An Eco-system Health Approach to Address Emerging Infectious Diseases in China

REPORT ON THE UN CHINA ONE HEALTH EVENT

Convened by the UN Theme Group on Health

Sub-working group on Diseases at the human-animal-interface

29-30 June 2011

Beijing China

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Executive Summary

The H5N1 HPAI worldwide crisis makes evident the need for a broader perspective to address the challenges of Emerging Infectious Diseases (EIDs) and the root causes of disease emergence through a wide-angle, landscape lens that offers both clinical and ecological perspectives (Leighton, 2007). This perspective is not new and was first raised by pioneers in applied ecology such as Aldo Leopold (1887-1948), who believed that it is possible to restore the function and stability of damaged ecosystems if only we can "think like a mountain", that is, understand the full complexity of cause and effect in ecological processes and to plan and act on time scales of decades and centuries. One health approaches also formed the backbone of the ideas promoted by epidemiologists such as Calvin Schwabe in the late 1960s.

Similarly, the Manhattan Principles that came out of the 'One World, One Health' conference organized by the Wildlife Conservation Society in 2004, through a list of 12 recommendations, set the foundation for a more holistic approach to preventing epidemic disease and for maintaining ecosystem integrity. The application of this approach aims to minimize the impact of epidemics and pandemics due to EIDs. It sets out to provide preventive action on the root causes and drivers of EIDs, build more robust public and animal health systems, better address the concerns of the poor, promote cross-sectoral and multi-disciplinary approaches, and conduct strategic research.

More recently, the One Health concept was endorsed by several international organizations (including the FAO, OIE, WHO, UNICEF and the World Bank, among others) seeking to follow up on the achievements attained in the fight against the avian influenza panzootic. Today, there is an increasing demand for greater collaboration between international and national agencies, encouraging a move towards the practical implementation of the One Health concept in countries where the ecological landscape favours the genesis of new pathogens. During the United Nations System Workshop on Animal and Pandemic Influenza held in Bangkok Thailand in 3-4 February 2011, it was suggested that a 'road show' be developed in order to promote the understanding and practical application of a One Health approach at the country level.

China has over a decade of experience in the control of H5N1 HPAI. The challenges and successes of epidemic control efforts for HPAI strongly demonstrate the potential benefits of a One Health approach. The emergence and persistence of HPAI is known to involve complex ecological relationships among domestic chickens, free-ranging ducks, wild birds, and human market systems which can be best understood and managed through One Health principles. Although HPAI is largely under control today (and despite the fact infection remains entrenched in several parts of the country), the recent emergence of new diseases in China (e.g. the Severe Fever with Thrombocytopenia Syndrome (SFTS) virus responsible for hemorrhagic fever in people as well as a Tembusu-related Flavivirus causing egg-drop syndrome in ducks) are reminders of the need to move towards a holistic and preventive approach to disease emergence.

On June 29, the first Chinese national meeting on One Health was hosted in Beijing, with the support of the United Nations Theme Group on Health, sub-working group on diseases at the human-animal interface coordinated by the FAO Emergency Centre for Transboundary Animal Diseases (ECTAD) unit in China. Experts and officers from the Ministry of Health, Ministry of Agriculture, and State Forestry Administration participated in the meeting. The meeting took stock of the lessons learned in China through the control of emerging infectious diseases, particularly HPAI H5N1; related these lessons to the concept of One Health; and developed a roadmap for instituting One Health concepts in China.

Introduction

The experiences from the highly pathogenic avian influenza (HPAI) global crisis makes clear that a broader perspective is needed to address the challenges of emerging infectious diseases (EIDs), a perspective examining the root causes of disease emergence, spread and persistence from the molecular to the ecological scale (Leighton, 2007). Today's epidemics of infectious disease increasingly emerge and spread at the interface of human, domestic animal and wildlife populations. However, government institutions and scientific disciplines divide up the responsibility and expertise over these separate populations. The concept of One Health describes the need for an institutional and scientific approach to diseases that combines the expertise of many disciplines (including, but not limited to, veterinary, medical, wildlife specialists, social scientists, ecologists and microbiologists). Rather than dividing expertise into separate 'stovepipes' of responsibility, a One Health approach aims to increase knowledge of the complete ecosystems-environment in which pathogens emerge and persist according to a ecological health paradigm.

Representation of Ecological Health Approach, Source: Conservation Medicine, Oxford University Press, 2002

In response to the HPAI epizootic, the United Nations among which the FAO and WHO along with the OIE (World Organization for Animal Health) adopted the One Health concept as a guide for future joint activities by delivering a concept note that among re-affirming their work together has the vision to building “A world capable of preventing, detecting, containing, eliminating and responding to animal and public health risks attributable to zoonoses and animal diseases with an impact on food security through multi-sectoral cooperation and strong partnerships”.

On June 29 2011, FAO ECTAD China hosted the first Chinese national meeting on One Health, with the support of the United Nations Theme Group on Health, sub-working group on diseases at the human-animal interface coordinated by the FAO ECTAD unit in China and the UNDP. Experts and officers from the Ministry of Health, Ministry of Agriculture, and State Forestry Administration participated in the meeting. The meeting took stock of the lessons learned in China through the control of emerging infectious diseases, particularly HPAI H5N1; related these lessons to the concept of One Health; and made some recommendations to further develop and apply this concept in China.

Opening Ceremony of UN China One Health Event, Beijing, June 2011

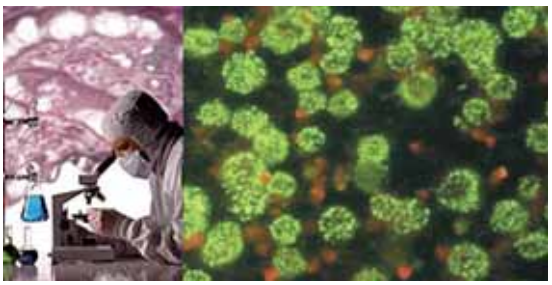
The application of a One Health approach aims not only to minimize the local and global impact of epidemics and pandemics caused by emerging infectious diseases but also to look at more holistic approaches for solving health-related problems (in this regard, it also encompasses food safety issues). By aiming to reduce the impact of disease on livestock populations, One Health is also an essential component of food security and food safety planning It aims to provide preventive action on the root causes and drivers of EIDs, build more robust public and animal health systems, better address the concerns of the poor, promote cross-sectoral and multi-disciplinary approaches, and conduct strategic research.

China has over a decade of experience in the control of HPAI H5N1. The challenges and successes of epidemic control efforts for HPAI strongly demonstrate the potential benefits of a One Health approach. The emergence of HPAI, as well as its persistence and transmission, is known to rely on complex interactions between domestic

poultry (both ducks and chickens, from 'backyard' to commercial to industrial), human social and economic systems; wild birds and animals also playing a role in the initial introduction and in some places, in short and long distance transmission of H5 viruses.

A specific challenge faced during the control of HPAI provides a useful example. One of the main questions throughout the epizootic has been the mechanism of transmission between flocks, particularly transmission over long distances and across territorial borders as well as the question of disease persistence in specific ecosystem configurations. However, to understand the dynamics impacting transmission required going beyond the traditional disciplinary boundaries of veterinary or medical epidemiology. Among other things, experts debated the relative importance of wild bird migrations, on the one hand, or commercial trade in poultry, on the other. To uncover evidence on the transmission of HPAI, wildlife specialists conducted tests in wild birds and studied the migratory pathways of various bird species; epidemiologists uncovered the ecological risk factors associated with the emergence and spread of the disease while social scientists investigated the networks and market chains of commercial poultry trade. Only by combining the expertise of many disciplines could the true risks of transmission be assessed and mitigated.

During the past decade, China's disease control efforts have successfully mitigated HPAI H5N1 outbreaks, transforming HPAI from an urgent crisis to relative stability. However, the success of these efforts should not lead to complacency, as risks still remain. The persistence and, constant and fast evolution of the virus lead to remaining questions about its ecology and the need to adapt control measures accordingly. Moreover, HPAI H5N1 is not an exceptional event, but is exemplary of an emerging infection and transboundary animal disease with a potentially high public health impact. Other viruses continue to emerge at the interface of human, domestic animal, and wildlife populations, including a newly identified bunyavirus (now referred as the Severe Fever with Thrombocytopenia Syndrome (SFTS) virus) responsible for hemorrhagic fever in people as well as a Tembusu-related Flavivirus recently discovered by Chinese scientists and responsible for duck-egg drop syndrome.



Left: Chinese researchers have identified a novel bunyavirus. Source: www.modernemedicine.com
Right: SFTS Virus grown in Vero cells and detected on immunofluorescence assay from a serum sample obtained from a patient with SFTSV infection. Source: Fever with Thrombocytopenia Associated with a Novel Bunyavirus in China, The New England Journal of Medicine, 2010

The ecology of these viruses is being explored including the role of possible domestic animal hosts and competent vectors for the newly discovered bunyavirus responsible for hemorrhagic fever and death in people or as yet unknown vectors for the new Tembusu-related Flavivirus responsible for duck egg-drop syndrome.

Regions of BYDV infection outbreaks in China. *The province or autonomous cities (regions) affected are indicated in gray. Regions from which viruses were isolated and confirmed by RT-PCR/sequencing are labeled with triangles. Source: PLoS ONE, March 2011, Volume 6, Issue 3.*

By looking forward towards the possible emergence of new viruses, the importance of developing a One Health approach to disease prevention and control is clear. A strong capacity for sharing, integrating and understanding information about domestic animals, wildlife, human biology and human societies is essential not only to minimize the risk of emergence and spread of emerging and known infectious diseases but also to answer to

the challenge of reducing the burden of endemic diseases. In addition, among the many aspects that need to be strengthened are disease surveillance and investigations. As an example, at present the source of virus in most H5N1 HPAI outbreaks is only rarely identified and surveillance systems do not provide sufficient information on the level of threat.

An Integrated Approach to Agricultural Health: Linking Natural Resource Management, Wildlife, Livestock Production and Food Security

(Summary of Presentation and Discussion of Day 1)

'One Health' and Ecohealth are ways of thinking about, approaching and investigating disease that go beyond the traditional pathogen-centric approach. They examine the complex issues that result in disease emergence and transmission and this information can be used to implement better disease control and preventive measures.

Much has been written and discussed about One Health approaches by international agencies and donor communities in the various international forums that have been held since 2007. The discipline of Ecohealth has been growing over the past 20 years through the work done by a number of academic groups and agencies, including the work presented by Professor Wilcox. A number of groups have been promoting Ecohealth approaches to disease and have been exploring and building the discipline, including the new language of ecosystem health (see glossary in Annex 1), ways of viewing ecosystems and how diseases emerge and spread within ecosystems. In this regard, interplay that exists between urban, agricultural and natural landscape largely explains disease emergence, especially:

- Intensification of human and biological activity (mainly driven by human activity)
- Mixing of living systems and biological agents
- Transport of biological agents

Source: Bruce Wilcox's Presentation, June 2011

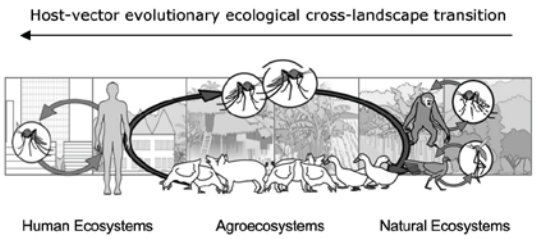
Ecohealth practitioners use a transdiciplinary approach to examine how changes to ecosystems can drive or are driving disease emergence. Proponents recommend that it should be used in determining issues such as land use planning. The rapid development in Asia means that the complex effects of changes to ecosystems have not always been discussed or examined in a way that takes account of the positive and negative effects of development. More attention should be focused on these issues.

Examples were given of diseases where a One Health-type, multidisciplinary approach has been adopted. In these examples the many elements that result in disease emergence and persistence have been assessed and all actors in the process are involved in determining and implementing appropriate control and preventive measures. The examples included the improved live poultry retail market stalls in a few provinces in China and the development of other control and preventive measures for highly pathogenic avian influenza. One Health approaches are not new, as shown by the work done in different areas including in the field of food safety, which has for a long time long crossed disciplines. However the crossing of disciplines also represents a potential problem in a country like China where responsibility for health-related problems is spread over different agencies. The need for an integrated and transdisciplinary approach is therefore essential.

For highly pathogenic avian influenza it has been important to understand how the disease emerged and spread so that appropriate measures could be implemented. However, this knowledge was only gained once the motivations of the various players in the poultry sector and the overall structure of the industry and movements of poultry were understood. In some areas we still have a poor understanding of the motivations of farmers and traders or do not have appropriate ways to motivate behavioral change to prevent diseases. Better engagement of those affected is a crucial part of One Health approaches.

At the simplest level in government, One Health starts with the various Departments responsible for disease control and prevention in the areas of human, animal and ecological health having good cross departmental communication so that information on new and emerging diseases is shared. Positive steps in this direction have been made recently. An example of how one health approaches are being applied was described in the training exercise on rabies control and prevention for the FETPV program[1].

The two recently emerged diseases described during the meeting demonstrate the importance of understanding the factors that drive the emergence of disease. So far these factors are not known and they represent ideal candidates for investigations using a One Health/Ecohealth approach.



Source: Bruce Wilcox's Presentation, June 2011

The animal health implications of the novel bunyavirus and the human health implications of the novel flavivirus are also not yet known. The experience with related viruses and the ecological predictive modeling done for Rift Valley Fever – a related bunyavirus may have potential for adoption to assist in disease control and prevention. Already it is evident that there are aspects of these diseases that warrant a strong cross disciplinary/ transdisciplinary approach.

Diseases today cross borders easily and quickly, as demonstrated by the rapid spread of the influenza A (H1N1) pandemic strain. It is therefore essential that, even when the cause is unknown, information on these diseases is shared with the global community as soon as it is evident that a new syndrome is occurring. In this regard, we should be strengthening our capacity to detect factors or changes in ecosystems and production methods that might result in disease emergence and undertake appropriate applied research and active surveillance in these places using One Health approaches.

The two new diseases discussed at the meeting are just examples of new diseases. Other diseases such as highly pathogenic strains of PRRS and FMD (diseases that are not considered zoonotic) also represent causes of concern for the swine and cattle industry. An Ecohealth approach should be adopted to better understand the dynamics of these diseases and improve their controls.

The meeting highlighted the many gaps existing in the knowledge about diseases at the human-animal-ecosystem interface as well as the need for strengthening surveillance systems at global, regional and national levels. However, we also have to recognize the costs of surveillance (ensuring we ask the right questions and the objectives are clear) and have to understand the implications of doing surveillance so that farmers who allow their animals to be tested are not disadvantaged by the consequences of doing so (e.g. when the herd has to be slaughtered while no financial compensation system is in place).

Two Mongolian Farmers Visited by CMC-AH/FAO ECTAD China Experts during FMD Evaluation Mission, December 2010

When outbreaks of zoonotic diseases occur (including when it can potentially involve wildlife species), forming transdiciplinary teams is essential but not just a matter of having members in a team from different disciplines. They have to be working

[1] *The China FETPV (Field Epidemiology Training Programme for Veterinarians) was launched in November 2010 and aims to provide government agencies with veterinary field epidemiologists who can meet critical needs including conduct effective and timely outbreak investigation and surveillance for existing and emerging infectious diseases.*

towards a common goal, led by a clear direction and allowing various partners to fully contribute.

The introduction of control and preventive measures for diseases can have adverse consequences and there are many real world examples and a body of academic work in this area. Leslie Sims used Livestock intensification as a case study of the positive and negative effects that can arise as a result of changes to the way livestock are reared as a response to HPAI. These negative effects provide fertile ground for application of one health approaches so as to understand the likely effects of change before the changes are made. If the potential problems are identified, appropriate measures can be implemented to minimize or prevent the risks. Studies can be done to monitor emergence of new problems such as increases in antimicrobial resistance or the emergence of new strains of influenza virus.

Ultimately One Health and Ecohealth approaches are tools that disease managers can and should use to assist them in making decisions about the control and prevention of disease. The tools are not an end in themselves but a means to an end. These approaches are meant for decision makers to set the right questions and address them.

Disease Emergence at the Wildlife Livestock Interface

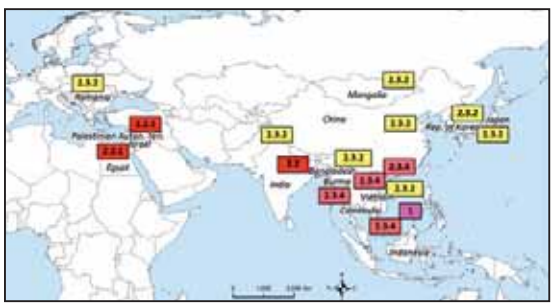
(Summary of Presentation and Discussion of Day 2)

The second day of the One Health event focused on the importance of wildlife in emerging disease ecologies, and the necessity of integrating wildlife science into a One Health disease prevention and control strategy.

Investigation into the role of wild birds in the spread of HPAI H5N1 is a central example of early efforts to undertake One Health approach to emerging diseases. After the massive die-off of wild birds in Qinghai Lake in China in 2005, wild birds were widely blamed for the spread of H5N1 influenza. Yet very little was known about the actual mechanisms of transmission. Using migration ecology, we can learn about pathogens and pathogen movement through following migration routes. Studies aimed to compare wildlife migration with outbreak information, as well as with other risk factors such as poultry density.

Wild Birds at Qinghai Lake, May 2006, FAO ECTAD China

Pivotal for the success of these studies is knowledge of the molecular epidemiology, including the geographic distribution of particular virus clades. The conclusions of a large number of studies support the hypothesis that wild birds are an “intermittent transmission host.” Wild bird populations are unlikely to be long term reservoirs of H5N1 HPAI viruses (For instance, disappearance of Clade 2.2 viruses from wild birds suggests that these viruses are not maintained for an extended period). Wild bird populations are not needed to perpetuate transmission once virus is established in poultry and transmission occurs through the poultry sector. Nevertheless molecular and epidemiological evidence also suggests wild birds may play a significant role in spreading the virus from one area to another (strong evidence has accumulated during the last two years with



Spread of H5N1 HPAI 2.3.3 virus towards Europe in 2010-2011, Source: EMPRES-i

the dissemination of the clade 2.3.2 and the likely involvement of wild birds in its long-distance spread towards Europe).

A number of new technologies are enabling enhanced understanding of wildlife movements. Bird banding, historically the primary technique for studying wild bird migrations, would only provide the beginning and end points of migration; Additional and detailed information on e.g. where or why a migratory bird dies can be provided by continuous global positioning, remote sensing technologies or recording of body indicators such as heart rate and body temperature.

An exemplary study investigating the migration and movement of the African fruit bat discovered that they engaged in stereotypical foraging behavior, used predominantly urban areas and fed mainly on cultivated and introduced crops.

Using GPS to Track Bats Movement, Martin Wikelski, Max-Plank Insitute

The Scientific Task Force on Wildlife Disease is a collaboration between the FAO and the Convention on Migratory Species (CMS), and was launched in June 2011. The Convention on Migratory Species is a convention of the United Nations that governs conservation of migratory species across their entire range. The convention calls on attention that beyond the often-cited statement that “diseases know no borders”; similarly migratory species do not recognize country borders. As these migratory species may be hosts, carriers or vectors of disease, One Health approach must account for the movement of wildlife populations, including across political borders.

One Health approaches must also address the human-directed movement of animals e.g. wildlife trade. The global illegal trade in wildlife, including both live animals and animal derivatives, is enormous, with its annual value estimated at US $10 billion dollars. Trade in wildlife can cause ecological damage through species extinction or population reduction, and can also cause damage to the destination ecosystem through introduction of invasive species.

In addition, wildlife trade represents a key risk of disease emergence, potentially bringing diseased animals in contact with human populations, including distant and immunologically naïve populations. Bushmeat - defined as hunting of any wildlife as sources of food poses a particular risk because of the manner in which slaughter and food preparation take place. Finally, farming of wildlife presents a risk of disease emergence through the mixing of wildlife species with domestic species. Farming of wildlife can be a lucrative industry, and may be a way of preventing exploitation of native populations provided breeding occurs in farms and animal welfare concerns are met. Much more research into proper management of wildlife in farms is needed.

Major Shipping Routes of Wildlife Trade, Source: TRAFFIC

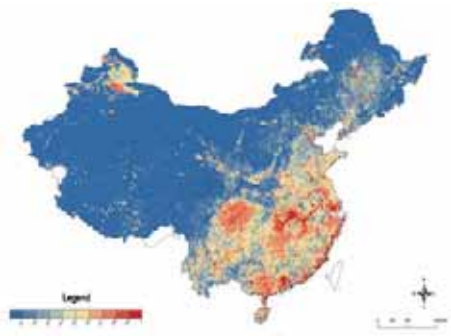
The day ended with a presentation and discussion of a document outlining the way forward to institutionalizing One Health in China.

Possible Ways Forward to Institutionalizing One Health Principles in China

Through a decade of implementing measures to control HPAI, China has accumulated experience that forms an excellent foundation for building One Health institutions. Following are concrete proposals that could help develop a One Health approach in China.

Develop capacity for spatial epidemiology and EID risk assessment

Development in the form of accelerating urbanization, agriculture intensification and expansion/expansion/encroachment and habitat loss along with increasing human population and trade/transport are known to be the main drivers of disease emergence. All of these drivers involve significant transformations of human and natural environments and ecosystems. Disciplines such as landscape epidemiology, medical geography and a range of related fields provide skills and technologies that enable the correlation of disease prevalence with environmental determinants and spatial patterns. As a supplement to basic epidemiology, these spatial approaches provide enhanced capacity for EID risk analysis/assessment applied in the context of development.



Predicted Distribution of HPAI H5N1 Risk Based on Virological Surveillance Data (Using Bootstrapped Logistic Regression Model), Vincent Martin, FAO ECTAD China

- Develop research capacity in the research areas of spatial epidemiology.
- Conduct studies addressing emerging infectious disease and emerging pandemic threat risk assessment.
- Conduct the above research with special attention to policy development in relation to land use and land use change; associate social and ecological factors as determinants of disease emergence.
- Facilitate participation of researchers and students in training and skill-building activities in the region, including working groups currently organized in association with the USAID EPT program.

Develop capacity for integrative research

Facilitate the development of the knowledge and skills necessary to provide leadership in integrative, One Health research at the national and international levels. This will include establishing the necessary institutional arrangements to provide training in transdisciplinary team-building and research design. Principles from systems theory and practice, including an ecosystem-based approach to the problem of zoonotic disease emergence; problem-based rather than disciplinary research; and incorporation of public or stakeholder participation will form the basis of this One Health research. Specific foci include:

- Disciplinary integration, cross-sectoral collaboration, and community participation.
- Development of human resource capacity aligned with the appropriate knowledge and skills required to build collaborative projects.
- Achieve the above objectives at a level that meets international standards of integrative, One Health research on emerging infectious diseases.
- Include biodiversity conservation in the approach and ensure that One Health research aims to enhance the health of all human beings
- Provide National as well as international leadership in One Health research.
- Conduct joint 'One Health' Research Projects (e.g. zoonoses).
- Develop collaborative research projects on particular disease-causing pathogens, involving

experts from disciplines including veterinary and medical epidemiology, wildlife conservation, and social science. Possible candidates include recently discovered bunyavirus or flavivirus, for which numerous questions remain about the interaction of wildlife hosts, reservoirs, vectors, and commercially-raised domestic animals. Projects should also be developed on detection and analysis of factors and systems that could lead to the emergence of new pathogens, examining and recommending practical and appropriate ways to reduce the risks.

Further strengthen influenza virus surveillance

While influenza viruses should not be the only focus of One Health initiatives in China, influenza surveillance of poultry, pigs, horses and wild animals/birds aimed at monitoring viral changes and emergence of new strains should still be further strengthened. Studies should integrate surveillance of high-risk human populations in contact with farmed domestic and wild animals. The studies could focus on sites identified as high risk of influenza virus emergence such as live poultry markets, wildlife breeding sites, farmed wild bird production areas, trading centres and livestock slaughterhouses.

The Poyang Lake Ecosystem located in Jiangxi province which combines all these dimensions would be an excellent system to study in the spirit of the One Health approach. All disease outbreaks with signs suggestive of influenza should be thoroughly investigated and systems should be in place to detect sub-clinical infection in poultry. Given the global importance of the information all results should be released internationally, including gene sequences and geolocation of outbreaks, as soon as data are validated (including geolocation for tracking purposes and analysis). Projects in Egypt, Indonesia and Vietnam, coordinated by the OFFLU network are already addressing these issues of utmost importance for influenza

Ducks at Poyang Lake, Jiangxi, January 2010, FAO ECTAD China

monitoring. In addition, access to data on ecology and animal movement should be made available to further understand the epidemiological landscape of influenza viruses.

Coordination across sectors and institutions

- Develop a mechanism for sharing disease information between the Ministries of Health, Agriculture and Forestry. Existing disease surveillance and reporting systems could be supplemented to include a function for sharing and integrating reports in order to perform joint analysis.
- Find mechanisms to operationalize One Health activities through newly formed steering committee meetings or existing coordination mechanisms.
- Develop mechanisms for connecting One Health research and practice with policymakers. Indeed policy makers represent one of the main users of the results of research program that should be translated into concrete actions and policies.

One Health China in Action-Rabies Awareness Campaign in Yulin, Guangxi, September 2011, FAO ECTAD China

Develop One Health university curricula and professional trainings

- Develop coursework on One Health for students in schools of medicine, animal health, and forestry/ environment/wildlife. Integrate students from various schools in common coursework, in order to foster familiarity and personal connections between future experts in the various fields.
- In the framework of existing training courses for professionals and administrators already employed by the Ministries, promote the concept of One Health and build bridges between disciplines. The Field Epidemiology Training Program (FETP) of China CDC and the Field Epidemiology Training Program for Veterinarians (FETPV) of Ministry of Agriculture provide examples of the feasibility and effectiveness of such training courses.

The 3rd Training Module of China FETPV, Beijing, June 2011, FAO ECTAD China

Establish a national technical One Health steering committee meeting

Food safety, like One Health, is the responsibility of many ministries and bureaus, each with its own area of expertise and authority. In 2010, the Central State Council created a special Committee on Food Safety. The objective of the Committee is to coordinate and harmonize the many Ministries and bureaus involved in the successful administration of food safety. Although not necessarily at the same level, a similar steering committee meeting focusing on the implementation of One Health would provide leadership and direct the coordination and harmonization of the various ministries involved in the prevention and control of emerging diseases. This steering committee meeting would also interact extensively with the UN Theme Group on Health, making sure national priorities are taken into consideration while guiding the UNTGH in the implementation of its activities.

Promote reporting of disease in wildlife, livestock, and human populations by:

- Employing social scientific approaches to better understand the needs and demands of various populations and stakeholders.
- Providing incentives and remove disincentives for disease reporting.

Participate in regional One Health networks and develop leadership

Several regional networks are being established consisting of university, government, and private sector One Health researchers and practitioners, which already include Chinese researchers. These networks-a 'One Health Network", 'Ecohealth Network for Asia', and 'communities of practice'-associated with various international agency programs (WHO TDR, IDRC, USAID RESPOND and others) aim to facilitate regional collaborative research and training for One Health research and practice.

- Identify researchers and students and facilitate their participating in these new regional activities, including developing leadership roles.
- Ensure participation of researchers and students in regional and international meetings and conferences on One Health on an ongoing basis.
- Participate in upcoming meetings in Chiang Rai, Thailand (Mae Fah Luang University, Integrative Health Research Symposium-Vulnerable Populations, Vulnerable Ecosystems) and Kunming (EcoHealth 2012). Participate in regional short courses and workshops currently being developed in association with the above programs and meetings.

Annex 1: Glossary

• **Ecotone** – The boundary or transition zone between two adjacent ecological systems. They are known to act as local 'hotspots' where biological activity is concentrated, including pathogen transmission events such as infection of an "accidental host" that can lead to disease emergence. The extent and types of ecotones potentially contributing to disease emergence tend to increase exponentially with natural habitat loss and economic development in the absence of sound urban and regional planning.

• **Ecosystem Approach** – The application of science of ecology to a conservation or public health problem including prevention and control of an emerging infectious disease. It includes using a holistic perspective and systems thinking, as well as specific principles and methods from systems ecology, landscape ecology, community ecology, and population ecology.

• **Landscape Epidemiology** – A field of study that merges concepts and methods from classical epidemiology and landscape ecology to attempt to determine the factors that influence the frequency and distribution of disease. It employs geographic information systems, remote sensing, and statistical methods including spatial statistics and theories of landscape ecology. It has been applied analytically to a variety of emerging zoonotic diseases, including malaria, hantavirus, Lyme disease and Chagas' disease.

• **Ecohealth** – An emerging field of study that considers how changes in the Earth's ecosystems affect human health. An interdisciplinary approach to research that brings together multiple disciplines (e.g., physicians, veterinarians, ecologists, economists, social scientists, and policy analysts) to study and understand how changes in biological, physical, social, and economic systems impact human health. A form of integrative science that includes participatory methods, often incorporating elements of community participatory action research (COPAR).

• **One Health** – A holistic approach to focused on the control of infectious disease. It requires collaboration among professionals from across different disciplines have an understanding and appreciation of the links among human, animal, and ecosystem health, and the importance of and commitment to working together to address health challenges

• **Transdisciplinary** – A form of integrative research that is integrative, employs a holistic and/or systems and participatory approach, combines knowledge from outside as well as with academia to address a 'real world' problem.

Poyang Lake National Nature Reserve, Jiangxi, June 2008, FAO ECTAD China

Annex 2: Agenda

UN CHINA ONE HEALTH EVENT

Convened by the UN Theme Group on Health

Sub-working group on Diseases at the human-animal-interface

An Eco-system Health Approach to Address Emerging Infectious Diseases in China
29-30 June 2011, Beijing China

Day 1

08:30 – 09:00	Registration
09:00 – 09:45	Welcome and introductions - Opening remarks, UNTGH, DG VB China, DG MoH, SFA, EU, WHO, FAO, USAID - Introduction of the workshop process
09:45 - 10:30	Keynote speech: Agriculture, Environment and Emerging infectious diseases of humans (speaker: Bruce Wilcox, University of Hawaii)
10:30 – 10:40	Group photograph
10:40 – 11:10	Coffee break

Theme 1: *Lessons Learned from HPAI H5N1 and H1N1 Pandemic Influenza (Chair: China MoH)*

11:10 – 11:40	Taking Stock of experiences gained and lessons learned from H5N1 HPAI crisis in Asia (speaker: Leslie Sims, consultant, Australia)
11:40 – 12:10	H1N1 pandemic influenza: lessons learned (Dr. Xu Zhen, Chief, Branch of Respiratory Disease Prevention and Control Office for Disease Control and Emergency Response, China CDC)
12:10 – 12:50	Lessons learned from H5N1 HPAI in China (Chen Guosheng, Division animal Disease Control and prevention, Veterinary Bureau, China MoA)
12:50 – 13:10	The influenza gene pool: planning the next pandemic? (Leslie Sims)
13:10 – 14:00	Light lunch
14:00 – 14:30	Discussion

Theme 2: *Integrated Approach to Agricultural Health: Linking Natural Resource Management, Wildlife, Livestock Production and Food Security (Chair: China MoA)*

14:30 – 15:00	The impact of EID on Food Security (S. Morzaria, FAO Regional Office)
15:00 – 15:20	One Health approaches to natural resource management, species conservation and global challenges. (Kathryn Campbell, Convention on Biological Diversity)
15:20 – 15:45	Dealing with Emerging Infectious Disease threats in China (Prof Zeng Guang, CFETP)
15:45 – 16:00	Coffee break
16:00 – 16:40	Severe Fever with Thrombocytopenia Syndrome (SFTS) and a new Bunyaviridae (Prof. Liang Mifang, China CDC)

16:40 – 17:00	Discovery of a new Tembusu-Related Flavivirus in Ducks (Prof. Su Jingliang, Laboratory of Zoonosis of MoA, China Agriculture University)
17:00 – 17:15	OH through education – Presentation of FETPV Rabies Case Study (Jia Beibei, FAO ECTAD China)
17:15 – 17:40	A multidisciplinary approach to answer Food safety challenges in China (Peter Ben Embarek, WHO China)
17:40 – 18:10	Discussion and closure of day 1
18:10 – 19:00	Dinner at the UN compound

Day 2

Theme 3: *Disease Emergence at the Wildlife Livestock Interface (Chair: SFA)*

09:00 – 09:20	Take home message from Day 1
09:20 – 10:00	The Role of Wild Birds in the Spread of Avian Influenza along the central Asian flyway- taking an eco-virological approach. Scott Newman (FAO)
10:00 – 10:20	New technologies to understand wildlife migration - how this can be applied to disease management and conservation. Martin Wikelski (Max Planck Institute)
10:20 – 10:45	Coffee Break
10:45 – 11:15	The Scientific Task Force on Wildlife Disease and how CMS is addressing wildlife disease as part of conservation management. Borja Heredia (UNEP-CMS)
11:15 – 11:40	Wildlife trade: implication for conservation and disease transmission (Lindsey McCrickard, FAO)
11:40 – 12:00	Key take-home messages from Day 1 and 2
12:00 – 12:45	A roadmap for One Health in China: Discussion
12:45 – 13:00	Next steps and wrap up
13:00 – 14:00	Light lunch

Annex 3: List of Participants

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