The One Health LACANET project in Cambodia and Laos

Aims and objectives

The LACANET One Health Surveillance and Laboratory Network project (also referred to as “LACANET”) is an EU-funded project which brings together partners in the human health, wildlife health and animal health sectors to create capacity to survey, diagnose and understand the drivers of disease at human-animal-environmental interfaces.

The overall objective is to develop a bi-national Lao PDR-Cambodia One Health Surveillance and Laboratory Network that will enable both countries to:

1- **Build capacity for surveillance and field investigation for zoonotic diseases:**

For this to happen, we are training district, provincial and national wildlife and livestock health authorities in both Lao PDR and Cambodia to jointly conduct surveillance for zoonotic disease pathogens in vectors, wildlife and livestock populations using various sampling techniques.

We are also developing capacity to implement diagnostic testing for national priority diseases at the human-animal-environment interface between both human and veterinary diagnostic laboratories, using whenever possible similar techniques and standard operating procedures.

2- **Improve laboratory capacity to detect zoonotic diseases**

Laboratory experiments and analysis represent a significant part of the LACANET project, since we need to analyze all samples taken from the field. The Cambodian National Veterinary Research Institute (NaVRI) and the Lao PDR National Animal Health Laboratory (NAHL) regularly receive animal samples from suspected disease outbreaks from various Lao and Cambodian provinces for testing. Improving Lao and Cambodian laboratory capacity therefore appears as being critical. Therefore, the Institut Pasteur du Cambodge (IPC) and the Lao-Oxford-Mahosot Hospital-Wellcome Trust Research Unit (LOMWRU) are providing laboratory training to NaVRI and NAHL respectively from year 1 to year 4.
3- **Improve national and regional cross-sectoral collaborations by establishing a One Health Surveillance and laboratory network**

Much of our efforts are designed to initiate lasting connections between One Health practitioners (field biologists and veterinarians, laboratory diagnosticians and medical microbiologists) within and between Lao PDR and Cambodia to promote knowledge transfer through exchanges, workshops and trainings, to encourage timely information sharing for effective and coordinated responses to zoonotic outbreaks. We are also hosting workshops on disease epidemiology and diagnostic techniques, across both animal and human sectors, and meetings to discuss One Health coordination as well as the economic and sociological aspects of these pathogens.

4- **Conduct strategic research on two important drivers of disease emergence – Wildlife trade and land-use change:**

We are investigating the role that land use change plays in disease dynamics by conducting surveillance for diseases with domestic and wild animal reservoirs, including Japanese encephalitis, leptospirosis and rickettsial diseases (as model disease systems) in vectors along a land use gradient, from pristine forest to industrial landscape.

We are also examining the role wildlife trade plays in disease emergence, including diseases such as rabies, anthrax, leptospirosis, typhus and trichinellosis, by conducting surveillance at high risk human-wildlife interfaces in wildlife markets.

**Project’s main activities: How do we make it possible?**

1- As part of our efforts to increase field surveillance capacity for regional priority pathogens, but also at national, provincial and district level, we are training 100% of NAHL and NaVRI Outbreak Mobile Response Unit staff members and at least 2 provincial and district staff from 100% of provinces where market disease hotspots have been identified.

2- NaVRI staff members will be trained at IPC on laboratory and sampling techniques, while NAHL staff members will be trained by LOMWRU. NaVRI and NAHL will also receive a 2-day training course on biosafety. By year 4, both NaVRI and NAHL will be able to test pathogens in their own laboratories.

3- We initiated the development of a Lao PDR-Cambodia One Health Network by building relationships and connections between livestock, wildlife and human health ministries and laboratories in Lao PDR and Cambodia.

4- We strive to improve these relationships through collaborative research projects to study the effect of anthropogenic activities on infectious disease prevalence and emergence.
Target pathogens: What are we looking for?

<table>
<thead>
<tr>
<th>Pathogens</th>
<th>Hosts</th>
<th>Vectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japanese encephalitis</td>
<td>Humans, pigs, birds</td>
<td>Mosquitoes (Culex spp)</td>
</tr>
<tr>
<td>Scrub/murine typhus</td>
<td>Humans, rodents</td>
<td>Fleas, chiggers, ticks</td>
</tr>
<tr>
<td>Leptospirosis</td>
<td>Humans, rodents, mammal hosts, livestock, pets</td>
<td></td>
</tr>
<tr>
<td>Arena-, Hantaviruses</td>
<td>Rodents, humans</td>
<td></td>
</tr>
<tr>
<td>Coronaviruses</td>
<td>Bats, rodents, carnivores, humans</td>
<td></td>
</tr>
</tbody>
</table>

How do we survey and monitor zoonoses?

Vector sampling:
We take swabs and blood samples from various vectors: livestock, rodents, birds, bats, mosquitoes, ticks, chiggers and fleas.

Human sampling:
We test patients presenting with a febrile illness for a wide range of pathogens, and also collect information about them, with a special focus on residence history.

Environmental sampling:
We observe and analyse water samplings, micro and macroclimate information, as well as many other environmental data.

Why is this project useful?

Evaluating the impact wildlife trade has on diseases outbreaks

Wildlife trade has contributed to the emergence of a series of zoonotic diseases including SARS, plague, monkey pox virus and others (Guarner et al., 2004, Bell et al., 2004, Tu et al., 2004). Through wildlife trade, animals move along trade/import/export routes, increasing their exposure to a broader geographic and taxonomic range of other animals, thereby linking previously fragmented populations, and enhancing the potential for pathogens to spread regionally and internationally. In addition, the crowded and stressful conditions in which animals are exposed to during trade facilitate disease expression. Thus, when humans come into contact with traded wildlife – through handling, consumption or more passive exposure through contact with excreta – they risk contracting pathogens carried by the wildlife. The role that wildlife and its trade play in diseases outbreaks of regional importance (typhus, anthrax, rabies, leptospirosis and trichinella),
remains unknown. Therefore, this project aims to provide valuable information on the prevalence of these diseases in wildlife found in markets and help to guide disease outbreak response and mitigation strategies.

**Assessing the consequences of massive deforestation and land-use changes**

Meanwhile, “the rate of deforestation in Cambodia between 1990 and 2000 was an estimated 56,000 hectares per year” (FAO, *State of the World’s Forests*, 2005), and became even greater from 2002, with an annual deforestation rate that moved from 0.34%, from 1965 to 2006, to 0.5% during the period 2002-2006-2010 (Suon Sovann, *Preventing illegal logging and trading of rosewood in Cambodia*, 2014). Despite the Cambodian government taking more and more provisions to counteract this issue, Cambodia will still need to bear the consequences of this deforestation for several years, and this is where our investigation on land-use changes comes into play.

**A One Health approach to counteract zoonoses**

Currently, 75 per cent of emerging infectious diseases are caused by pathogens originating in animals. Zoonoses kill 2.2m people annually at significant expense to people’s livelihoods, the environment and the health system. Mitigating the risks of further outbreaks demands intersectoral collaboration and coordination among public health, animal health and wildlife health professionals. The ‘ideal’ approach to disease prevention and control emphasizes transmission disruption, with early warning, early detection and early response for the emergence of new zoonotic diseases and the transmission of endemic zoonotic diseases. This ‘ideal’ necessitates well-functioning surveillance systems and epidemiological investigations. Early and accurate diagnosis requires well-equipped and organized laboratories in the medical and veterinary sectors. Early response means timely notification of the disease to Government, international organizations (WHO, FAO, OIE) and neighboring countries.

Due to the development of this new surveillance capabilities, more comprehensive disease outbreak responses and more targeted surveillance activities for an increased number of pathogens will be provided. This directly reduces the risk of zoonotic disease outbreaks and mitigates the risk of endemic diseases.
Duration of the project

48 months, from 1st March 2014 until 28th February 2018

Project’s stakeholders: Who are we?

Dr. Philippe Dussart:

In December 2014, Dr Philippe Dussart (pharmD, PhD) was appointed Head of the Virology Unit at the Institut Pasteur du Cambodge. Prior to working in Cambodia, he worked at the Institut Pasteur in French Guiana (South America), where he was the Head of a National Reference Laboratory for arboviruses and influenza and was mainly responsible for regional surveillance, improving diagnostic tools for dengue virus infection and participating in studies that aimed to describe the circulation of arboviruses within the wild mammals in French Guiana. As he recalls about an event that occurred in French Guiana, Dr. Dussart is convinced about the importance of bringing the human, animal and environmental elements together: in 2008, French Guiana saw an isolated human case of rabies. Emergence of this first human case in this French Overseas Department represented a public health event that markedly affected the local population, healthcare workers and public health authorities. A rigorous epidemiological investigation with a close collaboration with the animal sector was conducted to identify the contamination source and the exposed population. Communication was a key factor to controlling this episode and changing the local perception of this neglected disease.

According to Dr. Dussart, bringing all sectors together around the LACANET project is a dynamic that is already happening and will go beyond the project itself, since we can already notice strong ties between stakeholders. As an example, a zoonotic technical working group is already monthly gathering together the Cambodian Ministry of Agriculture, Forestry and Fisheries, the Cambodian National Veterinary Research Institute, the Cambodian Ministry of Health’s Department of Communicable Disease Control, the US Center for Disease Control and Prevention, the Institut Pasteur du Cambodge, the World Health Organization and the Food and Agriculture Organization, where stakeholders can discuss about their projects and share knowledge about various issues. To Dr. Dussart, this vehicle can surely help promote the LACANET project, which will, in return, include more institutions from the environmental sector, which approach has already become crucial when fighting against new emerging viruses.

Dr. Paul Horwood:

Dr. Paul Horwood completed his PhD in 2005 at James Cook University (Australia), investigating the virulence factors associated with the food poisoning bacterium Bacillus cereus. Subsequently he commenced postdoctoral studies with the Queensland Department of Primary Industries and Fisheries to study the molecular epidemiology of bovine respiratory disease in cattle. In 2010 (until Dec 2013), Paul joined the Papua New Guinea Institute of Medical Research (in Goroka, Papua New Guinea) where he was Head of the Environmental and Emerging Diseases Unit. Paul is
currently the Deputy-Head of the Virology Unit at the Pasteur Institute in Cambodia (Institut Pasteur du Cambodge). His research is focused on emerging infectious diseases in tropical developing countries.

To Dr. Horwood, Southeast Asia has everything to benefit from the One Health LACANET project. Recent outbreaks and pandemics from diseases such as influenza H1N1pdm, SARS-CoV, MERS-CoV, avian influenza (H5N1 and H7N9) and Ebola virus have highlighted that zoonotic diseases have the potential for major impacts on human populations. Only through collaboration between the three sectors of One-Health can we effectively mitigate and respond to the threat from these novel pathogens. The influenza A/H5N1 situation in Southeast Asia is a good example of a disease where a ‘One-Health’ approach is greatly needed. The virus can be spread over long distances by migrating ducks and waders. Mingling of these birds with domestic ducks and chickens can introduce the virus to poultry populations. Subsequently, close contact with infected poultry can lead to severe illnesses (and often death) in humans. All One-Health sectors need to work together to combat this important disease.

Dr. Horwood is very pleased the LACANET project has facilitated greater collaboration and communication between the three sectors of One-Health in both of the target countries. He further notices that improved integration of the wildlife sector into zoonotic disease surveillance activities has been a very positive outcome.

**Dr. Duong Veasna:**

Dr. Duong Veasna is a medical doctor, medical biologist and virologist. He obtained his PhD in 2011 from the University of Montpellier 2. However, soon after finishing his Master’s in Vientiane, in 2005, he had already started a career at the Institut Pasteur du Cambodge, which granted him with the opportunity to be involved in an FP6 European project, called DENFRAME, that aimed to detect asymptomatic dengue infections. This experience was repeated in 2012, with the DENFREE project, funded by the European Union (FP7 project) and focusing on the role of asymptomatic dengue infection in transmission of the virus. In parallel to these projects, Dr. Duong Veasna has also worked on the PREDICT project since the onset of its first phase (PREDICT 1), which provided him with a thorough experience of working with all three One-Health sectors. He is now also working on the second round of PREDICT (PREDICT 2), which is funded by USAID and involves IPC, National Veterinary Research Institute, Wildlife Conservation Society, Forestry Administration, Center for Disease Control, Ministry of Health, Cambodia and Food and Agriculture Organization to monitor potential pathogens that may emerge and cause outbreaks. Dr. Duong’s main research activities are currently focused on arboviruses and zoonoses.

Dr. Duong recalls that there have already been many attempts in bringing the human, animal and environmental sectors together around one same project, with more or less successful stories. With the deadly outbreak of highly pathogenic viruses like SARS, MERS-CoV, A(H5N1) and Ebola, the One Health concept becomes even more meaningful to every sector and has proved that only bringing the three sectors together can enable a quick response to any potential outbreak and
effectively provide prevention measures before any outbreak may start. Dr. Duong forecasts that the LACANET project will be one of these success stories. He is convinced that once properly implemented, the One Health concept will protect and save millions of current and future lives from any deadly outbreaks.

With the success of PREDICT project in bringing different Cambodian health sectors to work together, LACANET will continue to improve these relationships and help develop better surveillance and detection systems, and therefore prevent emerging pathogens from causing outbreaks in the country as well as in the region.

Dr. Mathieu Pruvot:

Dr. Mathieu Pruvot received his Doctorate of Veterinary Medicine (DVM) in France, where he is originally from. During his veterinary education, he specialised in the field of veterinary epidemiology, and got involved in a variety of research project in medical entomology, diagnostic test validation and field surveillance in Burkina Faso, Nepal, and Thailand. Dr. Mathieu Pruvot did his PhD in epidemiology and biostatistics in France and at UC Davis, CA. In 2014, he completed his PhD at the University of Calgary, AB, Canada, on a multi-disciplinary project aimed at assessing the risk of pathogen transmission between cattle and wild elk, through a combination of laboratory-based approaches, field-based epidemiological studies, analysis of elk telemetry data, and participatory approaches with the rural community. His interest for the role of anthropogenic ecosystem changes on disease emergence encouraged him to become involved in the One Health LACANET project, while carrying out surveillance of zoonotic pathogens in Cambodia and Laos, and analysing the effect of deforestation and illegal wildlife trade on zoonotic pathogens circulation in wildlife.

Dr. Mathieu Pruvot sees the One Health approach and the efforts made to include the environment sector as fundamental, considering that most major epidemics of the last few decades have originated from wildlife and have spilled over to humans due to various activities including encroachment into natural areas, wildlife trade and bushmeat consumption. In his opinion, humans, animals and the environment are inherently connected to each other, and studying them as separate entities would only provide a partial understanding of the issue. Dr. Dr. Mathieu Pruvot further notices that the One Health LACANET project has already established important surveillance systems in wildlife, and allowed them to connect with the two other sectors. The One Health LACANET project has also proven to be able to detect significant health issues involving wildlife, livestock and people, and improve researchers’ ability to document these cases appropriately.

Dr. Paul Newton:

“Human, animal and environmental elements of disease are intricately related and improving human health cannot be comprehended without a thorough understanding of the natural world that surrounds us” is the reason why Dr. Paul Newton strongly believes all three sectors need to work together. He sees the increased liaison between human and veterinary health as being very
encouraging and places a lot of hopes on the LACANET project to build on this and enhance collaboration. As an infectious disease doctor and ex-zoologist, Dr. Paul Newton has a strong interest in public health and zoonotic diseases, and his experience is mostly focused on the Asian region. Dr. Paul Newton works at the Lao-Oxford-Mahosot-Wellcome Trust Research Unit in the Microbiology Laboratory of Mahosot Hospital in Vientiane, Laos, which facilitates collaboration with Lao counterparts and LACANET project’s stakeholders.

**Dr. Bounlom Douangngeun:**

Dr. Bounlom Douangngeun is a Veterinarian. He graduated from the Mongolian State University of Agriculture’s School of Veterinary Medicine in 1991, and from the University of the Philippines Los Baños’ College of Veterinary Medicine, in 1998, where he majored in Veterinary Public Health.

To Dr. Bounlom Douangngeun, controlling pathogens at human, animal and environment interface is crucial when addressing zoonotic diseases, such as anthrax. Anthrax can indeed be transmitted to humans through direct contact with other infected humans or animals, while the Bacillus anthracis, the bacterium causing anthrax, can remain in the soil for decades. Land-use change study is another reason that justifies the One Health approach, as recent habitats destruction can lead the wildlife to colonise new areas located in the vicinity of livestock and human dwellings, thus giving way to new emerging zoonotic diseases.

Although LACANET is a rather new project and that it may still be too early to fully assess its outcome, Dr. Bounlom Douangngeun thinks that bringing the human, animal and environmental sectors from both Lao P.D.R. and Cambodia together will lead to success in determining key factors of zoonotic diseases transmissions, recommending effective measures to control and eventually prevent the spread of the diseases.

**Ms. Sapho Briand:**

Ms. Sapho Briand’s interest into East Asia developed very early, as she started learning Chinese when she was 14. After a few working and study experiences in Asia and the completion of a Master’s degree in East Asian Regional Development from the University of Leeds (United Kingdom), Ms. Briand arrived in Cambodia in 2012 to work on a French-Cambodia-Lao P.D.R. multilateral development project for the French research institute *Institut de Recherche pour le Développement*. Since April 2015, she acts as the One Health LACANET project manager, while being based at the Institut Pasteur du Cambodge. Although Ms. Briand’s daily tasks are mostly focused on administration and budget management, science communication activities also represents an important part of her job, and this is where her enthusiasm for environmental matters and cross-disciplinary strategies comes into play. Contributing to a project that has already proven useful and promising in monitoring and counteracting existing and new emerging epidemics in Southeast Asia makes her very contented. She is hoping the findings discovered as
part of the One Health LACANET project will subsequently fully be assessed and that appropriate measures will be taken by regional and national authorities.

**Project’s core partners**

Institut Pasteur du Cambodge (IPC)
Wildlife Conservation Society (WCS)
Cambodian National Veterinary Research Institute (NaVRI)
Lao PDR National Animal Health Laboratory (NAHL)
Lao-Oxford-Mahosot Hospital-Wellcome Trust Research Unit (LOMWRU)

**Funding organization**

The European Union