaks of common livestock pathogens impact wild ungulates, domestic animals, and livelihoods. For example, Mongolian saiga antelope experienced 80% mortality due to Peste de Petit Ruminant virus and presently domestic and wild suids are experiencing dramatic losses in South East Asia due to the spread of African Swine Fever. In simple terms, greater human contact with wild animals and their pathogens is a consequence of degradation and destruction of nature and trading wildlife. Wildlife pathogens threaten human health directly as zoonoses, but also indirectly via food and economic insecurity. SARS-CoV-1, Ebola, Nipah, and Avian Influenza A are recent examples of lethal viruses of wildlife origin that have impacted human populations. SARS-CoV-2 also has a likely wildlife origin, providing a stark lesson of how these pathogens can cause global scale catastrophe, and highlighting the need to incorporate wildlife surveillance into the "detect, prevent, respond" approach of the global health community.

Despite the relevance of wildlife pathogens for biodiversity, livestock, and humans, wildlife health surveillance remains extremely rare on a global scale, with just a few developed countries conducting established, nationwide, and centralized programs for certain known pathogens. A cursory review of national assessments for 107 countries found 83% did not report wildlife surveillance or reported specific gaps[1]. The few wildlife health surveillance systems that are in place provide clear evidence of their value for conservation, food supply chains, and public health. In the aftermath of COVID-19 the world needs to get this right. While some progress has been made, efforts to build upstream prevention capacity on the front lines and develop national surveillance programs are still limited. The historic neglect of wildlife surveillance and environmental health has imperiled our ability to protect wildlife, domestic animals, and people from emerging diseases.

Solutions to improve and scale wildlife health surveillance that build on existing and ongoing successes are critically needed.

These Biomeme units, the latest portable smartphone-enabled diagnostic technology, were deployed in the Republic of Congo to rapidly test wildlife carcasses for Ebola virus using RT-PCR to prevent spillover into humans.

[1] Machalaba, C., Uhart, M., Ryser-Degiorgis, M.-P. & Karesh, W. B. Gaps in health security related to wildlife and environment affecting pandemic prevention and preparedness, 2007–2020. Bull. World Health Organ. 99, 342-350B (2021).

Vision Statement

WildHealthNet supports national wildlife health surveillance systems[2] that enable wildlife, human, livestock, and environmental health and well-being and respond to global needs for One Health intelligence. **WildHealthNet involves implementation and growing a global WildHealthNet Consortium composed of the following core processes**:

WHN

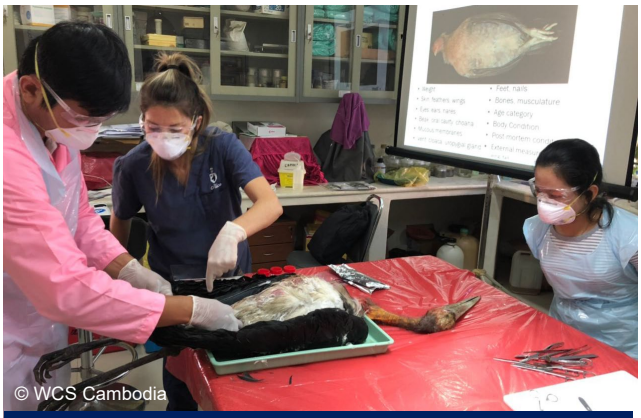
WildHealth**Build**
WildHealth**Skills**
WildHealth**Tech**
WildHealth**Response**

WildHealth**Build**: process of iteratively identifying, connecting, and integrating actors into an operational surveillance structure and formalizing their responsibilities. This requires mapping of communication between actors and sectors while building durable relationships among network members and between different levels of the network. As an existing One Health mandate is often lacking, it is essential that these relationships are built across human, wildlife, environment and domestic/livestock animal sectors. Policy development and legislation ensures network formalization and transition from project-based efforts to government-led surveillance that is standardized, sustainable, accountable, and effective. This involves creation of Standard Operating Procedures (SOPs) and Terms of Reference (ToR) that define the objectives of the surveillance and outline the roles and responsibilities of network actors. Implementation is iterative and includes evaluation through monitoring of indicators and targets, to improve the system with adaptive management principles. Local knowledge is highly valued. Because of the global scale and composition of the consortium, WildHealthBuild facilitates the establishment of regional collaborations and coordination with international multilateral organizations (i.e. OIE, FAO, WHO).

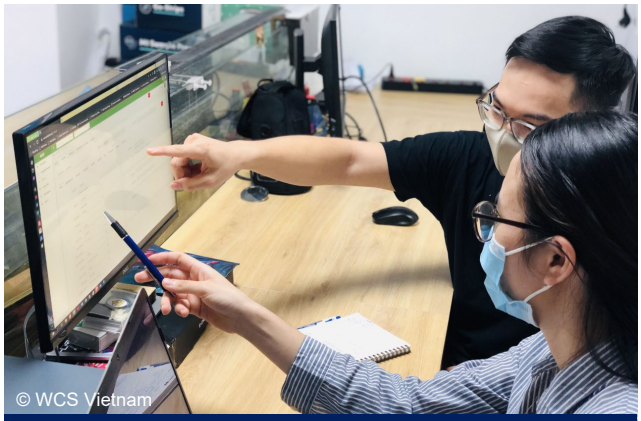
Workshop participants discussing how diverse local actors, from rangers on patrol in protected areas to district veterinarians, can contribute to Vietnam's national wildlife health surveillance system.

[2] World Organisation for Animal Health (OIE) definition of surveillance: 'the systematic ongoing collection, collation and analysis of information related to animal health, and the timely dissemination of this information so that action can be taken'

WildHealth**Skills**: process to identify existing capacity, knowledge gaps, and available human resources across different roles and levels within the network. The approach will deliver targeted, context specific capacity bridging material for stakeholders that goes beyond one-size-fits-all training. Examples range from basic observation, reporting and sampling of a wildlife mortality event, to improving expertise on data management, lab diagnostics, pathology, network coordination and cost budgeting, training of wildlife health intelligence responders, and guiding decision makers on evaluation and interpretation of surveillance data. The result is the development of a standard curriculum so that training is efficiently packaged, adapted to the respective target audience, and can be validated and certified using sustainable training of trainer approaches.



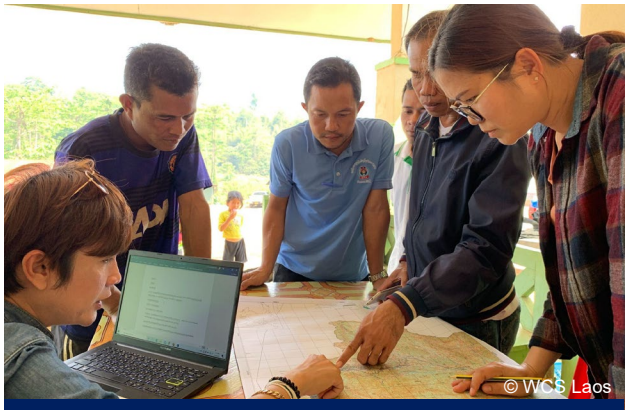
Building expertise on how to safely conduct wildlife necropsies in local labs, like here at the National Animal Health Laboratory in Cambodia.



One-on-one training and mentoring of national network coordinator on best practices for data management.

WildHealth**Tech**: process to identify and deploy appropriate and sustainable technology to support accurate data generation, smooth field data collection, and efficient data management with standardization, access, sharing, and communication of information that supports decision making. These tools include portable handheld devices and open source software for data collection, field diagnostics, bioinformatics, server-based software, cloud based data sharing, environmental sensors, and eDNA. They also include a suite of analytical tools (from dashboards with descriptive analytics and maps to high level statistical models, and machine learning) adapted to specific user or user group needs. Technology sustains the harmonized functionality of a multi-organization effort (e.g., wildlife health surveillance networks) and it is used in a context where human resources are the key factor for its successful implementation and use.

WildHealth**Response**: continuous process of building a community of practice around wildlife health surveillance and response across local to global scales. This network of individual to institutional practitioners engages a broader One Health community, provides access to technical support on study design, data, diagnostics, pathology, analytics, and any other surveillance or response related activity; connects members with knowledge resources, new approaches, novel technologies, and experiences of other members in managing wildlife health. When a threat is identified, it provides rapid response guidance, disease management resources and staffing to assist when requested.



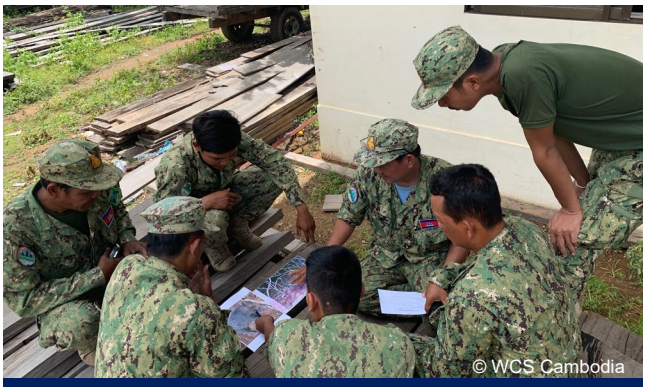
Meeting with local communities in Laos at the frontlines of an African Swine Fever outbreak and conducting participatory mapping interviews to better understand the impacts on wild boar and their potential role as a reservoir host.

Our Approach in Practice

WildHealthNet is a multi-pronged, multi-disciplinary, trans-sectoral, and locally relevant approach to implementing international regulations, standards, and best practices (Box 1). Our implementing teams build on existing capacity and communication networks in each country or region, backstop when needed, and link national programs with required resources. **Examples from WCS pilot efforts show how WildHealthNet works to support the range of the local skills, knowledge, and infrastructure needed for wildlife health surveillance systems.**

The key to our success in building wildlife health surveillance networks is our ability, with our partners, to translate global visions into locally relevant solutions. In over 60 countries globally, WCS works with a landscape-based approach, establishing strong and long-term equitable partnerships that strengthen local governance structures and local partners. This allows us to work collaboratively with local groups and institutions to prioritize meaningful surveillance objectives, facilitate rapid cycles of development/implementation/evaluation of surveillance procedures, and foster partner engagement and leadership in critical policy dialogues regarding roles and responsibilities among stakeholders.

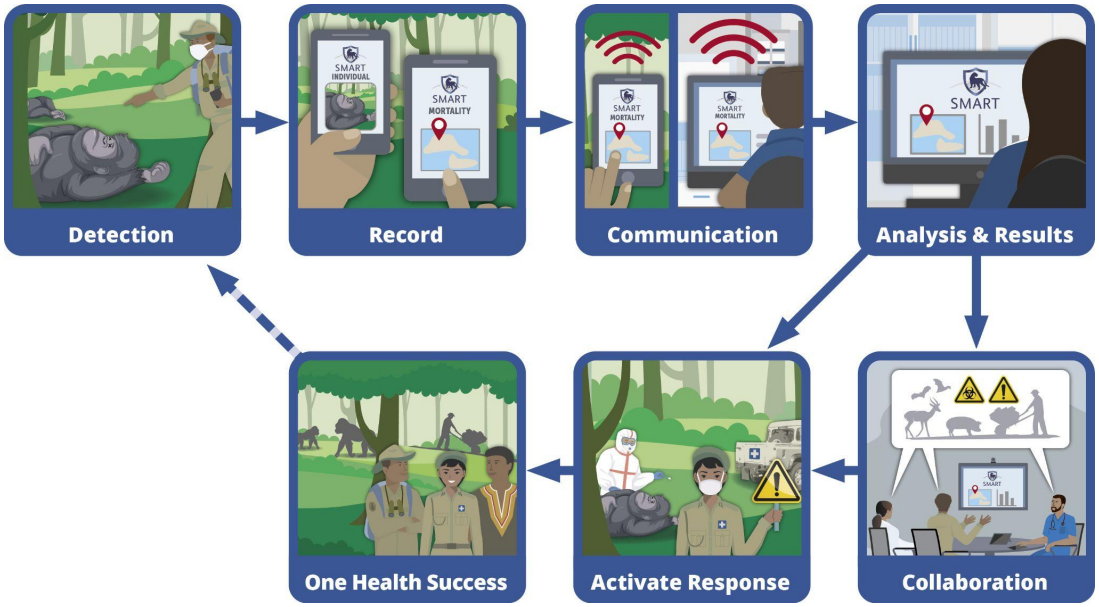
For instance, WCS' work in protected area management, wildlife monitoring, and wildlife health, integrates forest rangers, biologists, and animal health workers into effective surveillance mechanisms. Subsequently, these mechanisms can be assessed to inform policies that are sustainable, affordable, feasible and effective within the animal health and environmental sectors (i.e., government agencies, NGOs, others). **WildHealthBuild** allows for the iterative and adaptive self-organization of surveillance networks and empowers local capacity and institutions to define their own roles. Relationships and collaborations are then formalized into networks by the creation of working groups that dynamically draft, test, and improve SOPs to meet the local needs and realities.



Bottom up approach to wildlife health surveillance with WCS training rangers in Preah Vihear Protected Area in Cambodia on how to report wildlife morbidity and mortality and listening to ranger's feedback on ways to improve reporting.

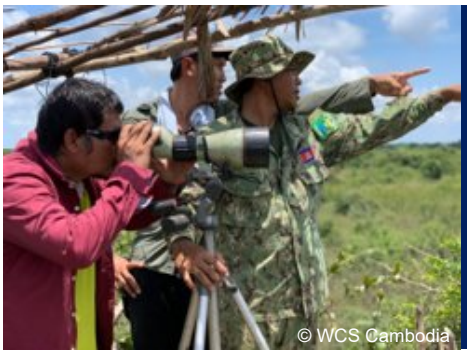
A significant challenge to any global-scale capacity bridging effort is the delivery of context-relevant and level-appropriate content. Our extensive experience in delivering wildlife disease surveillance training to diverse audiences and stakeholders is leveraged through our **WildHealthSkills** approach. For example, we designed stakeholder-specific training materials and curricula that provide clear learning objectives and competencies that are appropriate for a broad diversity of educational levels and skill requirements. Our globally distributed community of wildlife health experts and educators allows the delivery of content that is locally relevant and culturally appropriate, and inclusive of the diversity of knowledge systems.

We understand the role of data science and technology in supporting and revolutionizing key aspects of successful surveillance systems, such as the efficient collection, management, analysis, and communication of wildlife health data. For example, we have evaluated and piloted scalable solutions like the Spatial Monitoring and Reporting Tool (SMART) to leverage our extensive networks of boots on ground for wildlife health data collection (i.e. SMART for Health). We have also demonstrated a viable solution for nations to manage wildlife health surveillance and research data through adaptation of the Canadian Wildlife Health Cooperative's Wildlife Health Intelligence Platform (WHIP). Our molecular biologists, pathologists, information technologists, and partners are at the forefront of innovation, diligently working with our national partners to identify the best tools for transforming data into decisions through **WildHealthTech**.



Overview of how technology contributes to wildlife health surveillance data collection and management, and ultimately One Health collaboration, success, and improved systems.

Finally, the same way WCS's distributed community of wildlife health professionals is supported by international experts strategically located in the regions and headquarters, we leverage a vast network of One Health experts through a WildHealthNet consortium to adequately support structures and processes via **WildHealthResponse**.



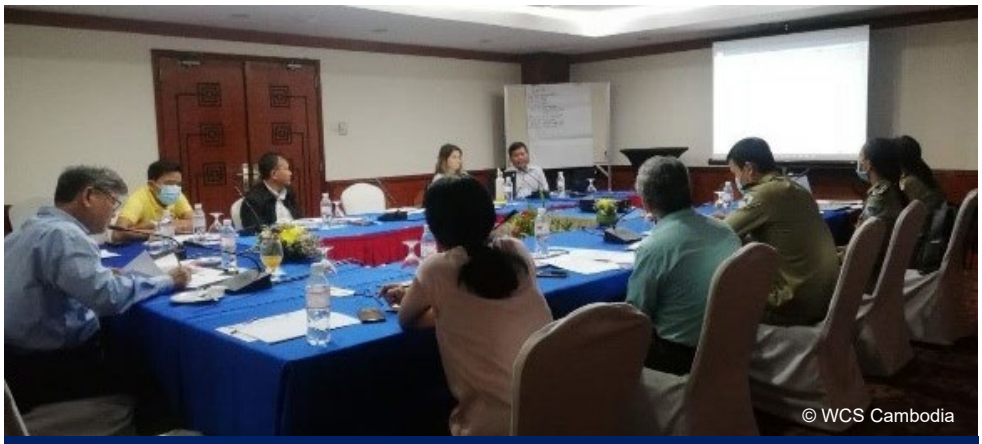
Wildlife health practitioners using SMART mobile technology for collecting standardized field observations that integrate with other One Health data platforms to support a comprehensive approach to wildlife health surveillance.

Box 1: Meeting existing regulations, standards, and best practices

WildHealthNet supports countries in reaching objectives outlined by the International Health Regulations (IHR) and the Global Health Security Agenda (GHSA), that recognize, promote, and establish country-based responsibilities to improve the detection, reporting, and response to global public health emergencies[a]. Individual processes within WildHealthNet support the achievement of IHR and GHSA core competencies beyond wildlife disease surveillance, and contribute to strengthening One Health capacity.

Our actions as part of WildHealthNet are already rooted in well-recognized attributes and best practices for wildlife health surveillance, and strive to be complementary of and consistent with frameworks and guidelines established by international organizations, in particular with the OIE through the OIE Working Group on Wildlife Health, OIE Wildlife Health Framework, and OIE wildlife focal points ToR[b]. In many ways, the WildHealthNet processes are a roadmap to achieve these standards, including the drafted goals of the Tripartite Plus Global Plan of Action for One Health. An expansion of our consortium will maintain these strong ties to global frameworks for wildlife health surveillance and build new ones with adjacent efforts like the Global Burden of Animal Diseases[c].

Beyond existing regulations, guidelines, and standards, WildHealthNet has adopted best practices for the evaluation of surveillance networks[d], ensuring transparency and accountability in assessments and reporting, and facilitating iterative refinement of the surveillance network operations.



Cambodia policy development meeting in October 2020, where representatives of multiple government ministries and the OIE focal point developed the country's standard operating procedures to coordinate a surveillance system and network for wildlife health.

[a] Centers for Disease Prevention and Control. International Health Regulations (2005).
https://www.cdc.gov/globalhealth/healthprotection/ghs/ihr/#anchor_1562351549
[b] OIE Wildlife Working Group 2021.
https://www.oie.int/en/what-we-do/standards/standards-setting-process/working-groups/working-group-on-wildlife/#ui-id-3
Stephen C, Sleeman J, Nguyen N et al. Proposed attributes of national wildlife health programmes. *Rev Sci Tech.* 37, 925 (2018).
OIE. OIE Wildlife Health Framework. Protecting Wildlife Health to Achieve One Health (2021).
https://www.oie.int/fileadmin/Home/eng/Internationa_Standard_Setting/docs/pdf/WGWildlife/A_Wildlifehealth_conceptnote.pdf
OIE. Training Manual on Wildlife Diseases and Surveillance (2010).
https://www.oie.int/fileadmin/Home/eng/Internationa_Standard_Setting/docs/pdf/WGWildlife/A_Training_Manual_Wildlife.pdf
[c] Global Burden of Animal Diseases (GBAD).
https://animalhealthmetrics.org/
[d] Calba, C, Goutard, FL, Hoinville, L. *et al.* Surveillance systems evaluation: a systematic review of the existing approaches. *BMC Public Health* 15, 448 (2015).
Centers for Disease Prevention and Control. Updated Guidelines for Evaluating Surveillance Systems (2001).
https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5013a1.htm
OIE tool for the evaluation of performance of veterinary services. PVS Tool, 7th Edition (2019).
https://www.oie.int/en/what-we-offer/improving-veterinary-services/pvs-pathway/

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https://oneworldonehealth.wcs.org/Initiatives/WildHealthNet.aspx

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WildHealthNet in South East Asia
https://oneworldonehealth.wcs.org/Initiatives/WildHealthNet/WildHealthNet-in-South-East-Asia.aspx

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Network
WildHealthNet is deployed in Cambodia, Laos, and Vietnam. Policy development, trainings, laboratory analyses, and reporting are conducted jointly by the following partners:

Cambodia: Department of Wildlife and Biodiversity, Forestry Administration, Ministry of Agriculture, Forestry, and Fisheries (MAFF); General Directorate of Animal Health and Production, MAFF; General Department of Administration for Nature Conservation and Protection; Ministry of Environment; Institut Pasteur du Cambodge, Food and Agriculture Organization (FAO) of the UN.
Laos: Department of Livestock and Fisheries, Ministry of Agriculture and Forestry (MAF); National Animal Health Laboratory, MAF; Department of Forestry, MAF; Department of Forestry Inspection, MAF; Lao-Oxford-Mahosot Hospital-Wellcome Trust Research Unit (LOMWRU); Lao Conservation Trust for Wildlife.
Vietnam: Department of Animal Health, Ministry of Agriculture and Rural Development (MARD); Regional Animal Health Offices 6 and 7, Ministry of Agriculture and Rural Development (MARD); National Institute of Hygiene and Epidemiology, Ministry of Health; Vietnam National University of Agriculture; Hanoi Medical University; Institute of Ecology and Biological Resources; Vietnam Academy of Science and Technology; Food and Agriculture Organization (FAO) of the UN.