



FOURTH REPORT

January – December 2010

GLOBAL PROGRAMME FOR THE
PREVENTION AND CONTROL OF
HIGHLY PATHOGENIC AVIAN INFLUENZA



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Foreword

The Food and Agriculture Organization of the United Nations' (FAO) response to the highly pathogenic avian influenza (HPAI) emergency which began in January 2004 can be summarized as Global Leadership, Regional Cooperation and National Action (from *FAO/OIE Global Strategy for Prevention and Control of H5N1 HPAI* [2007]). FAO's *Global Programme for the Prevention and Control of HPAI* is structured according to these principles.

Implementation in countries directly affected by disease outbreaks has been crucial to the success of the HPAI response, as well as in building capacity for prevention and detection in over 130 countries. The six endemic areas are parts of Bangladesh, the People's Republic of China, Egypt, India, Indonesia and Viet Nam. Regional and global projects related to HPAI reflect the increasing importance attached to the transboundary nature of the disease, which requires cross-border cooperation and collaboration in control and prevention. This regional emphasis has extended FAO's crucial partnerships from national authorities, and international agencies – in particular the World Organisation for Animal Health (OIE) – to engagement of regional organizations, including the Association of Southeast Asian Nations (ASEAN), South Asian Association for Regional Cooperation (SAARC), and the African Union Inter-African Bureau for Animal Resources (AU-IBAR), to establish regional animal health centres (RAHCs) and regional networks in surveillance, diagnosis, socio-economics and communication.

FAO continues to maintain its close partnerships with donors (currently numbering 35, of which 24 are government contributors, and 11 mainly multilateral organizations).

In 2004, the HPAI response required immediate and short-term interventions, while improving capacities for longer-term sustainable approaches which address the risk of additional emerging infectious diseases (EID's) or incursions of transboundary animal diseases (TAD's). These longer-term projects (with durations of at least three years) emphasize a development dimension which aims to strengthen the animal health infrastructure, and capacity for surveillance, early warning, efficient detection and rapid response when needed. Moreover, projects reflect the emphasis on an integrated and multidisciplinary approach which incorporates other important aspects of disease control, such as biosecurity, socio-economics, public-private-partnerships, wildlife aspects, and advocacy and communication. These initiatives are confluent with the 'One Health' approach, for which FAO has completed its new five year (2011-2015) *Animal Health Strategic Action Plan*, extending the six-year response to HPAI to other animal and animal-related human threats. The Action Plan emphasizes FAO's comparative advantage in its central and regional structures, its reference centres and partners, its broad, multidisciplinary approach to problem solving, and in building on

investments and lessons learned from the HPAI programme. These contribute to achieving 'Better managed animal, human, natural agro-ecosystem health' and contribute to 'Sustainable livelihoods, Food security and Improved animal, human, plant health'.



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Acronyms and abbreviations

AAHL	Australian Animal Health Laboratory
ADB	Asian Development Bank
AfDB	African Development Bank
AED	Academy for Educational Development
AGA	Animal Production and Health Division (FAO)
AHI	Avian and Human Influenza
AI	Avian Influenza
AIV	Avian Influenza Virus
APBA	Asia-Pacific Biosafety Association
APHIS	Animal and Plant Health Inspection Service (USDA)
ARC	Alliance for Rabies Control
ARRIAH	All-Russian Research Institute for Animal Health
ASEAN	Association of Southeast Asian Nations
ASF	African Swine Fever
AU-IBAR	African Union/Inter-African Bureau for Animal Resources
AusAID	Australian Agency for International Development
AVS	Additional Veterinary Surgeons
BNVL	Botswana National Veterinary Laboratory
CA	Central Asia
CARN	Central Asia Regional Network
CAHO	Community Animal Health Outreach
CAHW	Community Animal Health Worker
CBAIC	Community-Based Avian Influenza Control
CBPP	Contagious Bovine Pleuropneumonia
CCPP	Contagious Caprine Pleuropneumonia
CDC	U.S. Centers for Disease Control and Prevention
CEBEVIRHA	Communauté Economique du Bétail, de la Viande et des Ressources Halieutiques
CEMAC	Communauté Economique et Monétaire d’Afrique Centrale
CEN	European Committee for Standardization
CERF	Central Emergency Response Fund
CFR	Case Fatality Rate
CHF	Common Fund for Humanitarian Action in Sudan
CHL	Communication for Healthy Living
CIDA	Canadian International Development Agency
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora

CIRAD	Coopération Internationale en Recherche Agronomique pour le Développement
CMC-AH	FAO/OIE Crisis Management Center for Animal Health
CMS	Convention on Migratory Species
CNP	Chobe National Park
CSF	Classical Swine Fever
CVL	Central Veterinary Laboratory
CVO	Chief Veterinary Officer
DAH	Department of Animal Health (Vietnam)
DFID	Department for International Development, UK
DLD	Department of Livestock Development (Thailand)
DLS	Department of Livestock Services, Bangladesh
DOC	Day-old-chicks
DRC	Democratic Republic of Congo
EAREN	Eastern Africa Epidemiology Network
EARLN	Eastern Africa Regional Laboratory Network
EC	European Commission
ECOWAS	Economic Community of West African States
ECTAD	Emergency Centre for Transboundary Animal Diseases
EDRSAIA	Early Detection Reporting and Surveillance – Avian Influenza in Africa
EIDs	Emerging Infectious Diseases
EISMV	Ecole Inter-Etats de Science et Médecine Vétérinaires (Dakar, Senegal)
ELISA	Enzyme-linked Immunosorbent Assay
EMPRES	Emergency Prevention Programme for Transboundary Animal Diseases
EMPRES-i	Global Animal Disease Information System
EOD	Entry on Duty (date – beginning of project)
ERV	Ebola Reston Virus
ETMS	Event Tracking and Management System
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FETPV	Field Epidemiology Training Programme for Veterinarians
FMD	Foot and Mouth Disease
FPMIS	Field Programme Management Information System (FAO)
FVI	France Vétérinaire International
GEMP	Good Emergency Management Practices
GIS	Geographic Information System
GISAID	Global Initiative on Sharing All Influenza Data
GLEWS	FAO–OIE–WHO Global Early Warning and Response System
GoB	Government of Bangladesh
GoE	Government of Egypt
GoN	Government of Nigeria
GoV	Government of Viet Nam
GOVS	General Office of Veterinary Services
GP	Global Programme

GREP	Global Rinderpest Eradication Programme
HA	Hemagglutination screening test
H1N1	Pandemic (H1N1) 2009 (subtype of Influenza virus A)
H5N1	Subtype of the Influenza A virus
HI	Hemagglutinin Inhibition (laboratory test)
HPAI	Highly Pathogenic Avian Influenza
HPED	Highly Pathogenic and Emerging Diseases
IAEA	International Atomic Energy Agency
IATA	International Air Transport Association
ICT	Information and Communication Technology
IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute
IMCAPI	International Ministerial Conference on Animal and Pandemic Influenza
INAP	Integrated National Action Plan
IPAT	Inter-Professional Association
IRCM	Integrated Regional Coordination Mechanism
IZSVe	Istituto Zooprofilattico Sperimentale delle Venezie
LBM	Live Bird Markets
LoA	Letter of Agreement
LRVZ	Laboratoire de Recherches Veterinaires et Zootechniques
MDGs	Millennium Development Goals
MENA	Middle East and North Africa
MOFL	Ministry of Fisheries and Livestock, Bangladesh
NAIPRP	National Avian Influenza Preparedness and Response Plan
NAIRL	National Avian Influenza Reference Laboratory, Bangladesh
NDV	Newcastle Disease Virus
NIAH	National Institute of Animal Health, Thailand
NLQP	National Laboratory for Veterinary Quality Control on Poultry Production
NPQIP	National Poultry Quality Improvement Plan, Indonesia
NTE	Not-to-extend (date – end of project)
NVRI	National Veterinary Research Institute, Nigeria
OFFLU	OIE/FAO joint network of expertise on avian influenza
OHA	One Health Approach
OIE	World Organisation for Animal Health
OVI	Onderstepoort Veterinary Institute
OWOH	One World One Health
PAAT	Programme Against African Trypanosomiasis
PCR	Polymerase Chain Reaction (lab test)
PDSR	Participatory Disease Surveillance and Response
PPE	Personal Protection Equipment kits
PPLPI	Pro-Poor Livestock Policy Initiative
PPP	Public–Private Partnership
PRP	Partners for the Prevention of Rabies
PPR	Peste des Petits Ruminants

PTV	Porcine Teschovirus
QA	Quality Assurance
QC	Quality Control
RAHC	Regional Animal Health Centre
RAMSAR	Convention on Wetlands of International Importance
RAP	Regional Office for Asia and the Pacific (FAO)
REC	Regional Economic Communities
REMESA	Mediterranean Animal Health Network
RESEPI	Regional Network of National Epidemiosurveillance Systems for West Africa
REPIVET	Regional Epidemio-surveillance Network
RESOLAB	West and Central Africa Veterinary Laboratory Network for AI and other Transboundary Diseases
RLA	Regional Latin America
RNA	Ribonucleic Acid
RP	Reporting Period
RTE	Real-Time Evaluation
RT-PCR	Real Time Polymerase Chain Reaction (lab test)
RVF	Rift Valley Fever
SAARC	South Asian Association for Regional Cooperation
SADC	Southern Africa Development Community
SAIDR	Strengthening Avian Influenza Detection and Response (project)
SAR	Special Administrative Regions (China)
SEA	Southeast Asia
Sectors (poultry production)	Sector 1: industrial integrated production with birds or products marketed commercially Sector 2: commercial poultry production with birds or products sold through slaughterhouses or live poultry markets. Sector 3: commercial poultry production, including water fowl, with birds or products usually sold through live bird markets. Sector 4: village or backyard production with birds or products usually consumed locally.
SFERA	Special Fund for Emergency and Rehabilitation Activities (FAO)
SMS	Short Message Service
SOP	Standard Operating Procedure
SPINAP	Support Programme to Integrated National Action Plan
TA	Technical Activity
T&T	Tsetse and Trypanosomiases
TADs	Transboundary Animal Diseases
TCE	Technical Cooperation for Emergencies
TCP	Technical Cooperation Program
TF	Trust Fund
TFCA	Transfrontier Conservation Areas
UEMOA	Union Economique et Monétaire Ouest Africaine

ULO	Upazilla Livestock Officers
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNICEF	United Nations Children’s Fund
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
UNSC	United Nations System Influenza Coordination
USA	United States of America
USAID	United States Agency for International Development
US\$	United States of America dollar
USDA – APHIS	United States Department of Agriculture – Animal and Plant Health Inspection Service
VLA	Veterinary Laboratories Agency (VLA Weybridge)
VS	Veterinary Services
WACA	Western and Central Africa
WAHID	World Animal Health Information Database (OIE)
WAVLD	World Association for Veterinary Laboratory Diagnosticians
WB	World Bank
WHO	World Health Organization

Executive summary

Sixty-three countries/territories in Asia, Europe and Africa were affected by H5N1 highly pathogenic avian influenza (HPAI) since the beginning of the epizootic in poultry and wild birds in 2003. The number of countries where H5N1 was reported in 2010 increased to 18 (from 12 in 2009), predominantly in Asia (14 countries). Thus, H5N1 AI continues to be a major concern, including the risk of human infection. In six countries, the disease is entrenched in poultry populations (Bangladesh, the People's Republic of China, Egypt, Indonesia, Viet Nam and parts of India) and elimination remains a long-term goal.

H5N1 HPAI was newly introduced to Bhutan in 2010, and reintroduced to five countries, including Bulgaria and Romania, which were the first H5N1 HPAI disease events in Europe since October 2008. The overall number of reported outbreaks worldwide increased in 2010, compared with 2009, while outbreaks/cases are still likely to be under-estimated and under-reported in some countries due to limitations in the capacity of veterinary services to implement effective disease surveillance or to perform epidemiological investigations.

The World Health Organization (WHO) reported 48 human cases – of which 24 were fatal – in five of the six countries noted above. Overall, the number of countries reporting cases remained the same in 2010, but disease prevalence and incidence in humans decreased. As of the end of December 2010 (Source: WHO website, 29/10/2010), the total number of human cases was 512 (with 304 fatalities).

FAO continued to play a key role in the global response to HPAI, having commenced – initially in Asia, and then globally – its joint *Global Strategy on the Progressive Control of HPAI in 2005* (developed with the World Organisation for Animal Health [OIE]), and HPAI Global Programme, ongoing since 2006, and implemented by FAO's Emergency Centre for Transboundary Animal Diseases (ECTAD). The programme comprised 168 donor-funded projects, of which 64 remained active at the end of December 2010, more than half of which are in Asia; while 20 were focused on other transboundary animal disease projects (TADs), such as African swine fever (ASF), anthrax and Rift Valley fever (RVF).

In 2010, there were only six new HPAI projects (compared with 18 in 2009), and a decline in the pipeline of funds available for FAO HPAI project activity. This may be a reflection within the international animal health and donor community on the need to move away from disease specific interventions to a more integrated, multidisciplinary approach to developing sustainable animal health systems at country, regional and global levels; and to build on lessons learned from the responses to H5N1 HPAI and apply them to other TADs and emerging infectious diseases (EIDs). FAO has been working towards this approach, including with its new *Animal Health Strategic Action Plan (2011-2015)* in line with the 'One Health' agenda.

During 2010 other major animal diseases also continued to spread in different regions of the world, disrupting livestock production, rural economies and people's livelihoods and food security. This has been largely due to the limited capacity of veterinary services to contain animal diseases in, and to disease drivers such as poor husbandry practices, high

intensification of animal production, increased trade of animal and animal products and intensified contact between animal, human and wildlife populations. Disease events in 2010 included: the spread of ASF in eastern Europe, foot-and-mouth disease (FMD) in east Asia, *Peste des petit ruminants* (PPR) in eastern Africa, and porcine reproductive and respiratory syndrome (PRRS) in Asia.

Within the FAO Global Programme there are several thematic areas to concentrate objectives, resources and activities. Qualitative assessments of the impact of thematic areas on the overall performance of the portfolio and on the control of the disease were undertaken in 2010 – with particular reference to surveillance, laboratory capacity and biosecurity, which are high-priorities for FAO and are a successful component of most country projects – and results can be read as a preliminary assessment of overall government capacities to prevent and control HPAI. Overall, the results of the survey were positive, with countries generally continuing to improve their capacity. Public-private-partnerships, preparedness, response, socio-economics, communication and wildlife are also key components of disease emergence, response, prevention and elimination, and major efforts were undertaken to build capacity and integrate these concepts within veterinary services and others in the public and private sector.

A further qualitative assessment and review of programmes and country capacities was carried out in five key countries (those above with the exception of India) which are at the centre of the agro-ecological zones where H5N1 HPAI is endemic. The countries were assessed in terms of (i) FAO's contribution to the national HPAI response in 2010; (ii) progress with developments of country capacity over the past 12 months; and (iii) observations on the impact of FAO's contribution in the country and the region.

The endemic countries generally have large poultry sectors which generate significant internal economic activity, but not foreign exchange. Thus, the sector is not necessarily regarded as a significant economic sector by government and a priority for further investment or regulatory oversight. In such countries many operators who entered the poultry sector are not necessarily well-informed about the need to balance all aspects of production and are often vulnerable to incursions of infectious disease agents. Furthermore, many small-scale producers across the globe accept deaths in poultry as the norm. This is a key constraint, implying that HPAI will not always be reported or even seen as a problem, especially in low-input farming systems and in areas where Newcastle disease is endemic. Where there is international trade and associated business investment involved, governments have a greater tendency to apply the necessary resources and supports to ensure control and elimination of H5N1 HPAI.

It is not yet possible to predict the emergence of new diseases. However, it is recognized that certain 'hot-spots' for disease emergence exist, and must be monitored for new (and existing) diseases with the potential to cause widespread disease in human or animal populations. While such surveillance and pathogen hunting is likely to return findings, at present it is not clear how to predict a species jump of a potential pathogen. More knowledge is required on pathogens which have jumped species, in order to forecast those which might in the future.

FAO is committed to pursuing the One Health approach and to support its partners in developing a constructive operational framework to deliver the outcomes required to make

progress. Control of serious livestock diseases is seen as necessary to ensure the health and well-being of human populations and to continue pathways to development. Zoonotic diseases in many instances have their roots as controllable diseases of livestock or domesticated species and well-understood interventions can be applied in the context of the One Health approach. Equally, FAO has the expertise, partnerships and data to strengthen its work in forecasting emergence of diseases as a result of livestock intensification, climate change or ecological issues.

Introduction

This Fourth Report on FAO's Global Programme on highly pathogenic avian influenza (HPAI) covers the period 1st January to 31st December 2010 and provides an overview of the disease situation, the activities conducted and the strategic approach with respect to the reduction of infection in endemically infected countries. Moreover, additional information is provided on the way in which FAO approaches the control of HPAI and other emerging infectious diseases (EIDs) in the context of the One Health strategic framework.

The activities of the global programme are carried out in conjunction with partner organizations and donors and are intimately linked to the FAO Strategic Framework which is detailed in the Medium Term Plan 2010 – 2013 and its biennial Programme of Work and Budget (PWB). The activities of the HPAI programme contribute to Strategic Objective B (SO-B) of the Plan: Increased sustainable livestock production.

FAO's Strategic Framework also details specific Impact Focus Areas (IFAs); with respect to the animal health portfolio this is IFA-EMPRES: *Transboundary threats to production, health and environment*. EMPRES supports the building of national, sub-regional, regional and global systems for surveillance, identification of sources of potential and imminent threats, detection of outbreaks, early warning, rapid response, supportive research, and rehabilitation emphasizing 'building back better' after outbreaks of transboundary animal diseases (TADs) and plant pests, and food safety incidents. IFA-EMPRES focuses on strengthening national systems, especially in developing countries, to recognize and respond to transboundary threats in a more timely manner; reduce the risk of those threats spreading within countries, to neighbouring countries and to trading partners; protect national production; and ensure food safety and quality along the supply chain.

Global, multisectoral, multidisciplinary coordination and collaboration is crucial for achieving the goals outlined, and FAO has a variety of mechanisms for interaction with partner organizations which are utilized in the Global Programme (including the Global early warning and response system [GLEWS], OIE/FAO Joint network of expertise on avian influenza [OFFLU] and the Crisis Management Centre-Animal Health [CMC-AH]).

This report does not reiterate the detailed matters covered in the previous reports, especially the comprehensive *Third report for the period October 2008 to December 2009*. It is recommended that where further information is required about matters covered in that report, such as the real-time evaluations, the reader refer to that document and in general to the Avian Influenza section on the FAO website¹.

The contents of the Fourth Global Report are

Chapter 1 provides a global update on the H5N1 HPAI situation as recorded in domestic poultry, wild bird populations and humans during the reporting period

¹ <http://www.fao.org/avianflu/en/index.html>.

Chapter 2 is a quantitative review of the FAO H5N1 HPAI project portfolio during the reporting period, including details of the current funding environment and future funding requirements.

Chapter 3 is a detailed thematic review of FAO's activities at the global, regional and national levels, including analysis of national capacity to prevent and control HPAI.

Chapter 4 contains a detailed analysis of the HPAI activities and programme impacts in the five countries where HPAI is endemic (Bangladesh, the People's Republic of China, Egypt, Indonesia and Viet Nam). For each country the key activities conducted by FAO and the specific achievements or developments and their impacts are reviewed.

Chapter 5 is an outline of the FAO strategy for the progressive strengthening and consolidation of the gains made in the context of the lessons learned and the particular features of the disease in the five agro-ecological zones where the disease is endemic

Chapter 6 provides the strategy framework for FAO to engage in the One Health initiative and a brief description of FAO's activities related to the control of key TADs.

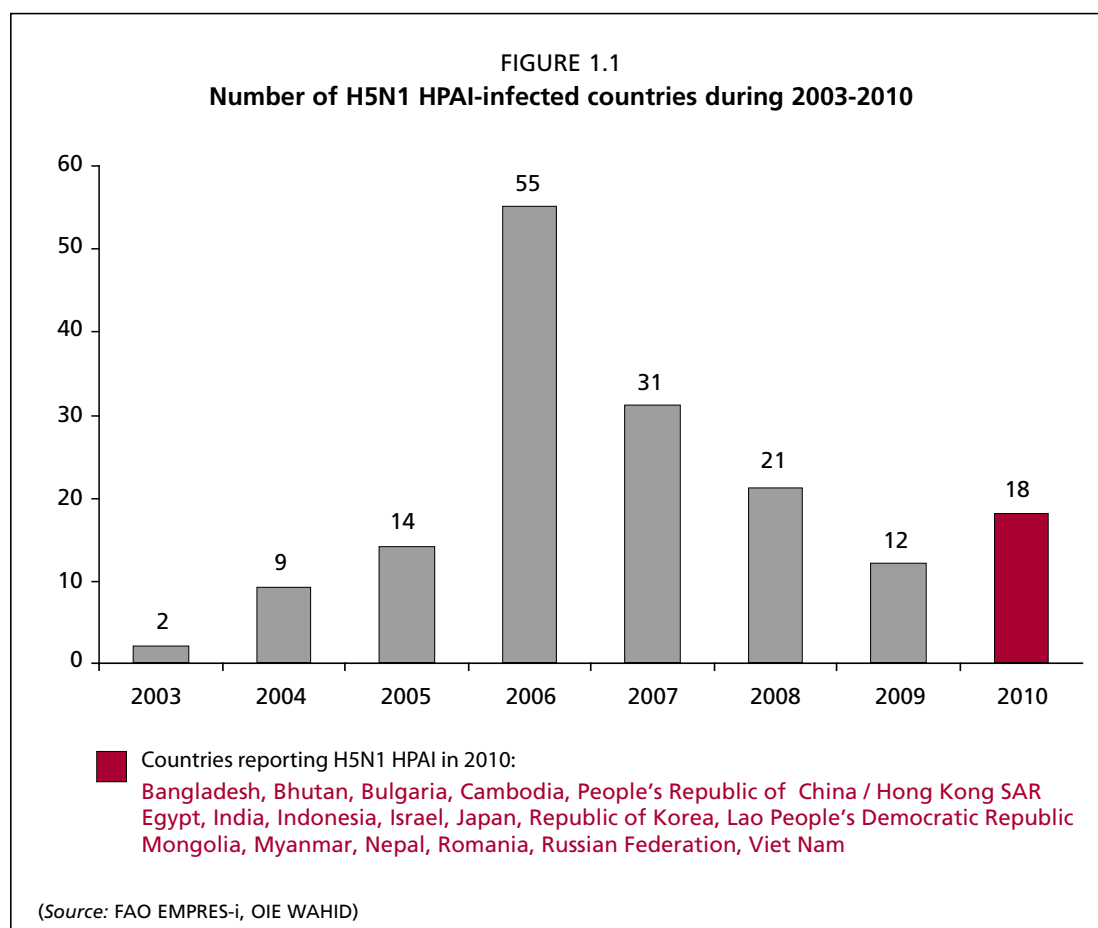
The **Annexes** contain further analysis of HPAI activities in the five HPAI endemic countries. These sections provide a disease situational and funding analysis.

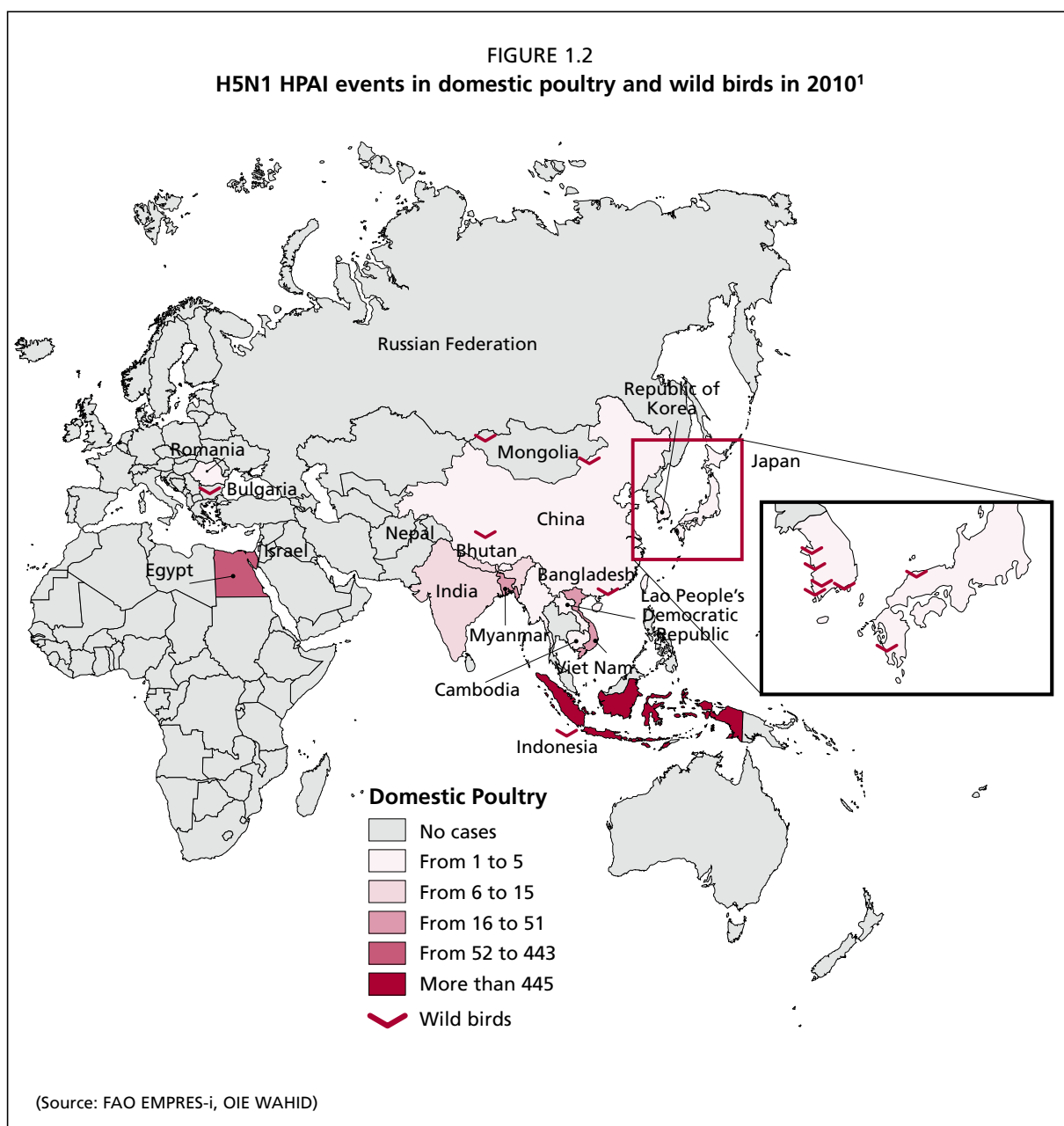
Chapter 1

H5N1 highly pathogenic avian influenza situation update (January-December 2010)

OVERALL H5N1 HIGHLY PATHOGENIC AVIAN INFLUENZA INCIDENCE INCREASED IN ANIMALS IN 2010

Sixty-three countries/territories in Asia, Europe and Africa have been affected by H5N1 highly pathogenic avian influenza (HPAI) since the beginning of the epizootic in poultry, wild birds or captive wild birds in 2003. Of these, 18 countries (14 in Asia; 3 in Europe; and 1 in Africa) experienced outbreaks during 2010 (see FIGURES 1.1 and 1.2; TABLE 1.1), against 12 in 2009, 21 in 2008 and 31 in 2007 (see FIGURE 1.1). H5N1 HPAI continues to be a major concern, with a slight increase in the overall number of infected countries/territories





in 2010. However, the disease is entrenched in poultry populations only in Bangladesh, the People's Republic of China, Egypt, Indonesia, Viet Nam and parts of India. In these settings, elimination remains the long-term goal.

Bhutan was the only newly infected country in 2010, reporting H5N1 HPAI outbreaks in February and March. Bulgaria, Israel, Japan, Myanmar, the Republic of Korea and Romania had not reported outbreaks of H5N1 HPAI in 2009, however, the disease was re-introduced into these countries (or re-occurred) in 2010. The reported outbreaks in poultry in Romania and a H5N1-positive dead wild buzzard found in Bulgaria in March 2010 were the first H5N1 HPAI events in Europe since October 2008 (although the H5N1 virus was detected in

¹ Jenks' natural breaks classification was used to determine the best arrangement of values into classes, comparing (iteratively) sums of the squared difference between observed values within each class and class means.

TABLE 1.1
Number of outbreaks during 2009-2010

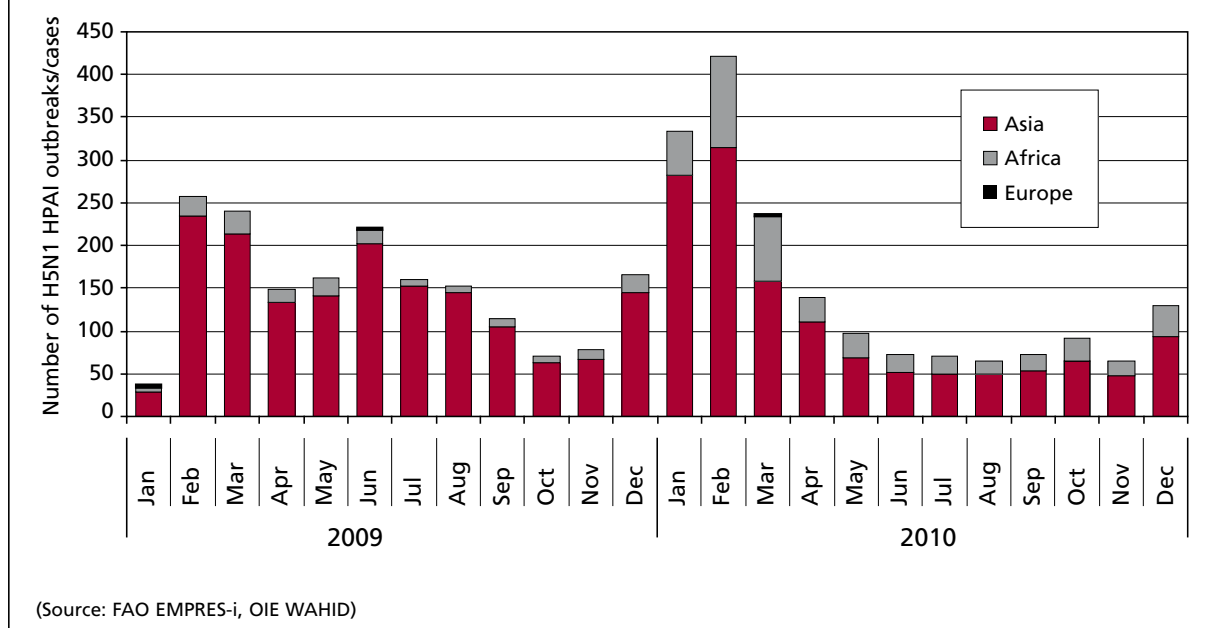
	Bangladesh	Bhutan	Bulgaria	Cambodia	China / Hong Kong SAR	Egypt	Germany	India	Indonesia	Israel	Japan	Republic of Korea	Lao PDR	Mongolia	Myanmar	Nepal	Romania	Russian Federation	Viet Nam
2009	32	0	0	1	4/15	176	1	10	1502	0	0	0	5	2	0	2	0	2	56
2010	31	5	1	2	1/2	443	0	15	1212	2	5	8	1	1	3	8	2	1	46

Source: FAO EMPRES-i

a wild duck shot in Germany in January 2009). The threat from H5N1 HPAI remains, including the risk of human infection.

The overall number of reported outbreaks of H5N1 HPAI worldwide increased in 2010 compared to the same period in 2009, partly due to the geographic expansion of the virus. The peak of disease activity in 2010 was once again observed in the cooler months of January to March (see FIGURE 1.3). At the country level, numbers of outbreaks in countries that had also been infected during 2009 generally decreased or remained more or less on the same level, with the exception of Egypt where they increased (see TABLE 1.1). In Egypt, the situation appears to have worsened considerably during 2010, although numbers of

FIGURE 1.3
Number of reported H5N1 HPAI outbreaks/cases by continent,
by month from January 2009 to December 2010



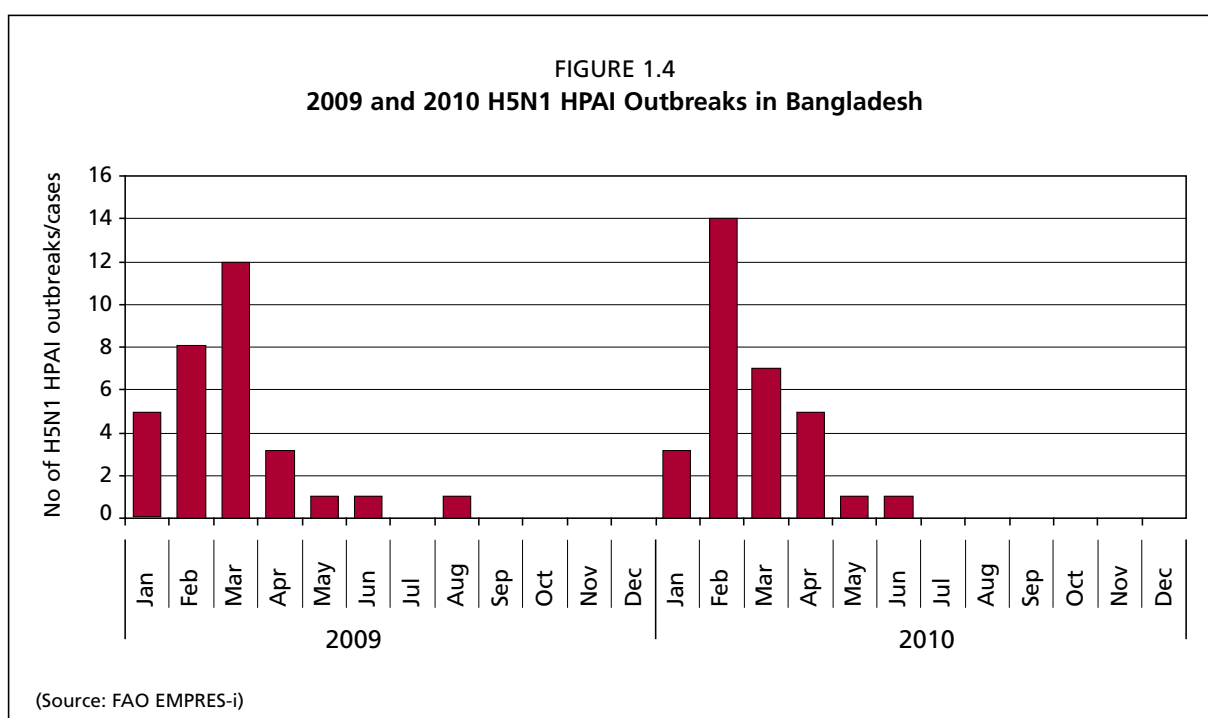
reported outbreaks may have increased following changes in the disease reporting system: the activities of the Community Animal Health Outreach (CAHO) project – initiated in December 2008 with assistance from the Food and Agricultural Organization of the United Nations (FAO) – were expanded from February 2009, with an apparent enhancement of outbreak notification.

Since 2004, an improvement in disease awareness worldwide can be noted, but as has been reported previously there are still some concerns about the efficiency of surveillance. Outbreaks/cases of H5N1 HPAI are still likely to be under-estimated and under-reported in some countries owing to limitations in the capacity of veterinary services to implement sensitive and effective disease surveillance or to perform epidemiological investigations. Most animal disease surveillance systems depend on livestock owners to report suspicious incidents, but the general weakness of compensation schemes means there are poor incentives for disease reporting by owners.

FOUR HIGH-BURDEN COUNTRIES REMAIN ENZOOTIC

The large majority of outbreaks in 2010 occurred in four high burden countries (see TABLE 1.1): Bangladesh (2 percent), Egypt (25 percent), Indonesia (68 percent) and Viet Nam (3 percent). This is comparable to the situation in 2009.

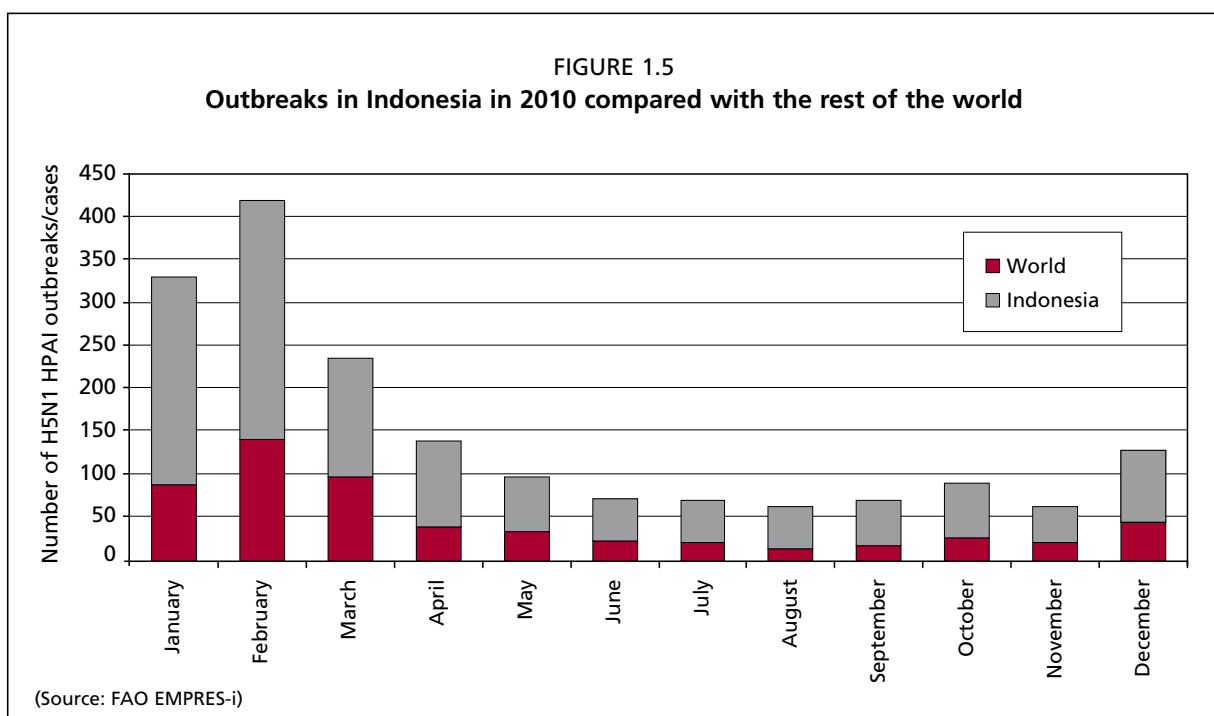
During 2010, there were 31 reported outbreaks in **Bangladesh** (see FIGURE 1.4), with the majority of outbreaks being registered on commercial farms (29) and just two in backyard holdings. Approximately 175,000 birds were culled. In 2009, there were 32 outbreaks reported, with a high proportion of outbreaks observed between January and April in each year. Although no H5N1 HPAI outbreak was observed between June and December 2010, the disease is still believed to be endemic, with active circulation of the virus (clade 2.2): in particular, 2010 virus isolates grouped in sublineage 3 and clustered with sequences of



viruses from Bangladesh isolated from 2007 to 2009. These results suggest that the virus is being maintained in reservoirs unnoticed within the country. The total number of outbreaks from 2007 to 2010 increased to 358, recorded in 49 out of 64 districts on both commercial farms and in backyard holdings.

Indonesia continued to report a high number of H5N1 HPAI outbreaks in poultry, as it had for the past four years. More outbreaks were reported in the country itself than the rest of the world combined (see [FIGURE 1.5](#)). H5N1 HPAI is confirmed as endemic on the islands of Java, Sulawesi and Sumatra, with sporadic outbreaks reported elsewhere. High incidence areas are recognized at both provincial and district level on Java (especially Yogyakarta) and in the south of Sumatra (Lampung). Only two few of Indonesia's 33 provinces (Maluku and North Maluku) have never reported the occurrence of H5N1 HPAI. The high number of reports each month is partially explained by the implementation of the Participatory Disease Surveillance and Reporting (PDSR) programme (established and supported by FAO) which targets village poultry production systems (mainly backyard) and reports outbreaks at the village level. Clade 2.1 has been isolated in 2009 but no sequence data is available for isolates from 2010 outbreaks. Data from 2009 shows that Indonesian isolates remain in clade 2.1.3, and continue to diversify with greatest variation observed for viruses from Sumatra.

In **Viet Nam**, between January and December 2010, the Department of Animal Health (DAH) officially reported 46 H5N1 HPAI outbreaks in 20 of 63 provinces (32 percent), mostly on duck farms (83 percent) and in the small-scale commercial sector (61 percent of outbreaks in flocks with 50 to 1,000 birds). Approximately 42,684 birds were culled. This compares with 56 outbreaks reported in 2009. Using real time polymerase chain reaction (PCR) for detection, active surveillance for virus circulation was carried out in eight target provinces and cities. Prevalences of Type A and H5N1 avian influenza viruses in ducks were 0.94 percent and 0.67 percent, respectively, while in chickens respective prevalences were



0.54 percent and 0 percent. There was no evidence of avian influenza virus persistence in Muscovy ducks. Viruses isolated from outbreaks were characterized and in 2010 three virus clades have been isolated: (1) haemagglutinin (HA) clade 1 (predominant in southern Viet Nam and also isolated in Cambodia); (2) HA clade 2.3.4 (predominant in northern Viet Nam in the first half of 2010 but not detected in the second half; and also circulating in the People's Republic of China); and (3) HA clade 2.3.2 (detected for the first time in late-2009, four cases detected in the first half of 2010, and since September 2010 predominant in northern Viet Nam but also isolated in the south).

Egypt, which reported its first H5N1 HPAI outbreak in February 2006, is considered endemic with regular reporting of outbreaks in almost all of its 29 governorates. The outbreaks continue throughout the Nile delta, corresponding with areas of high human and poultry density. As of 31 December 2010, there were 443 outbreaks observed in poultry during the year, mainly in backyard systems, compared to 176 in 2009. Detection has, however, improved since the implementation of a programme similar to that of the PDSR in Indonesia: CAHO, operating in ten governorates (Bani-Seuif, Behera, Dakahlia, Fayoum, Gharbia, Kafr-Elshiekh, Menia, Menufia, Qalubia and Sharkia). This partially explains the increase in the number of outbreaks reported in domestic poultry. Viruses isolated during 2010 were genetically similar to those isolated in 2009 and belong to clade 2.2.1, clustering in two major genetic groups: A and B. The majority of the samples belong to group B (or group F according to the United States Centers for Disease Control and Prevention [CDC] nomenclature), while the remainder belong to the group A (or C according to the CDC), to which most human samples belong. Viruses from group A are predominantly from backyard birds, and B from vaccinated commercial poultry. Preliminary studies suggest there is little to no human influenza (HI) cross reactivity between the two groups.

SPORADIC H5N1 HPAI EVENTS STILL PREDOMINANTLY IN ASIA

Southeast Asia

In **Cambodia**, H5N1 HPAI poultry outbreaks were reported in January (Takeo Province) and April 2010 (Prey Veng Province). This compares to only one outbreak in domestic poultry for the whole of 2009, which occurred in December. The outbreak in Prey Veng Province was detected as a result of domestic poultry being tested following the death of a 27-year-old man from H5N1 infection. In Cambodia, follow-up investigations of human cases have often alerted authorities to poultry outbreaks. All available human and animal isolates since 2004, including all those from 2010, are clade 1 (genotype Z) and most closely related to clade 1 viruses previously circulating in Cambodia. This is also the same clade that circulates predominantly in southern Viet Nam.

Lao People's Democratic Republic (Lao PDR) reported only one H5N1 HPAI outbreak in 2010, occurring in April in Vientiane Province. No new outbreaks have been identified since then. This compares with five poultry outbreaks reported in January and February 2009, all in Phongsaly Province. Samples sent to the Australian Animal Health Laboratory (AAHL) in Geelong were identified as clade 2.3.4, clustering together with viruses seen in Lao PDR previously. The 2010 active surveillance was carried out in nine highest-risk provinces, based on the location of historical HPAI outbreaks. The surveillance was focused on

ducks in live bird markets, villages with high duck populations, and farms. A total of 30 markets, 35 villages and 28 farms have been visited. Three rounds of active surveillance sampling (March, June and September 2010) have been completed and no H5 HPAI virus was detected.

Myanmar had not reported H5N1 HPAI outbreaks between December 2007 and February 2010, when the disease was re-introduced or re-occurred and two outbreaks were detected in domestic poultry in Yangon Division in the south of the country. A third outbreak was recorded in March in Sagaing Division in the north-west. Viral analyses of 2010 isolates showed two different clades: clade 2.3.4 (from the two outbreaks in Yangon Division), and clade 2.3.2 (from the last outbreak in Sagaing Division). Clade 2.3.4 is the same clade as the 2007 isolates from the Yangon area, suggesting that this year's outbreaks occurred following a spill-over of virus from a reservoir in domestic duck flocks. However, clade 2.3.2 had not been found previously in Myanmar. This clade has been found in other countries, such as Bulgaria, China (including Hong Kong SAR), Japan, Republic of Korea, Mongolia, Nepal, Romania, Russian Federation and Viet Nam, during 2010 in poultry and wild birds.

East Asia

In 1996, the **People's Republic of China** first identified HPAI viruses of the H5N1 subtype in geese in Guangdong Province, and H5N1 HPAI viruses have continued to circulate and evolve since then. Approximately 200 H5N1 HPAI outbreaks have been reported in poultry and wild birds in 29 provinces or Special Administrative Regions (SAR) of China since 2004 and a total of over 35 million poultry have been culled to control the spread of the disease. Virtually all of the identified clades of Asian-lineage H5N1 HPAI virus found globally have been detected in China. Of particular interest is the recent expansion of clade 2.3.2, which was originally detected from a dead Chinese pond heron in Hong Kong SAR in 2004 and has now expanded its geographic range to include Bulgaria, Mongolia, Myanmar, Nepal, Romania, and the Russian Federation. In 2010, one outbreak in domestic poultry and one outbreak in wild birds affecting four different species (red-billed choughs, bar-head geese, brown head gulls and wigeons) were recorded, compared to 11 outbreaks in domestic poultry in 2009 and eight in wild birds. No poultry outbreaks have been reported in mainland China since April 2009 and the last wild bird outbreak dates from May 2010. Hong Kong SAR has reported the H5N1 HPAI virus in a swallow in March 2010 and experienced an outbreak in poultry in December 2010. Between 2004 and 2009 there has been a marked decrease in the number of reported outbreaks in domestic poultry. Despite this decrease in outbreak numbers, official ongoing surveillance activities conducted at national and provincial levels provide evidence that H5N1 viruses are still circulating in many provinces in domestic poultry, as well as in wild birds. Results from the national surveillance system released in November 2010 by the Ministry of Agriculture for activities conducted during January, April and July 2010, show that 14 provinces (Anhui, Chongqing, Fujian, Guangdong, Guangxi, Guizhou, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Sichuan, Yunnan and Zhejiang) had H5N1 positive samples.

After having reported no outbreaks in poultry or cases in wild birds for 2009 and most of 2010, **Japan** isolated the H5N1 HPAI virus from wild duck faecal material during surveil-

lance conducted at Lake Oonuma, Wakkanai City by the Hokkaido University in October 2010, and experienced an outbreak of H5N1 HPAI in poultry in Simane Prefecture in November 2010. Three other Prefectures, namely Kagosima, Tottori and Toyama, reported different species of wild birds (including hooded cranes, tufted ducks and wild tundra swans) that tested positive for the H5N1 HPAI virus during December 2010. Virus isolates belonged to clade 2.3.2.

The **Republic of Korea** reported six H5N1 HPAI events in wild birds, in mallard, mandarin and spectacled teal ducks and two owls, during November and December 2010, and two H5N1 HPAI outbreaks in poultry in December 2010, all of them in western and southern provinces. These events occurred after a period of two-and-a-half years without disease being detected. Phylogenetic analysis of the circulating virus confirmed clade 2.3.2.

In 2010, **Mongolia** reported only one H5N1 outbreak in wild birds in May (whooper swans and greylag geese at Ganga Lake, Suhbaatar Province). Phylogenetic analyses placed them in the 2.3.2 virus clade.

South Asia

Bhutan was the only newly infected country in 2010, reporting H5N1 HPAI outbreaks in February and March. No outbreaks have since been detected. The disease was controlled by culling affected and in-contact poultry, burning coops, disinfection, and disposal of culled birds and poultry products by burial. Phylogenetic analysis confirmed clade 2.2, similar to the viruses detected in India and Bangladesh.

In **India**, no outbreaks have been reported since February 2010. In January 2010, there were 15 outbreaks reported, all of them in Murshidabad District, West Bengal. This compares with ten poultry outbreaks reported in 2009 (nine in West Bengal and one in Sikkim). The 2010 virus isolates are similar to those found during 2008 and 2009 and belong to clade 2.2.

In January and February 2009, **Nepal** reported its first two H5N1 HPAI outbreaks. Both occurred in backyard poultry in the Jhapa District bordering India (in the first outbreak, the property affected was along the main highway from India, approximately 1 km inside Nepal). Phylogenetic analysis of the virus isolated from the index case demonstrated approximately 99 percent similarity with publicly available sequences from contemporary viruses in eastern Asia, including viruses originating from India (West Bengal). In 2010, Nepal experienced eight H5N1 HPAI outbreaks in domestic poultry, seven of them in the period between January to March (Bheri, Gandaki, Lumbini, Narayani, Rapti and Seti Zones) and one in October in Narayani Zone. Phylogenetic analyses of virus isolates from these outbreaks identified H5N1 clade 2.2 (samples taken from the Karski District outbreak, Gandaki Zone) and H5N1 clade 2.3.2 (from all outbreaks). Clade 2.2 had been previously isolated in 2009 in Nepal's eastern region, but the outbreaks in early 2010 were the first detections of clade 2.3.2 in the south Asia region. The clade 2.3.2 viruses were most closely related to viruses isolated in wild birds in 2009 from the Bulgaria, Mongolia and the Russian Federation. The clade 2.3.2 viruses isolated in wild birds in Hong Kong SAR (China) and in poultry in Viet Nam were a little less closely related to these viruses, probably indicating a different evolution pathway from the source.

Middle East

In **Israel**, two H5N1 HPAI events have been reported in 2010. A poultry outbreak was observed in a high biosecurity poultry farm in Haifa in January 2010 where three poultry houses were infected. This was the first poultry outbreak observed in Israel since December 2007 and remained the only one in the area. The source of infection was attributed to contact with droppings from wild birds in the proximity of the poultry houses. Sequence data recently became available in GenBank for a virus isolated during this outbreak and the closest relatives appear to be clade 2.2 viruses from Egypt. Later, in April 2010, two emus tested positive for the H5N1 HPAI virus at a mini-zoo of a Kibbutz in Hadarom and clade 2.2.1 was isolated. Both findings suggest some movement of H5N1 HPAI in the region, and possibly into some bridge species.

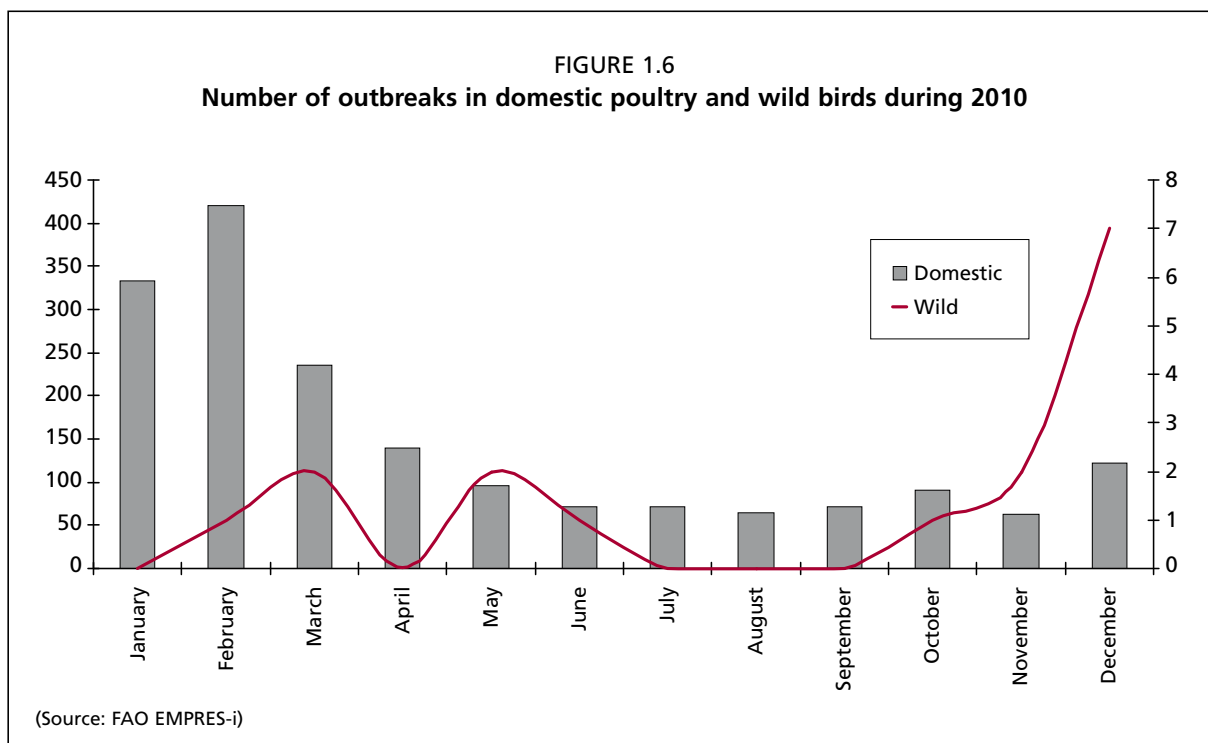
EUROPE REPORTS THE FIRST H5N1 HPAI OUTBREAKS IN POULTRY SINCE 2008

After having found the H5N1 HPAI virus only occasionally in wild birds during 2009 (a wild duck shot in January in Germany; great crested grebes, goosander, grey heron, gadwall and eurasian spoonbill found dead in June, and a rock dove found dead in October in the Russian Federation), Europe reported two outbreaks in backyard poultry in the Tulcea Province of **Romania** in March 2010. These were the first H5N1 HPAI outbreaks in domestic poultry reported by a European country since Germany last confirmed the virus during routine laboratory investigations in a mixed poultry holding in October 2008. Romania itself last experienced poultry outbreaks in November and December 2007, also in the Province of Tulcea. Later in March 2010, a dead buzzard found in Konstantin and Elena Resort in the District of Varna in **Bulgaria** tested positive for the H5N1 HPAI virus. Isolates from both countries grouped in the 2010 clade 2.3.2 and were 99.3 percent homologous to each other and to viruses isolated recently from poultry in Nepal.

In the Republic of Tyva (**Russian Federation**), which lies on the border with north-western Mongolia, 367 wild birds (including great crested grebes, goosander, grey heron, gadwall and eurasian spoonbill) were found to be infected with H5N1 HPAI virus in June 2010. Genetic analysis at the All-Russian Research Institute for Animal Health (ARRIAH) in Vladimir determined that the isolate belonged to clade 2.3.2 of the Asian lineage A/Guangdong/1/96, with 99 percent similarity to the 2009-2010 H5N1 isolates from wild birds in Mongolia, Tyva (Russian Federation) and Qinghai (China).

KNOWLEDGE GAPS REMAIN ON THE ROLE OF WILD BIRDS

During the reporting period, there continued to be reports of wild bird mortalities, while the overall number of outbreaks of H5N1AI in wild birds increased slightly in 2010 (16 outbreaks compared to 12 in 2009) affecting Bulgaria (1), the People's Republic of China (1) Hong Kong (1), Indonesia (1), Japan (4), Republic of Korea (6), Mongolia (1) and the Russian Federation (1) (see [FIGURE 1.6](#)). Compared with domestic poultry populations (see [FIGURE 1.6](#)), clinical disease in wild birds remains a rare event in terms of numbers affected. While the increase between 2009 and 2010 is far from being significant (given the high number of unreported outbreaks in wild birds, notably in waterfowl in over-wintering locations), none of the outbreaks were on the scale of thousands of wild birds, as was the case in 2005



in China and Russia. It is possible that a more virulent strain of H5N1 has been replaced by a less virulent one in wild bird populations, or that the predominant strain in domestic poultry that spills over into wild birds is less virulent. It would seem too soon for the avian population to have developed resistance to the virulent H5N1 HPAI strains, but exposure to other AI viruses may provide some level of cross-immunoprotection.

The wild bird species infected in 2010 were mallard, hooded crane, tundra swan, mute swan, eagle owl, great crested grebe, goosander, grey heron, gadwall, eurasian spoonbill, red-billed chough, bar-headed geese, brown-headed gull, whooper swan, greylag geese, common buzzard and barn swallow. Since the beginning of the H5N1 epizootic, over 100 species from 13 orders of bird have been found to be infected with H5N1 AI virus.

In general, wild bird H5N1 HPAI outbreaks were reported in single birds. However, this was not the case for single outbreaks with multiple mortalities in the People's Republic of China, Mongolia and the Russian Federation, and for two outbreaks in the Republic of Korea. On 26 May, 26 whooper swans and greylag geese were found dead and tested positive for H5N1 HPAI in Mongolia. On 15 May, wild birds were found dead and by the end of the month, a total of 170 wild birds – including 1 red-billed chough, 27 bar-headed geese, 141 brown head gulls and 1 wigeon – had been recorded dead in China. At the beginning of June, great crested grebes, goosander, grey heron, gadwall and eurasian spoonbill were found dead at Ubsu-Nur lake in the Russian Federation, near the Mongolia border. In previous years, a similar temporal and spatial pattern of wild bird deaths has been observed in both Mongolia and Russia, where mortalities occurred during the northern hemisphere Spring season, as birds arrived to breeding grounds. On 29 December, 20 wild mallards were found dead in the Republic of Korea. There were concurrent poultry outbreaks in the country at the time, but they occurred over 100 km away from the location of the wild birds.

BOX 1.1**H5N1 HPAI infections in wild birds**

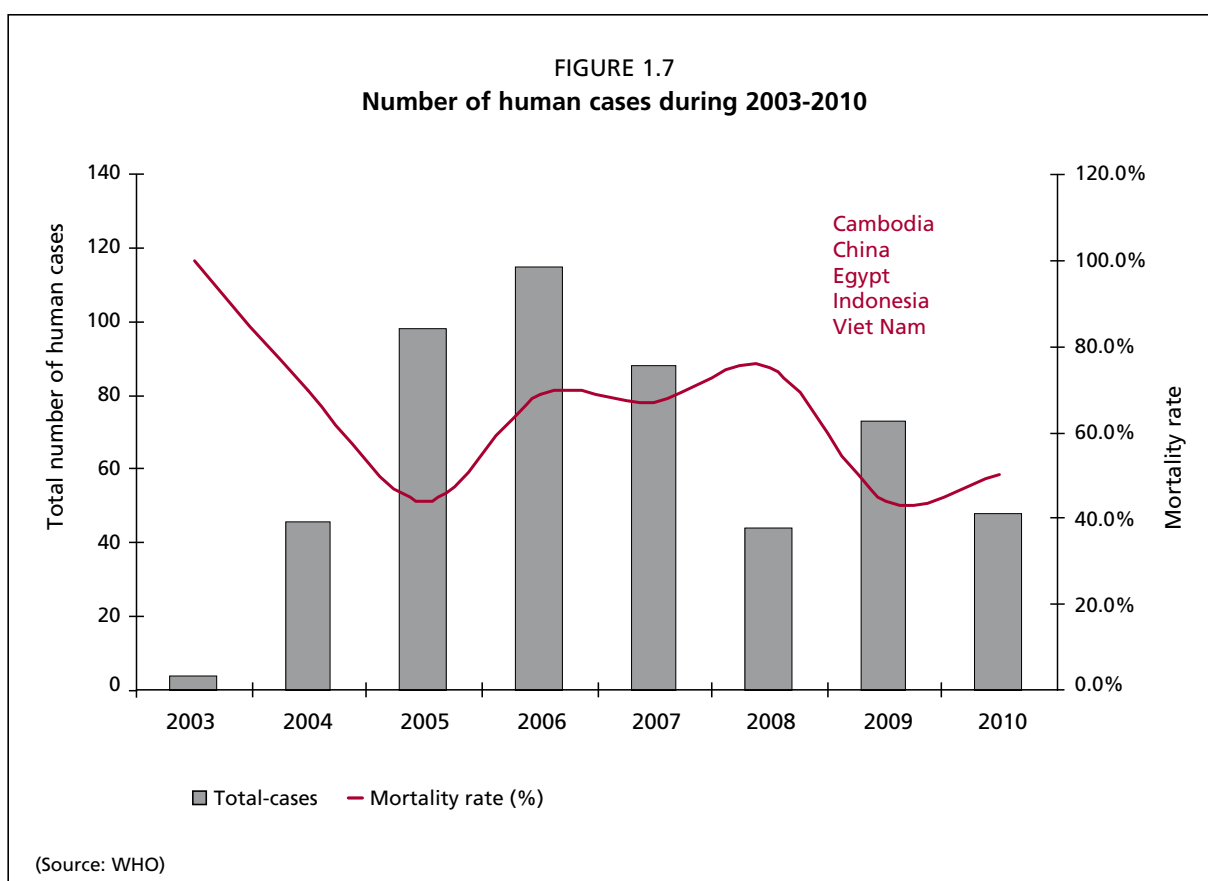
The main clades found in wild birds are 2.2 and 2.3.2. Clade 2.2 viruses have circulated in wild birds predominantly since 2005, however, in 2010 the predominant clade has been 2.3.2, and found in Japan, the Republic of Korea, Mongolia and the Russia Federation. Although clade information is not yet available for the wild birds in the Republic of Korea, clade 2.3.2 viruses are suspected, as this strain has been detected in the Republic of Korea in poultry. It is highly likely that clade 2.3.2 viruses have spilled over from poultry into wild birds and are periodically transported by wild birds to other locations. Research has demonstrated that certain wild waterfowl can shed H5N1 HPAI virus asymptotically for between two-to-five days, and migration disease ecology research conducted by FAO has characterized distances wild waterfowl can migrate over this time frame. While individual migration flights can be long (hundreds of kilometers), for wild waterfowl to be transmitting virus over such distances it is more likely to be occurring through a 'leap-frog' migration pattern, with concurrent transmission of virus from one bird to many others at stop-over sites, and newly-infected birds carrying virus to the next site. To date, based on sampling of more than 750,000 healthy wild birds, no H5N1 HPAI wild bird reservoir has been found.

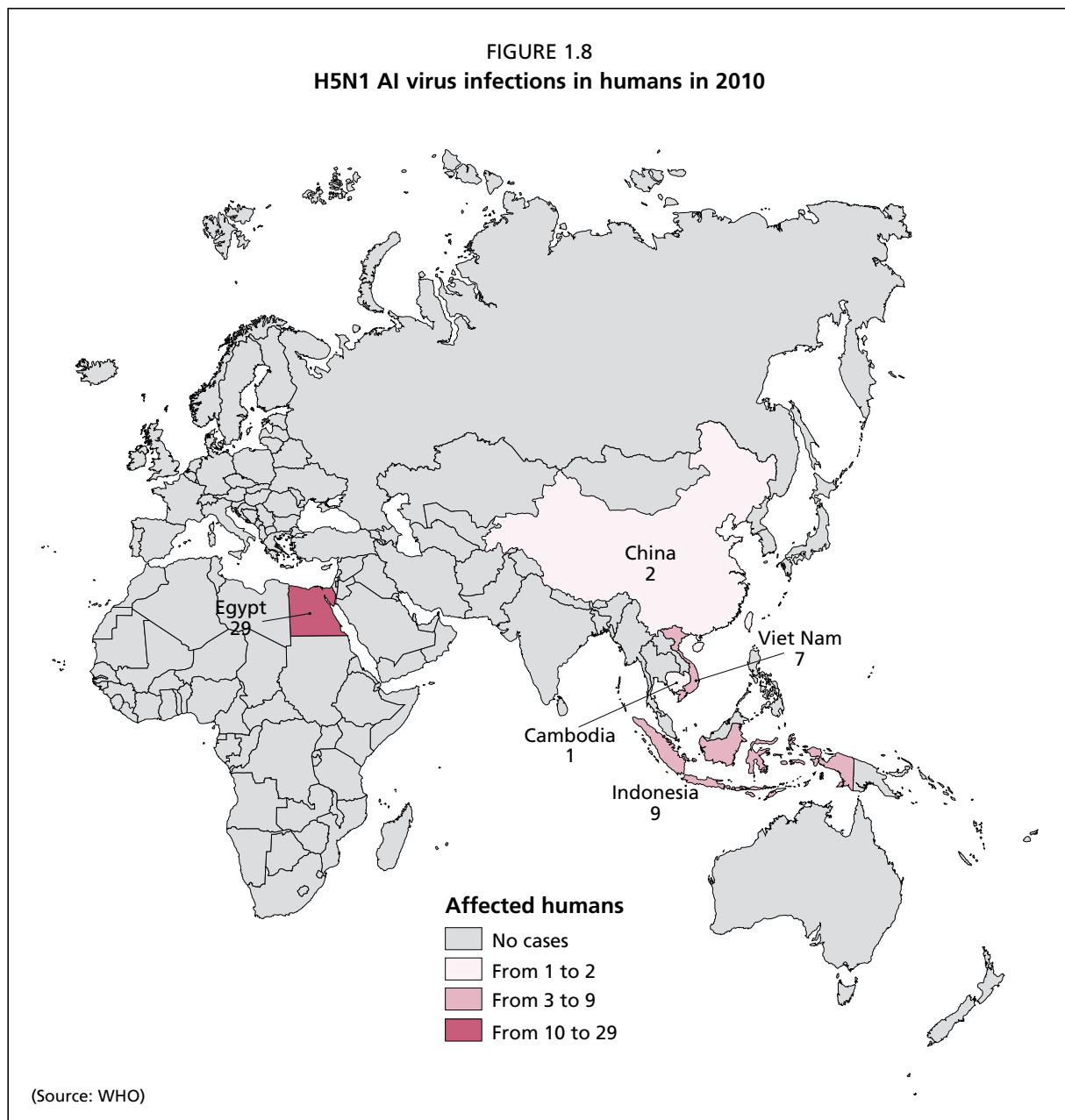
Single wild bird events were also reported in 2010. In February, one wild duck tested positive for the H5N1 virus during PDSR in Indonesia. On 26 March, a barn swallow carcass was collected in Hong Kong SAR at the Mai Po Nature Reserve where barn swallows usually visit in spring and summer. This H5N1 infected wild bird was detected during the ongoing surveillance programme on wild birds. There was no evident spread of disease, but as a precautionary measure the reserve was closed to visitors for 21 days. On 29 March a common buzzard was found dead in a resort in Bulgaria and tested positive for H5N1 HPAI. The bird was found during routine influenza surveillance in domestic and wild birds. During the necropsy, no signs of the disease were observed. Phylogenetic analysis revealed that the virus isolate groups with the 2010 clade 2.3.2 viruses from Romania and Nepal, showing 99.9 percent similarity with the Romanian isolates. At the end of November in the Republic of Korea, under the routine avian influenza surveillance programme, 39 wild birds were captured and sampled and one mallard tested positive for H5N1 HPAI. Additionally, two dead eagle owls were found and tested positive. In Japan, in December, four mute swans were found dead in a zoo and one Tundra swan was found debilitated. In addition, an injured hooded crane was found to be positive for H5N1 HPAI in December. In the Republic of Korea in December, a wild mallard and a wild mandarin duck were found dead and tested positive for H5N1 HPAI.

DECREASE IN HUMAN CASES IN 2010

In 2010, the World Health Organization (WHO) reported 48 human cases – of which 24 were fatal – in five countries: Cambodia (1 case, which was fatal), People's Republic of China (2 cases, including 1 fatality) Egypt (29 cases, 13 fatalities), Indonesia (9 cases, 7 fatalities), and Viet Nam (7 cases, 2 fatalities) (see [FIGURE 1.7](#)). Overall, the number of countries reporting human cases remained the same as in 2010, but the incidence of the disease in humans decreased. Within countries, Viet Nam was the exception, with seven human cases reported in 2010 and five in 2009. The reported case fatality rate in Indonesia in 2010 was high (78 percent), continuing the long-term trend for the country. However, this high case fatality rate may be exaggerated by factors related to the sensitivity of detection of mild human cases.

As of the end of December 2010, the total number of human cases amounted to 512 (of which 304 were fatal), with an annual peak observed in 2006 (Source: WHO website, 29/12/2010). Since then, the number of human cases (including fatalities) has steadily declined, other than a small peak in 2009, when there were 29 more cases reported than in 2008. In 2010, the number of human cases (48) is comparable to the situation in 2008 (44 cases), but with less fatalities in 2010 (24, as compared to 33 fatalities in 2008). The exception is Egypt, where the mortality rate increased from 10 percent in 2009 to 45 percent in 2010 (comparable to the situation in 2008 when the mortality rate was 50 percent). However, seemingly high mortality rates could also be explained by the fact that mild human cases are simply not being picked up by clinical surveillance. [FIGURE 1.7](#) shows





the yearly evolution of human cases since the beginning of the epidemic. The mortality rate in 2010 (50 percent) is comparable with 2009 (44 percent).

In Indonesia, there appears to be a shift towards indirect exposure to H5N1 infection. Indonesia has reported 170 human cases of H5N1 since the beginning of the epidemic, with 48 cases reported in Jakarta province: of these, 62 percent (28) of cases have been attributed to indirect exposure, 27 percent (13) to direct exposure, and the remainder (7), inconclusive.

PERSPECTIVES FOR 2011

There are a number of concerns for the HPAI global programme which must be considered during the following year. The endemic foci of disease will continue to pose a threat to

countries at risk in Asia and Africa. The finding of a new clade of H5N1 in wild birds would suggest that another round of outbreaks may occur in Europe, possibly Africa and certainly neighbouring countries in Asia. As will be argued in the following chapters, a long term approach is required to eliminate H5N1 HPAI from poultry in these endemic foci. The epidemiology of H5N1 in wild birds is far from understood, and the role of the evolution of viruses in domestic poultry as a source of new viruses for wild birds needs to be defined. If H5N1 viruses are now also entrenched in wild birds then there will be considerable challenges in maintaining some poultry populations free from disease, because of the links between such poultry and wild bird populations. The trend of increased numbers of outbreaks during the months of January to March is expected to continue, with a parallel increase in human cases, especially around the time of major New Year celebrations, when the numbers of poultry being traded increases. The central role of open range farmed domestic ducks and their contact with migratory waterfowl and other families of free ranging birds remains a key challenge to the long-term control of the disease.

Chapter 2

The FAO H5N1 HPAI programme

Since the HPAI outbreaks began in Asia in late-2003, FAO has played a key role in the global response to and prevention and control of HPAI. The following chapter provides a summary of the FAO HPAI Global Programme Portfolio as of December 2010.

OVERVIEW OF FAO'S HPAI GLOBAL PROGRAMME

FAO commenced its HPAI response in 2004, initially in Asia (*Recommendations¹ on the Prevention, Control and Eradication of HPAI in Asia - September 2004*). However, with the rapid spread of HPAI to other parts of Asia, Africa, and central and eastern Europe, FAO and the World Organisation for Animal Health (OIE) came together and developed the joint *FAO/OIE Global Strategy on the Progressive Control of HPAI in 2005*, which was later revised in 2007.

TABLE 2.1
FAO ECTAD portfolio as of December 2010

	HPAI	Other TADs
Number of Projects (2010)		
Active Projects		
<i>Asia (including Central Asia)</i>	36	
<i>Global</i>	12	
<i>Africa</i>	10	
<i>MENA</i>	5	
<i>Latin America</i>	1	
Total Active Projects	64	20
Total Closed Projects	104	8
Total Projects	168	28
Budget (in US\$)		
Total Budget (2004-2010)	328 525 279	31 307 553

(Source: FPMIS)

¹ Food and Agriculture Organization (2004) *Recommendations on the Prevention, Control and Eradication of Highly Pathogenic Avian Influenza (HPAI) in Asia*: <http://www.fao.org/docs/eims/upload//246982/aj126e00.pdf>

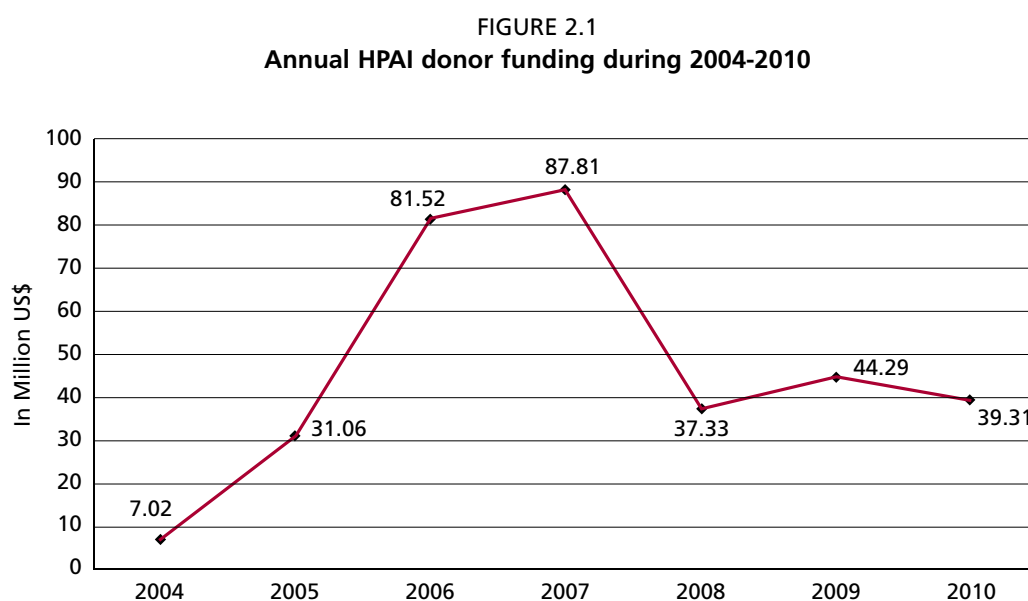
In order to meet its responsibilities under the FAO/OIE Global Strategy, FAO developed its HPAI Global Programme initially for the period of 2006-2008, which was subsequently adjusted and has been ongoing since 2008. The Global Programme is implemented by FAO's Emergency Centre for Transboundary Animal Diseases (ECTAD) established in 2004. In addition to the 168 donor-funded HPAI projects, the ECTAD programme portfolio also includes 28 projects related to other transboundary animal diseases (TADs) (See TABLE 2.1). Of the 168 HPAI projects, 64 projects remain active at the end of December 2010, more than half of which are in Asia.

At present, HPAI projects represents over 90 percent of ECTAD's total animal health programme in terms of funding. However, 20 TAD projects were in implementation during 2010, addressing key TADs such as African swine fever (ASF), anthrax, brucellosis, rabies, Rift Valley fever (RVF), rinderpest, peste des petites ruminants (PPR), and ebola reston virus. There were also a number of projects on Pandemic (H1N1) 2009 following the 2009 outbreaks.

These non-HPAI projects are funded by FAO, the African Development Bank (AfDB), the European Union (EU), the Government of the USA, United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA) and the Government of Sweden.

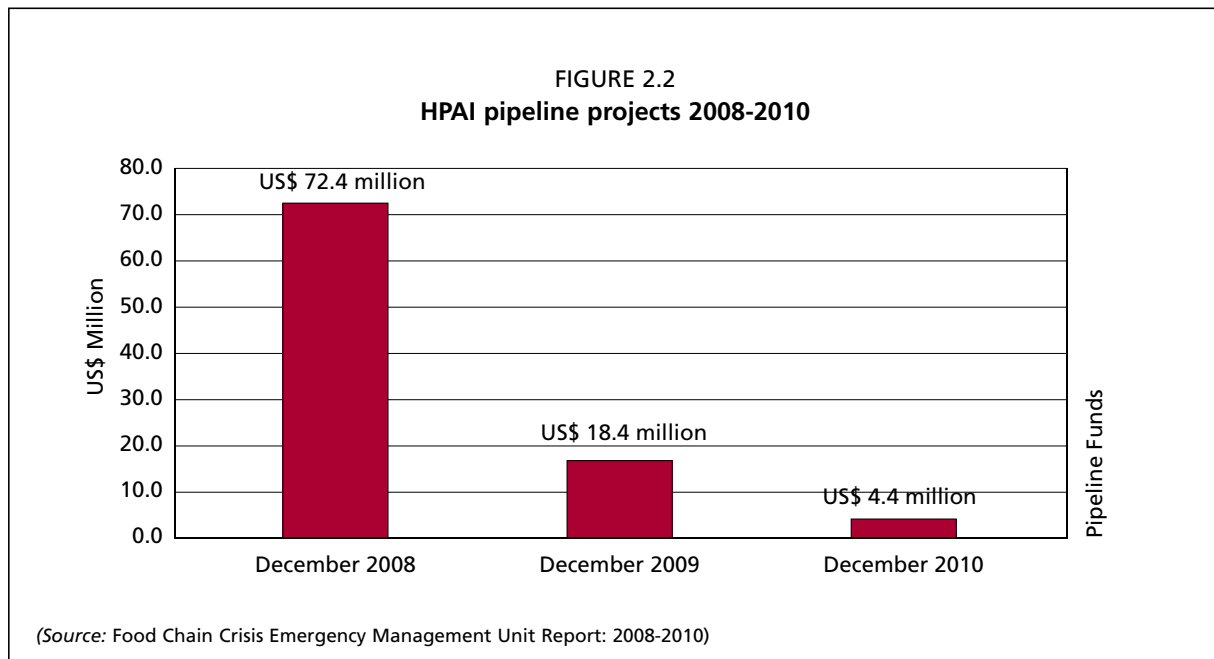
FUNDING STATUS

During the period 2004-2010, FAO and its partners have mobilized a total of US\$ 328.5 million towards HPAI projects in over 95 countries in H5N1 HPAI preparedness, prevention and control. The FAO Global Programme funding peaked in 2007 after which it has been on a declining trend, both in terms of new projects and donor funding (See FIGURE 2.1).



(Source: Food Chain Crisis Emergency Management Unit Report: December 2010)

Note: The figure represents actual project approvals and budget openings per year.



In 2010, there were only six new HPAI projects – a significant reduction compared to 2009 in which there were 18 new projects. Similarly, there has been a constant decline in the pipeline of funds available for HPAI since 2008 (See [FIGURE 2.2](#)).

This trend is at least in part due to the broader contextual changes taking place in the thinking within the international animal health and donor community on the need to move away from disease specific interventions to a more holistic and integrated approach to building sustainable animal health systems at country, regional and global levels. The Pandemic (H1N1) 2009 outbreaks worldwide during 2009 led to further recognition of the need to strategically build on lessons learned from the responses to H5N1 HPAI and apply them to other TADs and emerging infectious diseases (EIDs).

FAO has been working along this approach, and in 2009 published the *Highly Pathogenic Avian Influenza and Beyond: FAO Response – Towards One World, One Health*² and more recently its new Animal Health Strategic Action Plan³ (2011-2015) in line with the 'One Health' agenda.

DONORS

The HPAI Global Programme is financed by a total of 35 donors, of which 24 are government contributors, and the remaining 11 donors are mostly multilateral organizations.

The United States of America is the largest donor, contributing 44 percent of the total FAO HPAI Global Programme Portfolio, with a total budget of US\$ 147.81 million as of December 2010. The USA is followed by the European Union (US\$ 26.20 million), Sweden (US\$ 23.66 million), Australia (US\$ 16.33 million) and Japan (US\$ 13.65 million).

[TABLE 2.2](#) provides details of all donors and their contributions.

² http://www.fao.org/ag/againfo/resources/en/publications/agapubs/HPAI_and_beyond.pdf

³ http://www.fao.org/fileadmin/user_upload/bodies/Progr_Comm/PC_106-documents/PC106-3AnimalHealthMA145E.pdf

TABLE 2.2
Budget per donor in the HPAI portfolio as of December 2010

Donor	Funding (Million US\$)
1 Asian Development Bank	11.1
2 African Union-Inter African Bureau for Animal Resources (AU-IBAR)	0.2
3 Australia	16.3
4 Bangladesh	1.0
5 Belgium	2.8
6 Canada	9.9
7 CHF	0.3
8 People's Republic of China	0.5
9 European Union	26.2
10 FAO	9.6
11 France	6.7
12 Germany	9.5
13 Greece	0.1
14 ILRI	0.2
15 Ireland	0.3
16 Italy	0.2
17 Japan	13.6
18 Jordan, Hashemite Kingdom of	0.05
19 Nepal	2.3
20 Netherlands	1.3
21 New Zealand	0.3
22 Norway	3.7
23 OPEC Fund	0.7
24 Saudi Arabia, Kingdom of	1.0
25 Spain, Kingdom of	2.7
26 Sweden	23.6
27 Switzerland	3.7
28 UNAP	0.03
29 United Nations Development Group Office (DGO) Service & Support UNDG/ EXECCOM Secretariat	0.93
30 UNDP	0.7
31 UNDP Administered Donor Joint Trust Fund	10.0 ⁴
32 United Kingdom	10.2
33 United States of America	147.8
34 Viet Nam	1.0
35 World Bank	8.9
TOTAL	328.5

(Source: FPMIS)

⁴ US\$ 5.7 million provided by Canadian government was channeled through UNDP Administered Donor Joint Fund.

OTHER FINANCING MECHANISMS FOR FAO HPAI RESPONSE

FAO's Technical Cooperation Programme

FAO through its own resources has made a major contribution to the global HPAI response, especially during the pre-Global Programme period of 2004 and 2005 when donor funding was still scarce.

To date, FAO has provided US\$ 9.65 million in direct support to 27 projects, through its Technical Cooperation Programme (TCP). FAO funding has been a critical financial tool in regions where the disease incidence is relatively low and where donor assistance has been limited, such as in Central Asia, Europe and Latin America. For these three regions, FAO provided a total of US\$ 3.2 million in HPAI preparedness and response, representing 23 percent of total funding for the three regions.

As of December 2010, there are no operationally active HPAI TCP projects. Twenty three projects have been closed, while the remaining four projects have completed their activities and are pending closure.

Special Fund for Emergency and Rehabilitation Activities (SFERA)

Since SFERA was established in April 2004, it has proven to be a valuable mechanism in funding FAO's emergency programmes. The receipt of unearmarked funds through SFERA allows FAO to effectively channel funds in a flexible and efficient manner to the geographical and thematic areas where the needs are greatest.

A total of 15 projects were channelled through SFERA with a budget of US\$ 46.8 million from 10 donors. Of the 15 projects, 10 have been closed and the remaining five have completed their activities and are pending closure.

TABLE 2.3
List of donors contributing to SFERA as of 31 December 2010

Donors	Amount (US\$)
Sweden	23 659 236
UK	6 943 655
France	5 930 420
Switzerland	3 696 573
Norway	3 506 326
Saudi Arabia	1 000 000
OPEC	700 000
China	500 000
Greece	188 443
Jordan	50 000
TOTAL	46 880 143

(Source: Food Chain Crisis Emergency Management Unit Monthly Report: december 2010)

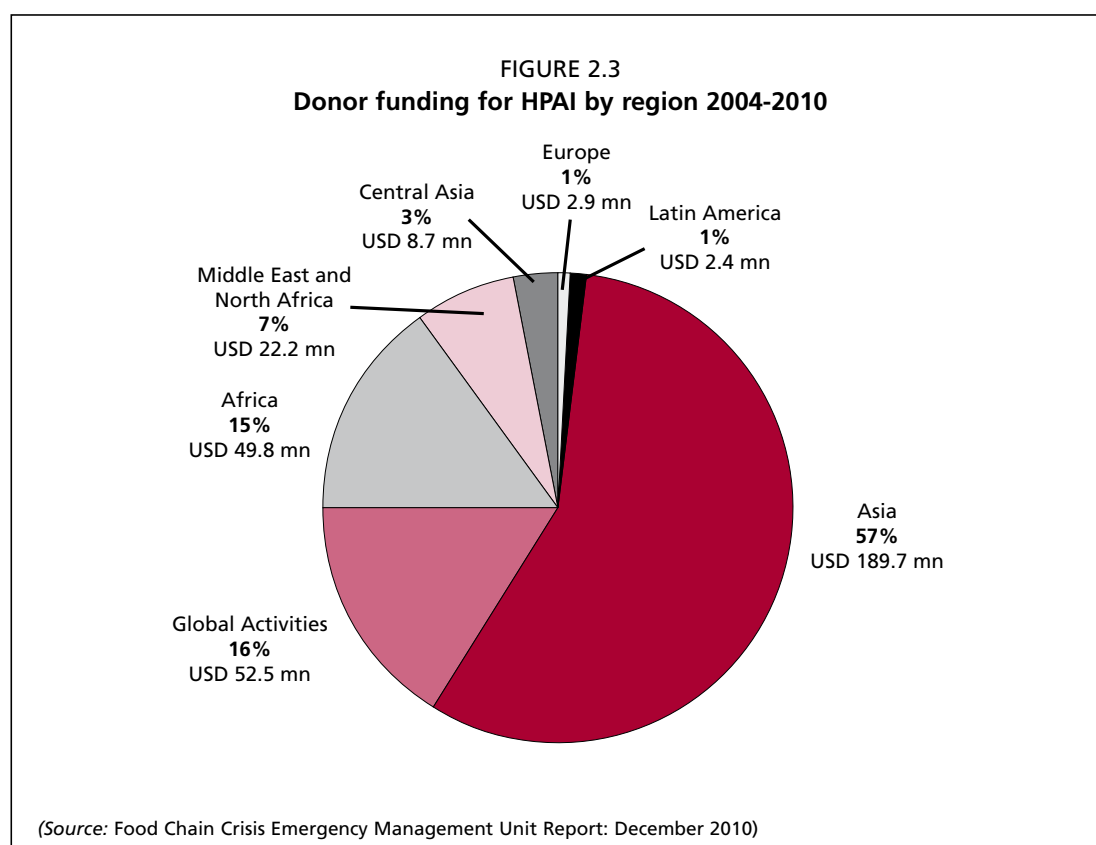
The largest donor to SFERA is Sweden, contributing almost 50 percent of total SFERA funds for HPAI. SFERA supports both country specific initiatives as well as regional and global coordination activities. The fund has also supported a range of operational and technical activities including the provision of laboratory supplies, veterinary equipment and other HPAI disease control essentials, recruitment of technical experts for country field missions, travel costs, costs for conducting meetings and conferences, and in a small part to the initial development of the Crisis Management Centre – Animal Health (CMC - AH). Additionally, SFERA contributions continue to play an essential role in filling critical gaps in priority countries and regions, especially when there is a shortfall in earmarked funding.

GEOGRAPHIC PRIORITIES

The Global Programme funding has been mobilized for a range of operational and technical activities, particularly developing and strengthening of veterinary structures, early warning, efficient detection and rapid response, in a wide range of geographic areas.

In the initial stages of the HPAI response, a substantial amount of funds were invested in mobilizing international technical and operational expertise for countries directly affected by HPAI outbreaks, especially in Asia. Although there has been a general decline in the incidence of HPAI, the disease remains entrenched in several parts of Asia and consequentially is the largest recipient of donor funding (see [FIGURE 2.3](#))

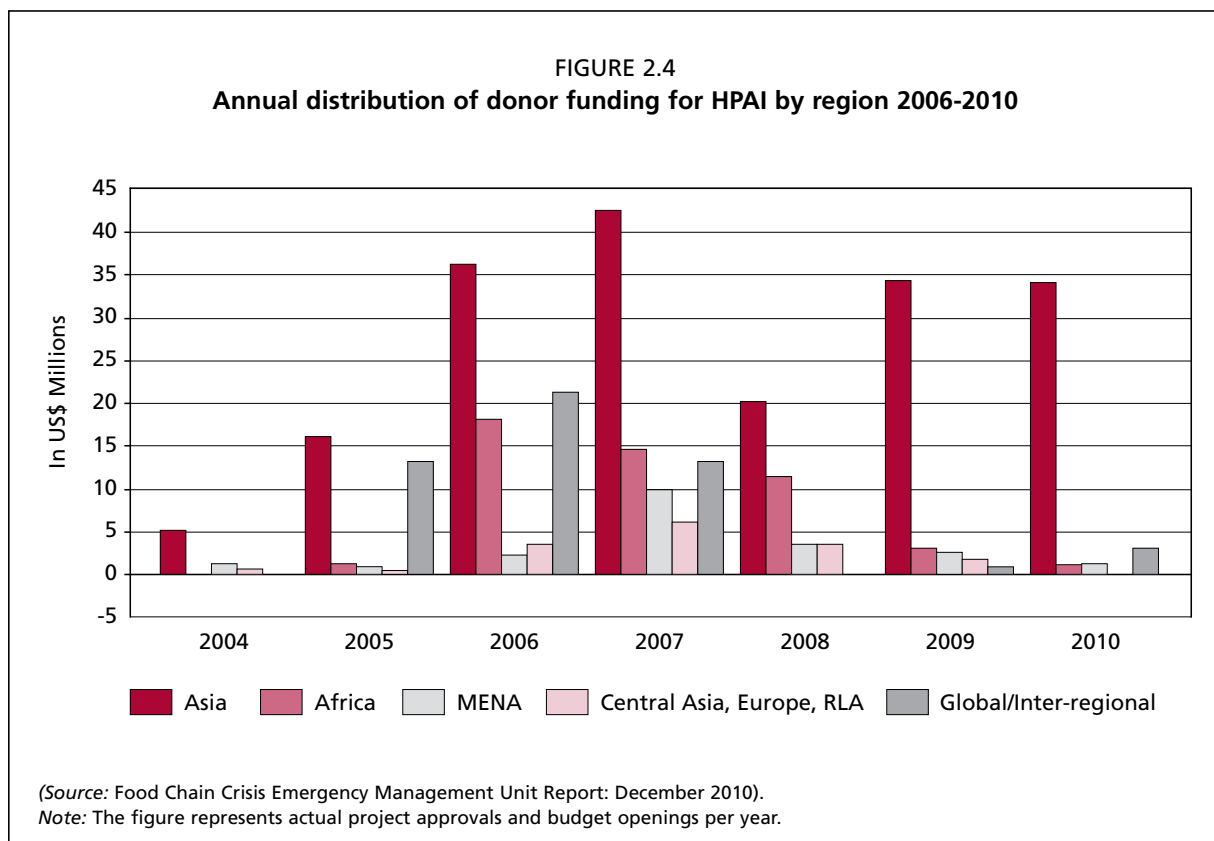
The Asian region as a whole received US\$ 189.7 million during the period 2004-2010, accounting for 57 percent of total HPAI donor funding for national and regionally implemented projects.

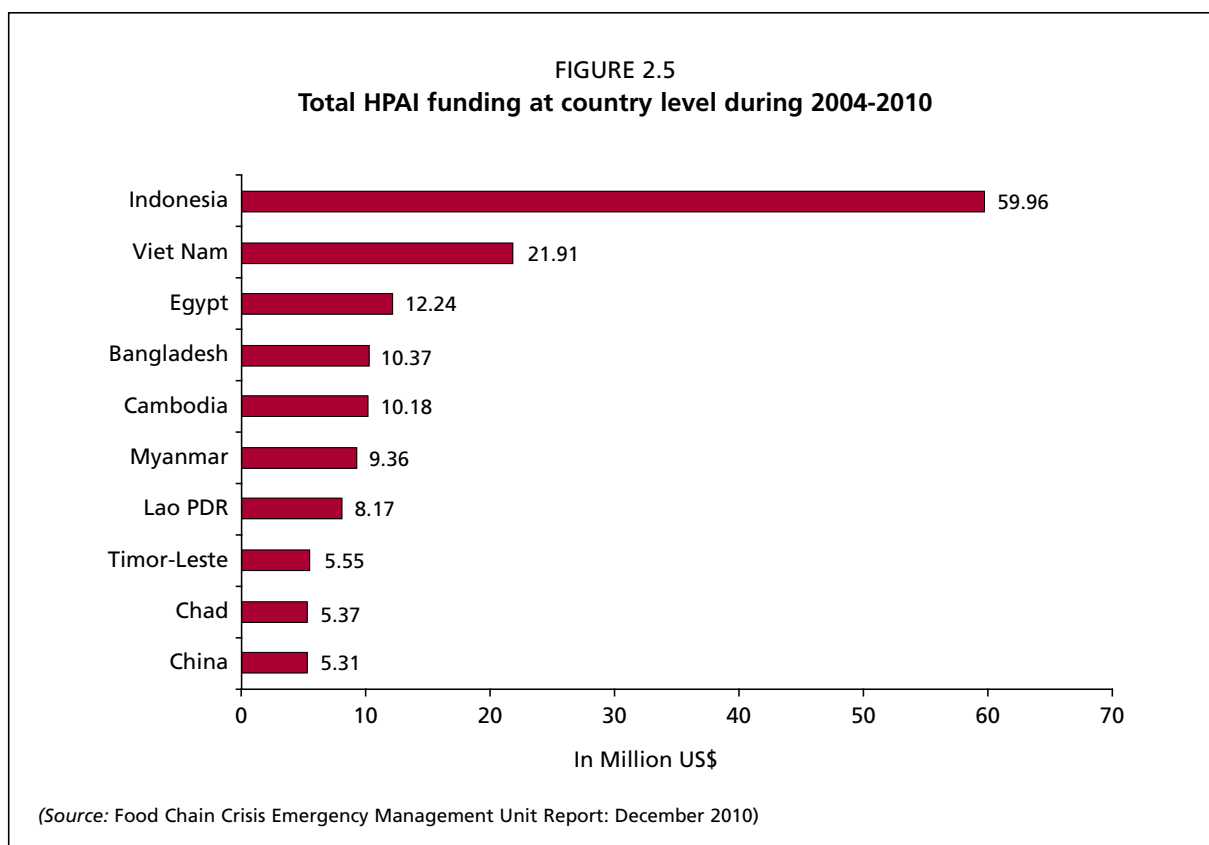


Global activities constitute 16 percent (US\$ 52.5 million) of the total donor funding on HPAI, followed by the African region, which received 15 percent (US\$ 49.8 million) of HPAI funding for national and regionally implemented projects. The Middle East and North African Region (MENA) received seven percent (US\$22.2 million) of total HPAI funding. Central Asia, Latin America and Europe received a total of US\$ 14 million in donor assistance, mainly towards regional projects in HPAI preparedness planning and response.

The annual HPAI funding follows the overall trend in geographic distribution of funding presented above, with the Asian region being the largest recipient of HPAI annual funding, including US\$ 34 069 953 for the year 2010. Africa remained the second largest geographical recipient (not including the global/inter-regional activities) of HPAI funding between 2006 – 2009. The African region has not reported an HPAI outbreak since September 2008, while the situation in Egypt worsened during 2010 (See Chapter 1). In 2010, the MENA region received a total of US\$ 1 340 513 – most of which went to Egypt. The country received approximately 55 percent of the total regional funding between the period 2004-2010, and is third largest recipient of the total HPAI funding during the same period (See [FIGURE 2.4](#)).

In terms of country allocation of donor funds, [FIGURE 2.5](#) below provides details of the top 10 recipients of HPAI funding. Eight of the top 10 countries are in Asia (with the remaining two being Chad and Egypt). The total budgets for these 10 countries comprise nearly 45 percent of the total Global Programme Funding Portfolio.





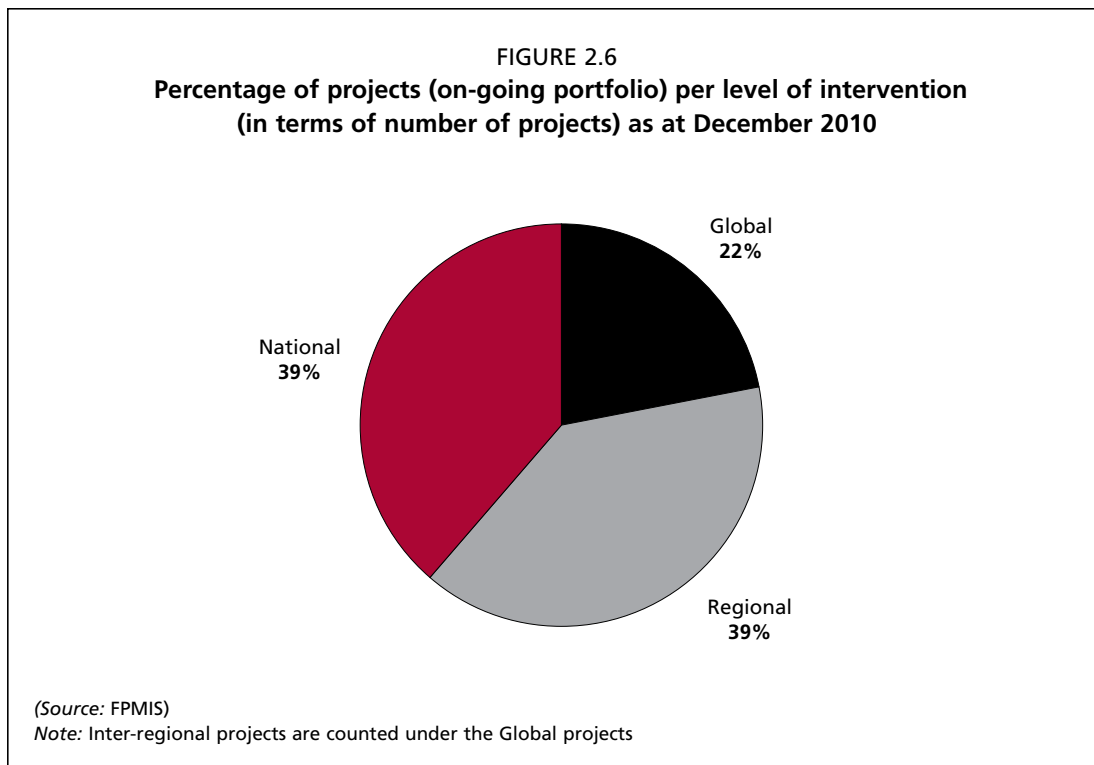
LEVELS OF INTERVENTION

The approach followed by FAO in its HPAI response is best summarized in the *FAO/OIE Global Strategy for Prevention and Control of H5N1 HPAI (2007)*, as 'Global Leadership, Regional Cooperation and National Action'. The FAO Global Programme has been structured according to these principles and is designed to operate at the three interlinked levels: global, regional and national.

During the early phases of the Global Programme, a large percentage of the projects were implemented at national levels, mostly in the countries directly affected by outbreaks. This country focus has been crucial to the success of the HPAI response, and has proved essential in building and strengthening basic animal health related capacities in the affected countries.

While maintaining the country focus, there has been an significant increase in regional and global projects within the HPAI portfolio, at least in part due to the growing consensus on the transboundary nature of HPAI, which requires cross-border cooperation and collaboration in disease control and prevention. Within the current active project portfolio, as of December 2010, 39 percent of projects are implemented at the national/country level, 39 percent at the regional level, and 22 percent at the global level (see [FIGURE 2.6](#)).

Regional and global activities complement country specific initiatives through fostering greater collaboration within and among regionally-grouped countries for a more harmonized and coordinated approach to HPAI control. Significant progress has been made in engaging regional organizations, including the Association of Southeast Asian Nations (ASEAN), South Asian Association for Regional Cooperation (SAARC), and the African



Union Inter-African Bureau for Animal Resources (AU-IBAR), to establish regional animal health centres (RAHCs) and regional networks in surveillance, diagnosis, socio-economics and communication.

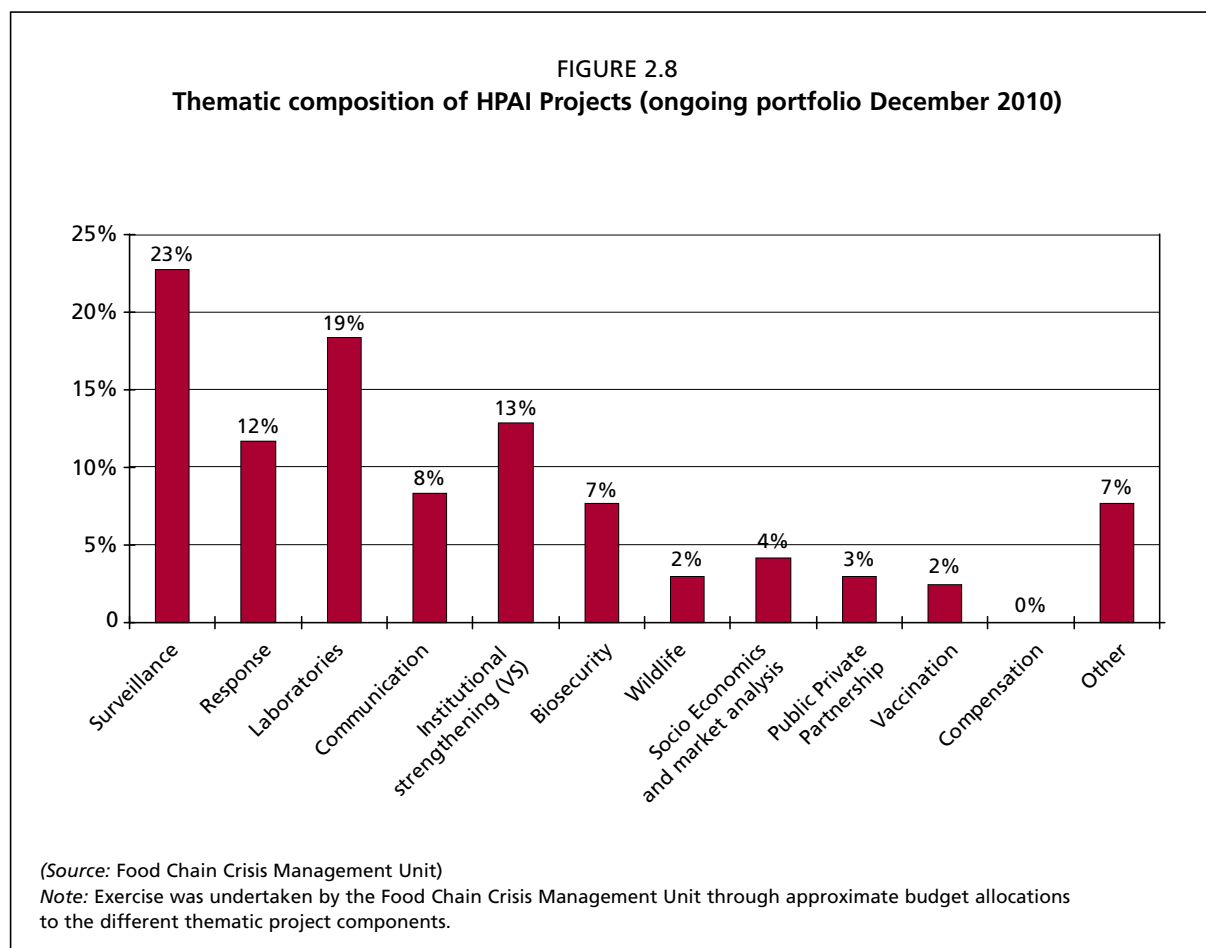
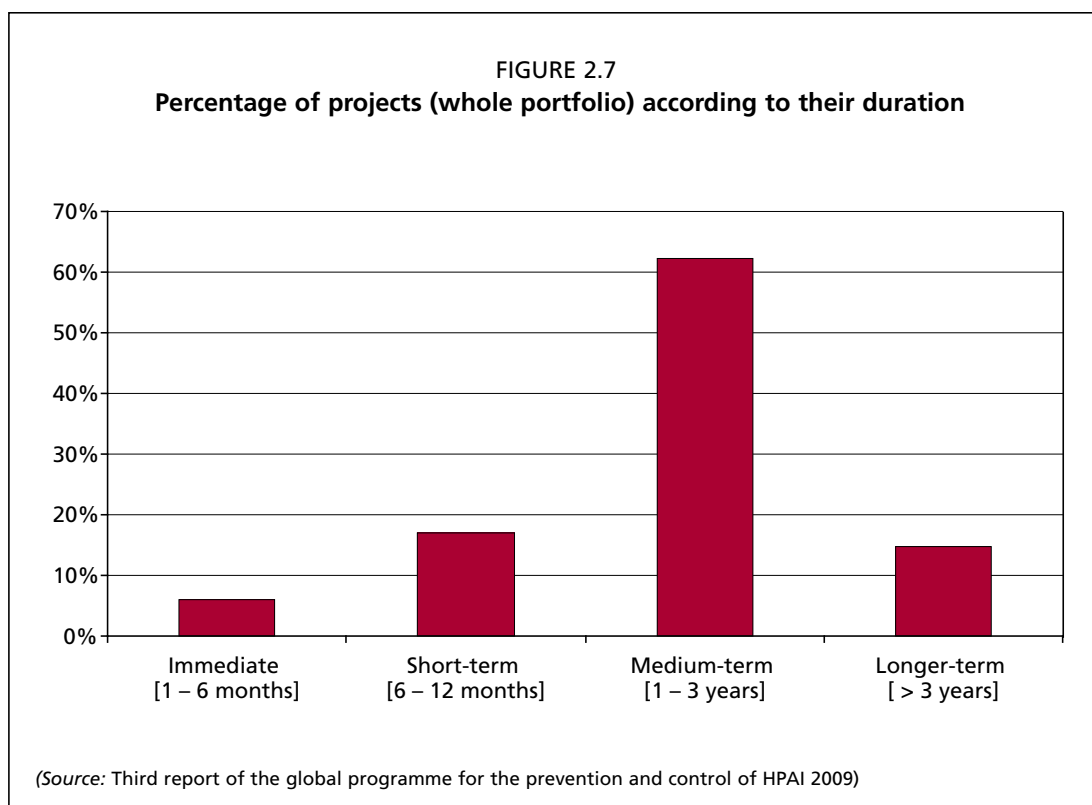
The simultaneous interventions at the global, regional and country levels provide greater efficiency and effectiveness of programming and implementation of HPAI prevention and control, as well as allowing for a more integrated response that is in line with the 'One Health'⁵ agenda.

LONGER-TERM MULTIDISCIPLINARY APPROACH TO HPAI

The projects introduced in the immediate aftermath of HPAI outbreaks in early-2004 were mainly implemented to address the pressing concerns of controlling the HPAI outbreaks in the affected countries. The percentage of projects in terms of their period of implementation (whole portfolio) was presented in the Third Global report of 2009, and can also be seen in [FIGURE 2.7](#).

Out of the ongoing 64 HPAI projects, approximately half of the projects have a duration of three years or more and incorporate longer-term activities such as strengthening capacities of national/regional veterinary services in disease surveillance, response and prevention mechanisms in addition to the more immediate needs of disease containment and control measures.

⁵ The 'One Health' concept establishes a more collaborative, cross-sectoral, multidisciplinary mode of addressing threats of infectious diseases at the animal-human-ecosystem interface (animal to be understood as a combination of livestock and wildlife).



While the short-term response focus is increasingly moving towards a longer-term sustainable approach, the declining Global Programme funds and the difficulty in engaging donors on projects on a longer-term basis presents significant challenges in the realization of such a system.

In terms of the multidisciplinary aspects of the HPAI projects, the ongoing portfolio is still largely focused on the veterinary disciplines of surveillance, response, strengthening of veterinary services and laboratory capacity. However, following the second real time evaluation⁶ (RTE 2) recommendation to develop a more integrated and multidisciplinary approach, there is a greater integration of other areas of work such as biosecurity, socio-economic and market analysis, communication, public private partnerships and wildlife aspects into the HPAI projects.

POST HPAI GLOBAL PROGRAMME – ADDITIONAL FUNDING REQUIREMENTS

FAO has completed its new five year (2011-2015) Animal Health Strategic Action Plan⁷ which extends its six-year response to H5N1 HPAI to other animal and animal-related human threats.

The Action Plan emphasizes FAO's comparative advantage in taking a broad, multidisciplinary approach to problem solving, and in building on investments and lessons learned

TABLE 2.4
Total indicative budget for 2011-2015 (by area of work)

	Budget in million US\$
Technical Activities	
Understanding the cross-sectoral nature of health hazards	20
Fostering collaboration between animal, human and environmental health sectors	12
Promoting strategies to preserve and enhance animal health which are socially acceptable and economically viable.	25
Strengthening the capacity of animal health systems for policy and strategy formulation	27
Developing core technical capacities to deal with animal diseases at national, regional and global levels.	85
Sub-total	169
Functional activities	
Ensuring adequate human force to implement the Action Plan	18
Communicating the Action Plan appropriately	5
Setting up a robust monitoring and evaluation (M&E) system	1.8
Sub-total	24.8
TOTAL	193.8

(Source: FAO Animal Health Strategic Action Plan, March 2011)

⁶ <http://www.fao.org/docrep/meeting/019/k8501e.pdf>

⁷ http://www.fao.org/fileadmin/user_upload/bodies/Progr_Comm/PC_106-documents/PC_106-3AnimalHealthMA145E.pdf

from the HPAI programme through cooperation with national governments, subregional, regional and global organizations, and with donor agencies.

The Action Plan proposes to enhance knowledge on how to strengthen global animal health management and engage countries in a long-term development roadmap towards prevention, control and response to animal and public health risks attributable to zoonoses and priority animal diseases.

The funding requirements for the five years are projected at US\$ 193.8 million. **TABLE 2.4** presents the key areas of work and the proposed budget for the period 2011-2015.

The key outcomes of the Action Plan are expected to be reduced incidence of animal diseases and the associated human health risks. This will result in improved livelihoods and public health, and reduced poverty and enhanced food security for the poor communities of today's global society, thereby contributing significantly to the achievement of the Millennium Development Goals (MDGs).

Chapter 3

Thematic review

INTRODUCTION

Within the FAO Global Programme there are several thematic areas to concentrate objectives, resources and activities. This chapter looks at the thematic areas in relation to surveillance, laboratory capacity, biosecurity and good poultry production practices, public private partnerships, preparedness, response, socio-economics, communication and wildlife. The contents of this chapter are derived from discussions with and contributions from thematic specialists, from the earlier global reports, in particular the third report, and from periodical reports submitted to FAO as part of project management requirements. In addition a short survey was conducted to follow up on the findings from previous similar surveys, for which countries were selected based on their current disease situation (endemic, sporadically infected and at-risk) and the importance of the FAO HPAI portfolio in the country. For this report only countries with active HPAI projects were surveyed and no distinction was made as to the current disease situation. This survey has not included the Latin American and Caribbean countries. The survey was completed by FAO staff stationed in the countries and regional offices and does not necessarily reflect the views of other agencies or governments.

A major challenge for FAO is to maintain investment in the Global Programme and so it is of great importance to continue to demonstrate the benefits of ongoing investments. Under the various headings there are qualitative assessments of the impact of thematic areas on the overall performance of the portfolio and on the control of the disease, with particular reference to surveillance, laboratory capacity and biosecurity. The results presented in the following section should be read as a preliminary assessment of overall government capacities to prevent and control HPAI.

SURVEILLANCE

Surveillance for HPAI remains a high priority for FAO in the global, regional and national level projects. However, it is also a difficult area for national animal health services to maintain investment in because of the costs involved and the declining interest in HPAI among animal health field services and poultry producers. Some early studies have been directed at the cost effectiveness of surveillance but in the emergency mode it was difficult to incorporate these considerations into national policy. The public health and human pandemic threat dimensions of the global enzootic also made such analysis difficult and this situation will remain, as it continues to be difficult to demonstrate the link between poultry health surveillance and human cases. While rare, in some places it has been the occurrence of human cases that has been the sentinel for H5N1 disease in poultry, which has not been identified by farmer reporting systems. In general, as H5N1 HPAI is a relatively uncommon

event, active surveillance for disease is relatively inefficient and it is difficult to assess the impact of such surveillance on the overall control of the disease. One of the benefits of active surveillance is that it creates a stronger link between producers and official animal health services, resulting in enhanced farmer awareness and implementation of control measures. However, as HPAI comes to be regarded as an endemic disease and surveillance part of more mainstream activity, then cost effectiveness becomes more central to the allocation of scarce resources from national budgets. Now it is more important to consider the full range of issues that influence the implementation of surveillance programmes and so such evaluations of cost effectiveness are continuing.

FAO'S GLOBAL SUPPORT TO SURVEILLANCE

Progress report of the Global Early Warning System (GLEWS)

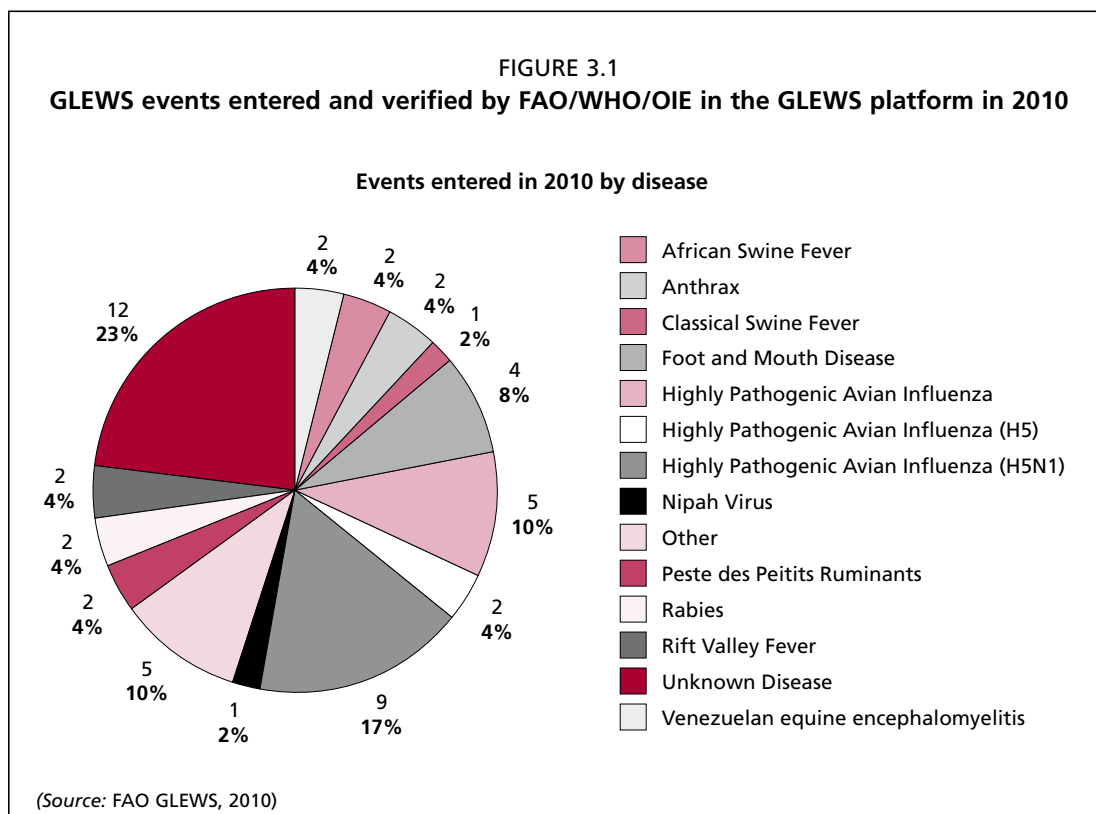
During 2010, the GLEWS initiative by FAO, OIE and WHO continued to strengthen its capacity in terms of disease event analysis, early warning and forecasting. In particular, integrated risk assessment of pathogen transmission at the animal-human interface were the focus of GLEWS analysis activities.

GLEWS activity in 2010 included requests for verification of suspected disease events, disease surveillance reports, epidemiological analysis and specific risk assessments. The joint GLEWS electronic platform (<http://www.glews.net/Glews-Platform>) designed for data sharing, was developed and is hosted by FAO (having been operational since February 2009).

During 2010, an average of four relevant disease outbreak events per month were investigated jointly by the three partner organizations and information was shared through the GLEWS electronic platform. Some of these events triggered a response from the Crisis Management Centre – Animal Health.

The GLEWS platform is password protected to safeguard sensitive or confidential data and provides a disease event management tool that facilitates and links information exchange between the focal points of the three partner organizations. E-mail exchange has been progressively replaced by communication via the platform. In 2010, a wider range of diseases was covered in comparison with 2008 and 2009, where avian influenza was predominant. A map has been available online, and accessible through the GLEWS website (www.glews.net) since November 2009, showing events that were tracked through the GLEWS platform and eventually officially confirmed or denied. However, GLEWS information-sharing activities are largely unavailable publicly, as they often contain confidential information that could potentially jeopardize relationships with information sources or member countries.

The GLEWS public website was launched in March 2009, and included in its content are joint articles from FAO/OIE/WHO relating to specific emergent risks. In 2010, articles published included analyses of the 2010 foot-and-mouth disease (FMD) epidemics in South Korea and Japan; an assessment of a glanders outbreak in the Middle East in 2009; an overview of *Brucella melitensis* in the Middle East and Eurasia regions; an overview of Rift Valley fever (RVF) outbreak-forecasting models; and a summary of the worldwide distribution of sheep and goat pox. Since its launch, the number of visitors to the website has steadily increased to almost 9,000 per month.

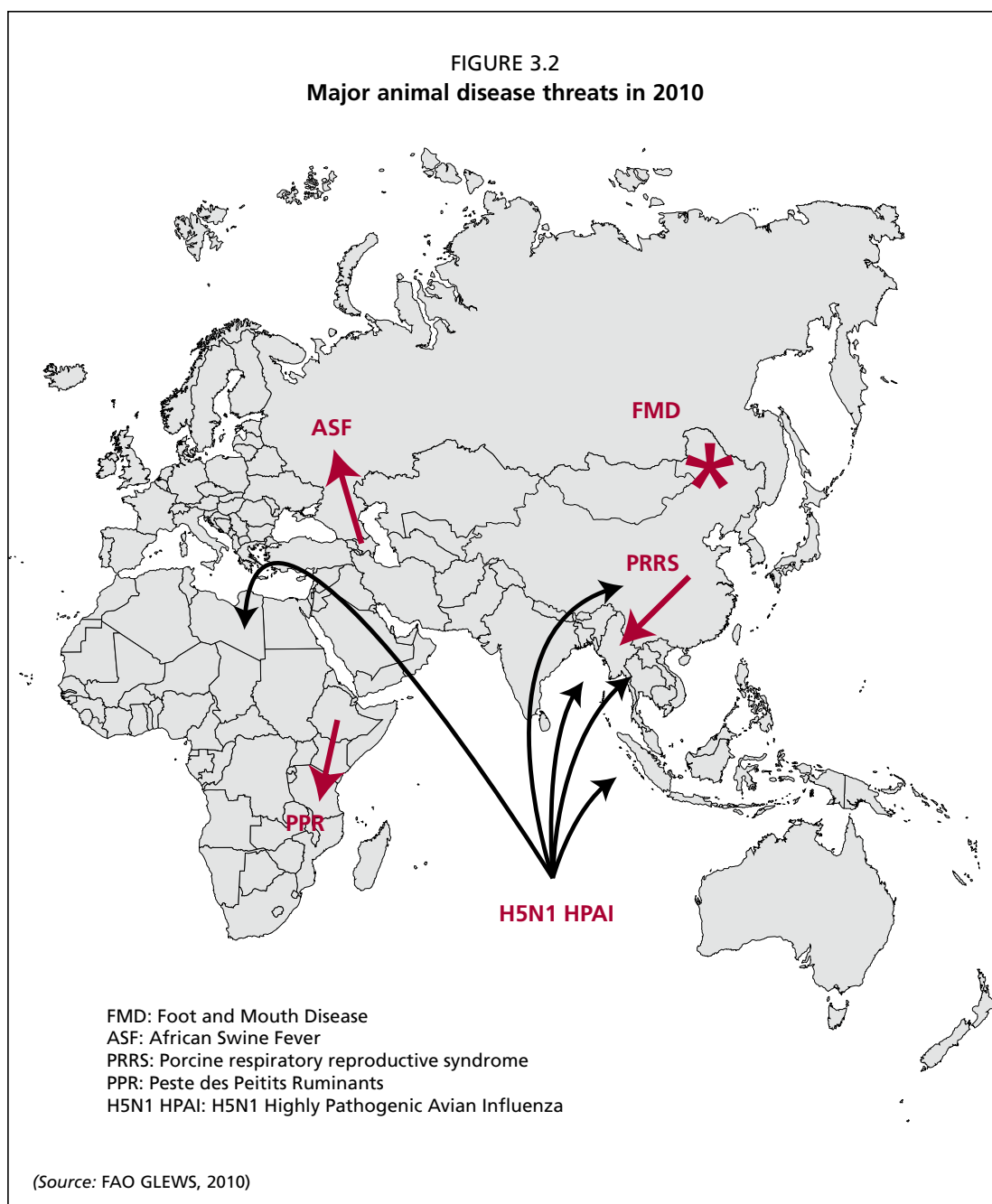


Since the beginning of the H5N1 HPAI epidemic in late-2003, the FAO-GLEWS team has on a weekly basis been summarizing global H5N1 HPAI occurrences in poultry and wild birds from official and unofficial sources and human H5N1 disease occurrence. A weekly '*HPAI Update*' describing the main HPAI events and a monthly overview of H5N1 HPAI are published by FAO, describing global trends, epidemiological analysis and events occurring during the reporting period. Access to animal data provided by OIE and FAO has been available to WHO to assess the risk of people contracting H5N1 infection.

In February 2010, a meeting of the GLEWS Task Force was organized by FAO in Rome to discuss progress, identify and prioritize items of work, and develop a work plan for 2010-2011. Issues discussed during the meeting included refinements to the functionality of the GLEWS platform and GLEWS public website to support the exchange and follow-up of disease events and their verification. Participants acknowledged that GLEWS funding was anticipated to end in mid-2012 and, although the GLEWS initiative is often mentioned in relation to the development of new initiatives such as IDENTIFY or One Health, a financial return to GLEWS was deemed necessary in order to contribute to its sustainability and development.

As discussed earlier, H5N1 HPAI continued to be a major concern in 2010, with an increase of both reported outbreaks and the overall number of infected countries, compared with the previous two years.

Integrated risk analyses of pathogen transmission at the animal-human interface were primarily established for H5N1 HPAI, but now include other priority diseases. The coordination and information sharing following the emergence of the influenza Pandemic (H1N1) 2009 is a good example of increased collaboration between FAO, OIE and WHO.



During 2010 other major animal diseases also continued to spread in different regions of the world, disrupting livestock production, rural economies and people's livelihoods and food security. This has been largely due to the limited capacity of veterinary services to contain animal diseases in endemic settings, and to disease drivers such as high intensification of animal production, increased trade of animal and animal products and intensified contact between animal, human and wildlife populations. This significant flare up of disease events in 2010 included: the spread of African swine fever (ASF) in Eastern Europe, FMD in East Asia, *peste des petit ruminants* (PPR) in Eastern Africa, and porcine reproductive and respiratory syndrome (PRRS) in Asia. The issues related to ASF, FMD, PPR and PRRS are addressed in Chapter 6 in the context of the One Health approach.

FAO'S REGIONAL SUPPORT TO SURVEILLANCE

ECTAD Bamako

Two regional networks of national epidemiosurveillance systems for west and central Africa (RESEPI for west Africa and RESEPI for central Africa) allowed for the prioritization of diseases at national and regional level in order to define tools and harmonize disease surveillance strategy. This served as a basis for the formulation of proposals for ECTAD strategy in these regions. In central Africa, a cross-border meeting on priority diseases surveillance strategies at borders was organized (through the OSRO/CHD/602/EC project) in Moundou, Chad, during August-September 2010. Cameroon, Central African Republic and Chad participated in the event.

TADinfo was installed and national staff trained in Côte d'Ivoire and Guinea-Bissau, while other countries continued to benefit from support services. During this period, TADinfo software for Gambia, Niger and Senegal has also been finalized and will be installed in 2011. Disease surveillance systems of some countries, including Chad, Gabon and Togo, continued to benefit from the support of country specific projects backstopped by the ECTAD-Bamako Unit (for example in terms of training, establishment of surveillance protocols and tools, and logistics). The ECTAD Unit also supported the organization of field simulation exercises in Gabon and Togo. Active surveillance of H5N1 HPAI in domestic ducks commenced in Benin, Burkina Faso, Côte d'Ivoire and Togo, in collaboration with the Istituto Zooprofilattico Sperimentale delle Venezie (IZVSe of Padova), Italy and the Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD) in France.

In the context of a Letter of Agreement (LOA) between the Communauté Economique du Bétail, de la Viande et des Ressources Halieutiques (CEBEVIRHA or Economic Commission on Cattle, Meat and Fish Resources) within the Communauté Economique et Monétaire d'Afrique Centrale (CEMAC), and FAO, a regional workshop was held in Douala, Cameroon in September 2010, entitled 'Study/survey of the zoonosary status and livestock statistics in central Africa: wrap up workshop'. Two experts from ECTAD Bamako facilitated this workshop and supported CEBEVIRHA experts in the preparation of a related project concept note. The ECTAD Unit has supported the worldwide campaign to control rabies through developing a website for the 'Rabies Blueprint' and has facilitated its translation into French.

ECTAD Bangkok

In 2010, the ECTAD Regional Office for Asia and the Pacific (RAP) initiated regional surveillance for H5N1 and the Pandemic (H1N1) 2009 virus in poultry in southeast and south Asia, and in pigs in ASEAN countries, respectively. Following two regional workshops held in Bangkok and at the Australian Animal Health Laboratory (AAHL) to harmonize surveillance and diagnosis approaches, a number of training courses at sub-regional and national levels were conducted during 2010 to provide practical guidance to diagnostic and surveillance design teams for implementation of specific activities for each participating ASEAN member country. National level longitudinal surveillance activities have resulted in a large number of both sera and swabs being collected specifically for H1N1 in pigs. The analysis

of these samples is expected to be completed in early-2011. This is the first time a coordinated regional approach to virus surveillance, isolation and characterization has been initiated, strengthening regional cooperation and the sharing of virus information. These regional activities are supported by the United States Agency for International Development (USAID), the United States Department of Agriculture (USDA), the Governments of Japan and Sweden, the Asian Development Bank, and FAO, and at the country level in Myanmar by the Avian and Human Influenza Facility administered by the World Bank.

ECTAD RAP takes a holistic approach to epidemiology capacity building by focusing on building networks and individual capacity (e.g. Field Epidemiology Training Programme for Veterinarians or FETPV) as well as assisting governments to strengthen institutional support for trainees, to enable the desired level of impact resulting from this capacity building. In March 2010, ECTAD RAP sponsored a meeting of veterinary epidemiologists from interested national veterinary services, academic institutions, advanced research institutions and international organizations to establish a coordination and collaboration mechanism for capacity building, information sharing and research. The outcome of this meeting was the establishment of the Regional Epidemiology Consortium to be led by FAO. In August 2010, ECTAD RAP and Thailand's Department of Livestock Development (DLD) co-sponsored an advocacy meeting of chief veterinary officers (CVOs) from the region to conduct a self-assessment for epidemiology capacity at the national level, in order to initiate longer-term efforts for more targeted advocacy at the national policy level concerning epidemiology needs in the future. In addition, recommendations from the meeting of CVOs highlighted the need to initiate a strategic planning process at national and regional levels. A meeting to develop a regional strategic plan for epidemiology will be held in early-2011 to implement this recommendation.

The regional FETPV was formally initiated in September 2008 in order to provide governments with field epidemiologists who have competencies in applied epidemiology, including outbreak investigation and disease surveillance. Regional FETPV is an in-service training programme based on 'training through service' and is supported by national and international partnerships which include animal health and human health sectors, with support from academia and international donors, and implemented through a formal partnership between USAID, ECTAD RAP and Thailand's DLD. The FETPV Programme Office was established at DLD in Bangkok, and the FETPV management structure and curriculum development were introduced during the reporting period. The prerequisite short course entitled 'Veterinary Field Epidemiology in Action' had already been held in February 2009 and was attended by participants from eleven countries and the first regional FETPV began in June 2009, involving joint training with the regional human health FETP supported by the CDC and Thai Ministry of Public Health, and specific veterinary training following a newly developed curriculum. The combined programme thus supported the One Health (OH) approach. The training continued in 2010 with five trainees from the People's Republic of China, Indonesia, Myanmar and Thailand. Training modules were developed, including laboratory surveillance, application of software for animal disease surveillance and field investigation training exercises. Additionally, mentors were identified for trainees with support being provided from ECTAD country programmes in collaboration with government implementing partners at national and international levels. Field-based activities were initiated by train-

ees with support from the country programmes, to conduct secondary data analysis and outbreak investigations on issues of importance to the national government. The FETPV in Asia is expected to make a significant contribution to improved epidemiological capacity in the region and serve as a testing ground for expansion into south Asia and the People's Republic of China. In 2010, an animal-human-wildlife interface module was introduced into the curriculum as well as a combined socio-economic and communication teaching module. Successful implementation of the FETPV relies on robust in-country ECTAD programmes.

ECTAD RAP also worked with FAO HQ and ECTAD China to establish and administer an information platform EMPRESi-Asia which provides disease event information, a document management system, a forum for discussion and spatial analysis tools. The general public can access disease event information, disease mapping tools, the document library and a directory of animal health personnel. In addition, 'Authorized Users' are able to insert disease events, utilize spatial analysis tools, participate in discussion fora and have access to the larger database of information in the repository. Currently there are more than 70 authorized users, including national veterinary services, FAO field officers and reference laboratories, providing inputs to the system. Since the system went online in April 2010, there have been more than 1,500 disease outbreak events reported through the system: of these, 300 events were informal disease outbreak events in Asia which were not reported through the OIE World Animal Health Information Database (WAHIS).

ECTAD Beirut

ECTAD Beirut was operational until the end of June 2010. Until this time it contributed to the prevention and control of HPAI in the Middle East region by promoting coordinated strategies for the control of HPAI which employed the integrated and harmonized regional approaches developed during the previous years. Continuing emphasis was placed on strengthened emergency preparedness and planning, and enhanced capacity for HPAI surveillance and control. During the reporting period technical assistance was provided to national authorities by supporting and reinforcing national databases of Ministries of Agriculture.

ECTAD Gaborone

Surveillance guidelines were developed with the assistance of the Southern African Development Community (SADC) Avian Influenza Working Group (an ad-hoc working group of the Laboratory and the Epidemiology Sub-committees of the SADC Livestock Technical Committee). These guidelines were also endorsed by the Support Programme to Integrated National Action Plans (SPINAP) of AU-IBAR for use in the countries not covered by FAO activities. The sampling frameworks outlined in the guidelines were used in Malawi, Mozambique, Zambia and Zimbabwe, and during 2008-2010, a total of 23,945 serum and 6,330 swab samples were taken and examined, in part at national Veterinary Laboratories and in part at the Botswana National Veterinary Laboratory (BNVL). Only serological tests were applied (hemagglutination/hemagglutination inhibition [HA/HI] and enzyme-linked immunosorbent assay [ELISA]) and all samples were found to be negative. The BNVL will retest a representative sample of swabs using polymerase chain reaction (PCR) in order to exclude the circulation of low pathogenic AI virus.

During the same time period, a total of 640 veterinary field personnel and 377 master farmers were trained in recognition of poultry diseases and the importance of surveillance of these diseases. Training and illustrated field materials (e.g. a poultry picture book) were produced and widely distributed. These materials can be found at www.fao-ectad-gaborone.org.

In 2009-2010, Digital Pen technology was introduced in Malawi, Mozambique and Zambia as a means of facilitating data collection in the field, and transferring the data in real time to a central database. The system is working well and is currently being used by field personnel engaged in poultry surveillance.

ECTAD Nairobi

The annual coordination meeting of the Eastern Africa Epidemiology Network (EAREN) was held in June 2010 in Kigali, Rwanda. The meeting reviewed the status of HPAI and other TADs in the region, discussed priority gaps in capacity building, held discussions on issues regarding sustainability of the network and drew up a one year workplan for the region. With a view to generating a regional database of epidemiology expertise in eastern Africa, human resource assessments in this field were carried out in Burundi, Ethiopia, Kenya, Rwanda, Tanzania and Uganda. The existing animal disease information systems in eastern Africa were reviewed and assessed during a workshop held in Entebbe, Uganda in May 2010. A regional meeting of CVOs in eastern Africa organized by ECTAD, was held in August 2010 in Zanzibar. This meeting considered and adopted key recommendations of previous ECTAD meetings on a wide range of issues and also discussed and agreed on a regional list of priority TADs and zoonoses for regionally coordinated surveillance, and prevention and control actions. Based on economic impact, disease prevalence, public health significance, species importance (i.e. number and distribution) and the possible surveillance strategy, the following TADs were ranked as priorities for the region: 1. PPR; 2. RVF; 3. FMD; 4. Contagious bovine pleuropneumonia (CBPP); 5. Newcastle disease (ND); 6. HPAI; 7. Contagious caprine pleuropneumonia (CCPP); and 8. Rabies. Recognizing that priorities could vary among and within countries, the CVOs meeting recommended that the design of animal health policy and implementation of control programmes for these regional priority diseases should be based on integrated and participatory approaches taking into consideration the various stakeholders involved and their priorities.

More specifically related to HPAI, analysis of poultry value chains and biosecurity reviews were carried out in Burundi, Kenya, Rwanda, Tanzania and Uganda as an aid to identifying areas most at risk for disease introduction or spread, and which could be targeted for surveillance activities. A regional training workshop on risk analysis was conducted in Namanga, Kenya with participants from all the 11 countries of the greater eastern Africa region. Similarly, participatory avian influenza surveillance training or refresher courses were conducted for over 70 field veterinarians in Kenya, Sudan and Tanzania in collaboration with the International Livestock Research Institute (ILRI).

ECTAD Tunis

The regional activities of ECTAD Tunis (for north Africa) are supported by two projects: GCP/RAB/001/SPA, 'Strengthening surveillance and control of HPAI in the Maghreb and Egypt (15 March 2007 - 14 June 2010); and GCP/RAB/010/SPA, 'Strengthening systems of pre-

vention and control of TADs in the Maghreb and Egypt: towards a Mediterranean animal health network (REMESA)' (1 July 2010 - 30 June 2012). While the second project does not have a specific HPAI focus, HPAI is still a priority disease for the REMESA countries (Algeria, Egypt, France, Italy, Libya, Mauritania, Morocco, Portugal, Spain and Tunisia). The Regional Epidemio-surveillance Network (REPIVET) is one of the four REMESA sub-networks (which also include communication, laboratories [RELABSA] and socio-economics).

During the Animal Health Regional Coordination Meetings in Zaragoza (April 2010) and Paris (May 2010), and within the framework of REMESA and with the participation of the ten countries of the REMESA network, short technical sessions were dedicated to discussing the situation and disease surveillance capacity for priority TADs (HPAI, together with brucellosis, RVF, PPR and FMD) with CVOs, and with the support of FAO headquarters staff.

An advanced regional training workshop on using geographic information systems (GIS) for epidemio-surveillance in animal health, was held in Porto, Portugal in July 2010, for eight officials from four North African countries (Algeria, Egypt, Mauritania and Morocco), and with the participation of four officials from three southern European countries (Italy, Portugal and Spain). The second meeting of the REMESA REPIVET was also held in Porto, Portugal in July 2010.

Central Asia

The Central Asia Regional Programme was supported by global funds made available through the projects OSRO/GLO/702/CAN and OSRO/GLO/604/UK, and by regional projects OSRO/RAS/601/ASB and OSRO/RAS/704/SWE, but was not managed through an established ECTAD. The recipient countries involved in these projects were Afghanistan, Azerbaijan, Iran, Kazakhstan, Kyrgyzstan, Pakistan, Tajikistan, Turkmenistan, and Uzbekistan. During the reporting period, the activities implemented ensured continuation of animal health activities already in progress under the Central Asia Regional Network (CARN) set up by FAO in 2006. A new workplan was elaborated at a regional meeting held in Istanbul, Turkey during 10-12 February 2010. Due to a lack of funding most of the regional activities had to be curtailed by the end of August 2010 and a final workshop was held for all the central Asian countries in Baku, Azerbaijan during 23-24 August 2010.

The Central Epidemiology Unit of the various national veterinary services was strengthened in order to achieve early detection of infectious diseases and TADs. National and regional training in epidemiology contributed significantly to the achievement of this objective. Some countries, such as Kyrgyzstan and Tajikistan, were assisted by FAO HQ through national and regional training/workshops on TADinfo software, to deploy and use the national TADinfo system and to develop a programme for assistance in troubleshooting and analysis of data. A regional epidemiology workshop was held in Istanbul, Turkey during 5-9 July 2010, in relation to applications of epidemiological concepts in animal disease control in the central Asian countries. To further strengthen surveillance, joint national trainings on wildlife surveillance were conducted in each country for ornithologists and veterinarians, and a final regional training was held in Almaty, Kazakhstan at the end of August 2010. In addition, in Turkmenistan 1,000 copies of the HPAI field manual were prepared, translated, printed and distributed to all field veterinary staff and wildlife experts from the National Ornithology Department.

In association with the main Central Asia programme, training activity was conducted in Turkmenistan to support the larger World Bank project being delivered through the national government. The project commenced in 2009 and the early activities were to develop a surveillance plan for government implementation and to prepare the emergency response procedures to deal with any outbreak of HPAI. The final part of the activities undertaken in 2010 was to train a number of master trainers who would then be able to provide cascade training in surveillance and disease recognition, sample collection and sample transportation for veterinarians, farmers and other poultry sector stakeholders.

Eastern Europe

Activities in 2010 focused mainly on Belarus, Moldova and Ukraine. The scope of activities implemented allowed for the continuation of FAO technical assistance provided through the services of national consultants who worked with the veterinary services of partner countries. In relation to surveillance, a workshop entitled 'Avian influenza virus HPAI and LPAI surveillance strategies and sampling intensities' was held in Kiev, Ukraine, from 26-28 October 2010, with 10 participants (two from Belarus, two from Moldova and six from Ukraine).

FAO'S NATIONAL SUPPORT TO SURVEILLANCE

Disease surveillance plays a central role in any disease control programme, thus it is a component of nearly all FAO country projects. The level of investment varies but in a number of key countries there are intensive active surveillance programmes which involve surveillance teams making regular visits to premises to check for the presence of disease (Bangladesh, Egypt and Indonesia). The surveillance teams also respond to requests from poultry producers to investigate a disease incident and this activity can be more effective in finding disease outbreaks than systematic searching. With PDSR in Indonesia most cases are found as a result of notification of a suspicion of disease. An earlier risk-based approach to surveillance had been instituted in Viet Nam but in general this was no more effective at locating disease than the passive reporting system. An active surveillance programme has commenced in Myanmar with Community Animal Health Workers (CAHWs) conducting front-line surveillance on backyard, and small commercial farms in high-risk areas in 78 of the 344 townships. This approach requires further evaluation. An intensive passive surveillance programme has been put in place in high-risk districts in Nepal through the establishment of a network of key contacts from whom information is collected on a weekly basis. More recently a new risk-based surveillance programme has been designed and implemented in five project provinces in Viet Nam with both active and passive elements. It remains to be seen how efficient and effective this programme is for early detection of disease. The lesson learned from projects in various countries is that the most cost-effective surveillance systems appear to be those based on informed stakeholder engagement in the control effort. Socio-economic and other observations to date indicate that where there appear to be punitive outcomes from reporting diseases, the efficacy of passive surveillance is seriously reduced. Compensation mechanisms are usually invoked to facilitate passive surveillance of notifiable diseases, and so where these are lacking or their administration lacks effective governance, there is limited incentive for participants in the market chain to contact disease control authorities.

In some countries (e.g. Bangladesh, the People's Republic of China, Indonesia, Lao PDR and Togo) specific surveillance activities involving sample collection are carried out in specific places (e.g. near migratory water bird sites), among particular species (e.g. free range ducks) or important assembly points (key markets) to identify epidemiological roles these variables might be playing in the maintenance of the disease. Cambodia, Myanmar and Nepal have significant ongoing efforts surveying ducks in high-risk areas, using both cross-sectional and longitudinal survey techniques and serum and/or swab collection. Detection of active infection in ducks is a rare event but where vaccination is not practiced, serology indicated significant exposure of ducks to Influenza A viruses.

In connection with surveillance is the important matter of the epidemiological value of the data collected, for example, to what extent the incidence rates are a true representation of the disease situation. Surveillance is then linked to and supported by outbreak investigations to obtain specific information about outbreaks that will lead to identification of risk factors associated with outbreaks. One of the constraints on surveillance and outbreak investigation is that it is expensive to send teams into the field. However, in all countries a concerted effort has been made to strengthen disease outbreak investigation, but the results are constrained by jurisdiction issues and lack of expertise at the field level. It is envisaged that national and regional applied epidemiology training will go some way to addressing this constraint. In some places there is reluctance among owners to hand over cadavers to veterinary staff for laboratory investigation, or there may be reluctance on the part of local authorities to have detailed investigations take place if there is concern about the impact of the outcome on business or trading practices.

In Viet Nam there is an ongoing intensive twice-yearly programme of post vaccination monitoring and virus circulation surveillance. The objectives are to determine the response of the vaccinated population and to determine if there is circulation of virus in areas where vaccination is carried out. As part of this activity and in other countries, FAO has also invested resources into data management, mainly but not exclusively through the implementation of the FAO disease information management system TADinfo. An additional aspect of data management is to shift the information storage from paper to computer and this for example has been an important aspect of activity in Myanmar. In recent years there have been a number of cross-border projects which have had a surveillance component built in. The current national cross-border project between Afghanistan and Pakistan is one example; a focal activity has been developed for one crossing point between Cambodia and Viet Nam; and the sub-regional project in south Asia supported by components of national projects in Bangladesh and Nepal is a further effort focusing on cross-border trade involving India as a bridge country.

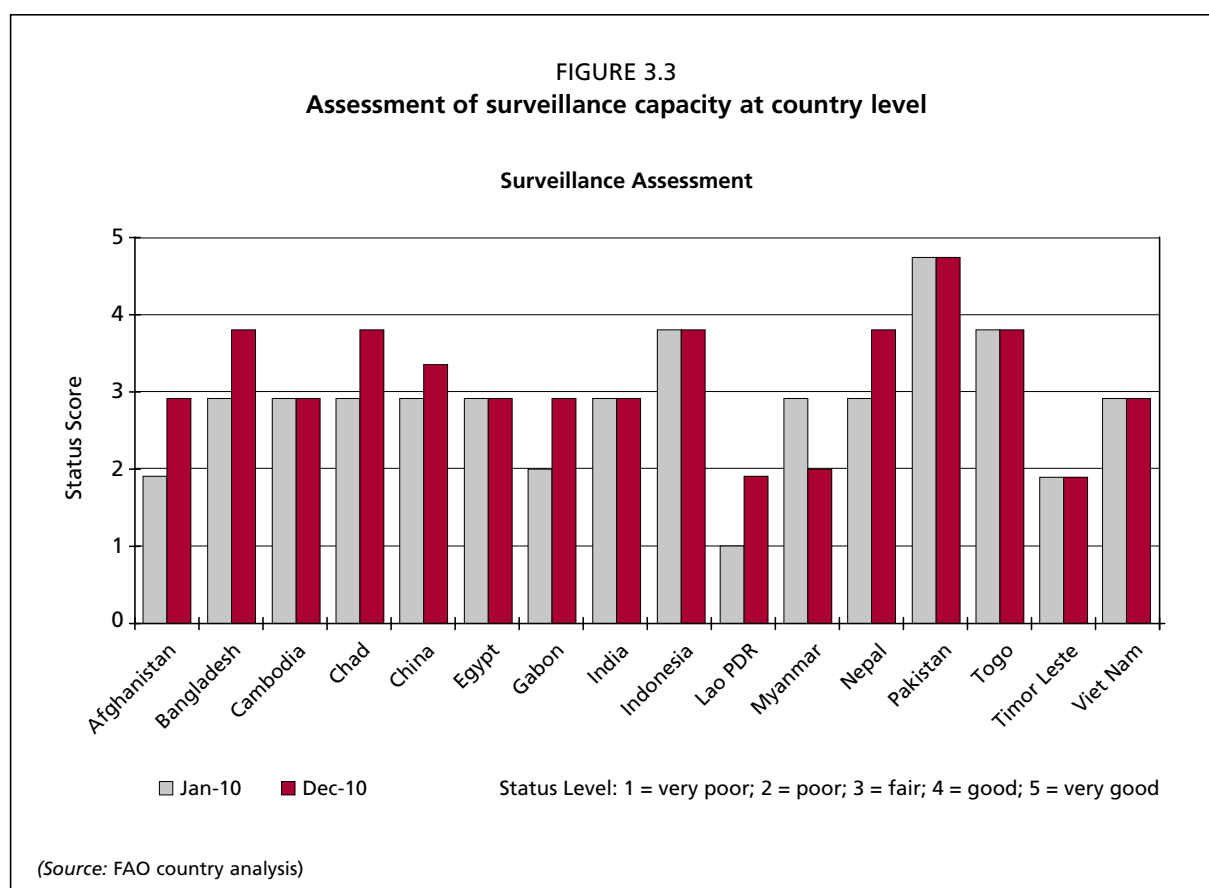
In conclusion, FAO projects have made significant gains in surveillance capacity in partner countries, but the challenge is to now have cost-effective systems in place to detect any upsurges in virus activity as soon as they emerge, so that there is no opportunity for an expanding epizootic to occur again.

Country Assessment on Surveillance

The self-assessment survey is the outcome of subjective interpretation of questions related to the status of surveillance capacity (see legend in [FIGURE 3.3](#)), how well the current lev-

els of investment from both national and international sources met the requirements for adequate disease surveillance, and if the activity could be sustained at an appropriate level without international inputs. The survey reflects generally the view of the country ECTAD team, including both international and national staff members. The capacity levels during 2010 are also shown in [FIGURE 3.3](#). FAO investment in surveillance was maintained in 10 countries and significantly increased in six, was sufficient for its purpose in nine countries, but insufficient in seven (i.e. these countries regarded an increase in funding for surveillance as necessary). All but three (China, India and Togo) considered that national resources were not sufficient to maintain a suitable level of surveillance for HPAI in the absence of international support.

Issues raised through additional comments provided in the survey included that inadequate human resources (qualifications and experience, or numbers) was a constraint on the surveillance capacity and needed to be addressed in some countries. There is still limited capacity in some countries to manage and analyse epidemiological data. In cases where support was geographically targeted then the surveillance was satisfactory, but there was an uneven spread across some countries and still a lack of commitment from national resources to support surveillance programmes. The issue of the inadequacy of disease outbreak investigation capacity and resources was also raised as a concern. These comments and findings reflect the conclusions related to the overall performance of surveillance at the project level.



LABORATORY CAPACITY

Strengthening of laboratory capacity has been one of the outstanding successes of the global inputs to HPAI control. Investments have been made in relation to training, equipment, and in modifying some aspects of existing structures to make them safer work places. Training has not only covered technical aspects of diagnostic testing, but also laboratory biosafety and biosecurity, as well as management and proficiency testing.

GLOBAL SUPPORT TO LABORATORY CAPACITY

This support is encapsulated in the progress report of the OIE/FAO joint network of expertise on animal influenza (OFFLU). The OFFLU network has recently received high visibility and acclaim through the GF-TADs evaluation, the FAO real-time evaluation, outcomes of the FAO/OIE/WHO tripartite meetings, scientific publications, and even the mass media. During this reporting period, OFFLU has exercised its expanded mandate with the Consultation on Influenza and Other Emerging Zoonotic Diseases at the Human-Animal Interface in April 2010. It has focused efforts on providing technical advice, training and veterinary expertise to Member Countries to assist in the prevention, diagnosis, surveillance and control of animal influenza. Exchange of scientific data and biological materials (including virus strains) within the network has been improved, and capacity to both analyze such data and to share this information with the wider scientific community has been strengthened. OFFLU continues to strongly advocate for purposeful, strategic and effective global surveillance of animal influenza in line with FAO, OIE and WHO mandates. Additionally, experts from both animal and public health agreed to collaborate on a landmark initiative to look at ways of predicting emerging threats by examining genetic sequences of viruses collected through global animal influenza surveillance.

Additional outputs during 2010 include formalization of the OFFLU partnership in the WHO process of human seasonal influenza vaccine strain selection to include animal influenza viruses of public health concern; an OFFLU influenza research agenda for equine, swine, poultry and wild birds; a mechanism for global coordination of swine influenza surveillance; a worldwide proficiency testing network; an expert group to monitor virus mutations; a road map for improved capacity building; and efforts to improve effective use of vaccines for poultry.

Updates to the OFFLU technical activity (TA) portfolio led by scientists from OIE/FAO reference institutions and coordinated by OIE and FAO focal points, which currently cover seven ongoing topics and three new activities, are as follows:

- The applied epidemiology TA reviewed influenza surveillance data requirements for existing infection and/or disease reporting mechanisms and published the *OFFLU Strategy document for surveillance and monitoring of influenzas in animals*¹ on the OFFLU website to provide global guidance on surveillance and aid in addressing gaps in animal influenza surveillance worldwide. A structured approach by country, across industry sectors, place and time, to detect in a timely manner any emergence of new genotypes and phenotypes, and conduct investigation as to potential transmission

¹ (http://www.offlu.net/OFFLU%20Site/OFFLUsurveillancepH1N1_180110.pdf)

routes, is recommended in the surveillance of influenza virus infections in animal populations.

- An international proficiency test for real-time PCR detection of influenza A viruses and selected HA subtypes is being coordinated under the TA for Proficiency Testing for OIE/FAO Reference Laboratories and Centres.
- The TA for generation of Standard H5 Antisera have identified and tested HI reference sera for standardization, and will submit the dossier for two reference sera and two additional reference antigens for consideration under the OIE Biological Standards Commission as an OIE standard.
- In line with the recommendation for standardization and harmonization of testing protocols, the TA addressing ribonucleic acid (RNA) standards has developed H5 and H7 RNA copy based controls which are available upon request. Additionally, monitoring of antigenic and genetic variation is recommended to ensure the use of sensitive and specific assays.
- A strategy to address biorisk management has been proposed by the biosecurity TA using the European Committee for Standardization (CEN) Workshop on Laboratory Biosafety and Biosecurity 2009 as a template.
- A comprehensive approach to sustainable capacity building is being addressed by the capacity building TA to include benchside diagnostic techniques and result interpretation, development of troubleshooting skills, and equipment maintenance.
- The TA on vaccination continued to evaluate fitness for purpose of vaccines for avian, swine, and other animals and recommends that improved vaccine control measures, including government registration and licensing, be based upon scientific data. Visualization of virus-typing data and post-vaccination serology generated by HI assay using antigenic cartography has shown promise in interpreting the antigenic relatedness and evolution among swine, equine, and avian influenza viruses, and the analysis can support selection of viruses for use in subsequent *in vivo* testing using standardized challenge test models. Additionally, H5 avian influenza seed strains should be selected based on genetic, antigenic and *in vivo* challenge data from relevant field viruses within the country of potential registration or use.
- A new TA for molecular markers was established to extract information on recognized and putative molecular markers demonstrating phenotypic characteristics of animal and public health concern, and distribute a practical, annotated and prioritized list to OFFLU laboratories.
- To address the emergence and spread of influenza, such as the Pandemic (H1N1) 2009 virus, from the animal reservoir to humans, a new TA for a global gene observatory has been proposed to invest in a novel approach to influenza virus infections, abandoning prefixed compartments linked to geographical origin or species of isolation, and analyze the influenza gene pool as one entity. This effort will improve understanding of the evolution dynamics of the influenza virus gene pool in animals and humans. The global gene observatory concept will be carried forward under the umbrella of OFFLU and in close partnership with public health counterparts.
- To address gaps in baseline knowledge on influenza viruses circulating in swine, a new TA for coordination of swine influenza virus surveillance and research has been

established. This will investigate geographic regions where very little is known regarding subtypes and genotypes of influenza viruses in swine and will try to improve accurate interpretation of field HI data from swine. The TA also aims to support the global network of laboratories conducting surveillance and research in swine influenza viruses.

FAO'S REGIONAL SUPPORT TO LABORATORY CAPACITY

ECTAD Bamako

ECTAD Bamako organized two workshops on laboratory quality assurance systems for central and western Africa laboratory quality managers (including laboratory directors for English-speaking countries): in Banjul, The Gambia in September, for five countries; and in Douala, Cameroon in October 2010 for 18 countries. The workshops were organized through the Western and Central Africa Veterinary Laboratory Network for Avian Influenza and other Transboundary Disease (RESOLAB), a network of 23 national laboratories. RESOLAB has been coordinated by the regional office of ECTAD-FAO at the Regional Animal Health Centre (RAHC) in Bamako, Mali. Its objectives are to enhance the effectiveness and efficiency of its 23 national veterinary diagnostic laboratories, improve communication between laboratories and with national epidemiological networks, and to stimulate improvement of AI and other transboundary animal and zoonotic diseases laboratory expertise within the region, and thereby the quality of disease diagnosis.

The most advanced laboratories (those with better equipment and experienced staff) were called upon to act as leaders for the others and to technically assist them. The RESOLAB itself is technically assisted by IZSVe of Padova, Italy and agencies/organizations such as USDA/Animal and Plant Health Inspection Service (APHIS), CIRAD, France Vétérinaire International and USAID. It has been funded by donors including Canada, France, Sweden, the United Kingdom and USA.

RESOLAB now has a portal on the FAO-ECTAD Bamako website (www.fao-ectad-bamako.org) which includes the main data and information on RESOLAB, in addition to the collection and dissemination of technical information through an e-mailing list.

The second inter-laboratory proficiency tests on AI and ND laboratory diagnosis were conducted in 20 laboratories in the region by RESOLAB in collaboration with the IZVSe of Padova, a FAO/OIE reference laboratory for AI and ND.

The synergy between epidemio-surveillance and laboratory networks has been enhanced with the participation of field and laboratory staff of 11 countries in a workshop on 'Autopsy, sampling, biosafety and laboratory biosecurity' held in Dakar, Senegal in July 2010. Links have also been strengthened with OIE and WHO through the implementation of the Identify project which aims to strengthen laboratory capacity in the countries of the Congo Basin area. Collaboration has increased with academic institutes: Ecole Inter Etats de Sciences et Medecine Vétérinaire de Dakar (EISMV) and University of Georgia, Atlanta (UGA); and with traditional technical partners such as France Vétérinaire International (FVI), IZVSe of Padova, STOP-AI, USDA/APHIS and the World Association for Veterinary Laboratory Diagnosticians (WAVLD).

ECTAD Bangkok

ECTAD RAP has been facilitating the Regional Laboratory Network for HPAI Diagnosis in southeast Asia (SEA) since 2004. Under this network, focal points were nominated from national animal health laboratories responsible for HPAI diagnosis of each FAO member country in ASEAN (including Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Thailand and Viet Nam). Regional (Veterinary Research Institute [VRI], Ipoh, Malaysia) and international (AAHL, Geelong, Australia) reference laboratories for HPAI were agreed upon. Diagnostic protocols as well as biosafety requirements and a networking mechanism were harmonized through the development of *Regional Guiding Principles for HPAI Diagnosis and Networking*.

Following on from the Consultative Meeting of Regional Laboratory Network Partners for HPAI Diagnosis in June 2009 and the Regional Laboratory Network Meeting in September 2009, the partner agencies and national animal health laboratories have agreed to collaborate under the Strategic Framework for Capacity Building for HPAI Diagnosis and Networking. It was later agreed that the developed skills, systems and equipment be transferrable for the improved diagnosis of other diseases. Under this Strategic Framework, partner agencies and national animal health laboratories collaborate to develop capacity in six key areas: 1) Laboratory facilities; 2) Equipment; 3) Personnel; 4) Protocols under accredited quality assurance system; 5) Sharing of information and biologic materials; and 6) Management, planning and policy advocacy.

In relation to laboratory personnel capacity development, ECTAD RAP organized training workshops on animal influenza virus diagnosis and characterization at three levels: at regional level with the aim of developing harmonized protocols and regional resource people with support from international reference laboratories (AAHL); at sub-regional level with the aim of developing country level resource people with support from international (AAHL) and regional (VRI) reference laboratories; and in-country training aimed at developing local laboratory staff. Since 2009, more than 100 laboratory staff have participated in regional and sub-regional training, while more than 120 laboratory staff participated in in-country training. Apart from training on influenza viruses diagnosis and characterization, ECTAD RAP also supported training on quality assurance and biosafety with AAHL and the Asia-Pacific Biosafety Association (APBA).

The network members and partner agencies also worked together to revise the *Regional Guiding Principles for Animal Influenza Diagnosis* to be used as regional harmonized protocols for diagnosis and characterization of both avian and mammalian influenza viruses using molecular and serological assays. ECTAD RAP also provided quality control reagents and collaborated with the AAHL and OIE Sub-Regional Representation for Southeast Asia (OIE SRR SEA) to conduct regional proficiency testing as part of a quality assurance system to ensure the quality of diagnostic results.

Several joint laboratory visits by regional team of experts from AAHL and other key laboratories in the region were organized during the past year. The objectives of these visits were to provide backstopping support, follow up on proficiency testing and provide in-house training for local laboratory staff. Apart from reducing the burden on the reference laboratories, these joint visits also minimized duplication of activities and harmonized inputs to the country programmes.

ECTAD Beirut

Over the reporting period, FAO's regional support in the Near East consisted of the procurement of technical equipment and diagnostic materials for laboratories and the provision of technical advice and recommendations to the national laboratories. In addition, technical advice was provided to veterinary authorities and laboratories in the region, particularly in the submission of infected specimens.

ECTAD Gaborone

FAO-ECTAD has actively supported the Veterinary Laboratories Network established under the SADC Laboratory Diagnostics Sub-committee umbrella since 2007. A programme based on an extensive needs assessment was implemented to build the necessary H5N1 HPAI diagnostic capacity to detect the infection and this has invigorated the network. With the support of ECTAD, the network embarked on harmonizing the protocols used by the different laboratories, and 10 countries and 12 laboratories successfully participated in proficiency tests using the harmonized protocol for HA/HI. Reports of these activities are available at www.fao-ectad-gaborone.org.

ECTAD Gaborone facilitated the formation of a specialized Avian Influenza Working Group (AIWG) composed of members from the Laboratory Network of seven SADC member states, as well as members of the Epidemiology Network, an already existing sub-committee composed of heads of Epidemiology Units. The AIWG met during 2008-2010 and reported regularly to the respective sub-committees. The work of the AIWG was concluded during its last meeting in March 2010 and the results were presented to the SADC Livestock Technical Committee. The results included: production of surveillance guidelines for backyard and free-range poultry farming systems in the SADC region for HPAI; production of HPAI risk maps for four countries to facilitate surveillance; establishment of a 'demand-supply hub' for HPAI diagnosis reagents; conducting of two regional training courses and five country training courses; harmonization of SOPs for HA/HI, real-time PCR and conventional PCR; and proficiency testing with all SADC laboratories using the HA/HI and ELISA SOPs (all activities/results are published and available at www.fao-ectad-gaborone.org). This working group was a good example of successful inter-country collaboration to deal with a specific new threat arising in the region. The AIWG was both productive and effective as a result of the strong support provided by FAO ECTAD Gaborone.

The need for a second regional service laboratory to support the regional diagnostic services provided by the Onderstepoort Veterinary Institute (OVI) was identified. ECTAD engaged in a consultative and analytic process which took almost one year, before the Botswana National Vaccine Laboratory (BNVL) was identified. This decision was endorsed by the SADC Council of Ministers in August 2009. Since then, an upgrade of capacity of BNVL has been supported by ECTAD in conjunction with an OIE twinning project on avian influenza with the Veterinary Laboratory Agency (VLA), Weybridge, UK. BNVL is currently supervising the second round of proficiency testing with all SADC laboratories, using HA/HI and ELISA as the tests. In addition, in 2010 a group of laboratory experts reviewed the PCR protocol used by the six laboratories in SADC that are capable of running this test, harmonized them and created the 'SADC PCR and real-time PCR harmonized protocol'. A proficiency test using this protocol is planned for 2011.

ECTAD Nairobi

The Eastern Africa Regional Laboratory Network (EARLN) was established in 2008 with the support of FAO-ECTAD. During the reporting period a range of activities including proficiency testing, training and capacity assessments were carried out.

Inter-laboratory proficiency tests on PCR and serological diagnostic techniques for AI and ND were completed, involving five central laboratories in the Democratic Republic of Congo, Ethiopia, Kenya, Sudan and Tanzania. The results of this exercise carried out by the OIE/FAO Reference Laboratory IZSVe were presented and discussed during the 2nd Annual regional workshop for the EARLN held in Dar es Salaam, Tanzania in July 2010.

Advanced training for laboratory personnel from Ethiopia, Kenya, Sudan and Tanzania was conducted at IZSVe on diagnostic techniques for AI and ND. An *in situ* training of PCR techniques for the diagnosis of AI and pathogen characterization was carried in the central veterinary laboratory of Sudan. A similar training for laboratory personnel from Burundi and South Sudan was conducted at the Central Veterinary Laboratory, Dar es Salaam.

Laboratory capacity assessments were carried out in Eritrea, Rwanda, Sudan, and Uganda between April and May 2010 with the assistance of IZSVe (and the same exercise was conducted in Ethiopia, Kenya and Tanzania between April and June 2009). This exercise is one of the prerequisites for selecting regional reference laboratories for AI. The regional CVOs meeting that was held in August 2010 discussed the findings of these assessments and agreed on the criteria, terms of reference and selection procedures for choosing regional service laboratories for HPAI and other TADs in eastern Africa. In pursuit of other recommendations of the CVOs meeting, ECTAD Eastern Africa convened a meeting to deliberate on an interim networks secretariat. The meeting which was held at Nairobi with the participation of OIE and AU-IBAR deliberated on and made proposals on the composition, terms of reference, governance as well as indicators for monitoring and evaluation of the interim secretariat. The proposals for the interim networks secretariat were presented during a joint regional epidemiology and laboratory networks meeting in Djibouti in October 2010.

ECTAD Tunis

The FAO-ECTAD office for North Africa, in collaboration with the FAO/OIE Reference Laboratory for ND and AI (IZSVe), Padova, Italy, organized the national laboratory proficiency test 2009-2010 for AI and ND diagnosis in Algeria, Morocco and Tunisia. Samples were dispatched within the countries' national veterinary laboratories and all participating laboratories conducted tests according to standard procedures. The proficiency test results were finalized in February 2010 and were used to plan and prioritize activities for further strengthening the capacity of laboratories in the region

Eastern Europe

The laboratories of Belarus, Moldova and Ukraine were provided with reagents for the diagnosis of AI virus (AIV) (both high and low pathogenic strains) and for the differential diagnosis between AIV and ND. This procurement was a follow-up to training that laboratory experts of the three countries underwent at the FAO/OIE International Reference Laboratory for AIV in Padova Italy. In 2010, a LOA with the IZSVe was prepared and signed,

allowing further laboratory activities in support of the beneficiary countries in responding to incursions of HPAI viruses. The three countries participated in the international laboratories ring and proficiency tests.

FAO'S NATIONAL SUPPORT TO LABORATORY CAPACITY

The FAO Global Programme continues to make significant inputs to the laboratory capacity in most member countries with active projects. For the five focus countries, the inputs to laboratory services are detailed in Chapter 4. In the case of the People's Republic of China, inputs are limited to the three provinces where the project is being implemented, but in the other countries it is more nationally spread. For countries without national projects and where HPAI is not a high risk, inputs have been channelled through regional projects mentioned above. In ECTAD zones with an endemic focus, laboratory capacity building and support to laboratory services is still a priority for the FAO programme. The regional laboratory networks in Asia and Africa maintained by FAO also provide inputs and technical support to these national laboratories, i.e. support is provided from two sources. In the case of Timor Leste, the laboratory started from a rudimentary level and while training has been provided to upgrade staff skills, much more needs to be done to enable the laboratory to operate satisfactorily. In Nepal, international technical assistance was provided in order to review and standardize diagnostic procedures and to train a sufficient cadre of diagnostic staff from the national laboratory service.

Lao PDR and Nepal have biosafety level three facilities which are under development using World Bank funds. FAO has facilitated the training of key staff at international laboratories such as AAHL Geelong, FLI Riems Germany and HSADL Bhopal, India, and also provides key laboratory supplies for routine HPAI diagnostic purposes to these laboratories. This general support has also been provided also to the laboratories in Chad and Myanmar. In some cases, such as Lao PDR and Myanmar, FAO has provided guidance and assistance for the laboratories to undertake the first steps on establishing quality assurance (QA) and quality control (QC) procedures for routine diagnostic procedures and to participate in proficiency testing rounds conducted by reference laboratories.

National laboratories are now more independent of the need for confirmation support of the initial diagnosis from international reference laboratories, but most still require assistance to genotype viruses because of lack of technical capacity, even in circumstances where other international projects have provided the necessary equipment to conduct gene sequencing.

While FAO projects in more recent times have not continued to provide equipment, in some instances this is still necessary. In Cambodia, for example the government had built a new laboratory but on moving expensive laboratory equipment there, it was clear that an unstable power supply needed to be resolved and so equipment to prevent power surges has been provided by FAO.

The OFFLU report highlighted the range of technical issues that support is provided for, and in particular the efforts with QA/QC and proficiency testing that have been made to improve the reliability of diagnostic services from the national laboratories. Overall it is clear that national authorities appreciate the gains that have been made in strengthening diagnosis of H5N1 HPAI in laboratory networks.

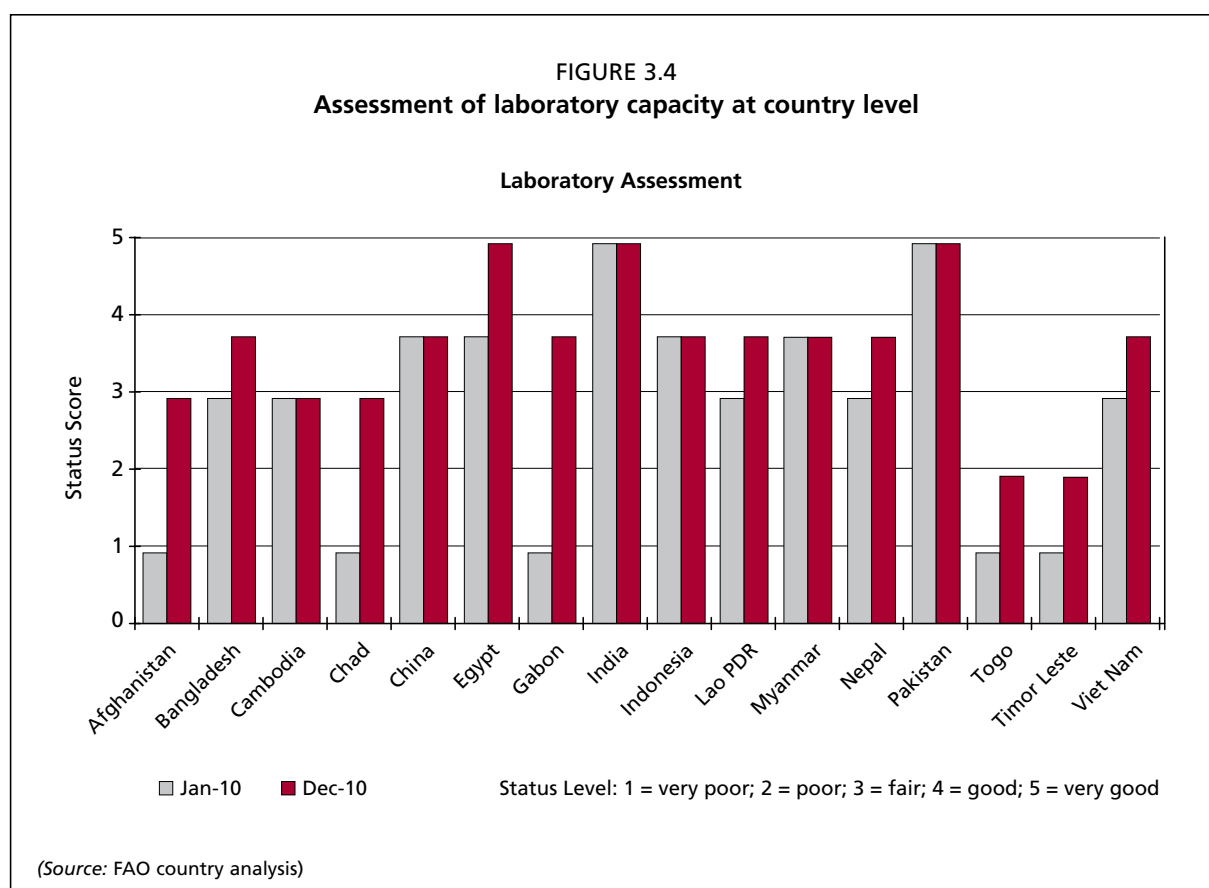
COUNTRY ASSESSMENT ON LABORATORY CAPACITY

Most country teams rated laboratory capacity as fair or good (although two countries – facing significant development issues – were rated as poor). Ten countries had seen an increase in the status of laboratory capacity in the past year and for the majority, this had occurred on the back of increased investment by FAO. All but one country regarded the current investment in the laboratory system as adequate for requirements and 13 considered that an adequate level of laboratory capacity could not be achieved without international support.

Additional issues commented upon were that problems existed with the distribution of laboratory capacity, with the peripheral laboratories in national networks having less capacity. The laboratories still had constraints in meeting the standards of proficiency testing in some instances and laboratory and data management were also areas where strengthening was still required. Another common thread was that government funding required to adequately support staff, provide utilities or laboratory supplies, was at times not available, thus laboratory performance was precarious going forward, even though equipment was adequate. The issue of conforming to biosafety standards was also raised by respondents.

BIOSECURITY

Biosecurity is a cornerstone of good animal production practice and the principle can be applied to most production enterprises, provided there are the means to demarcate the periphery of the production unit and to control entry to it. The efficacy of the systems



applied is then dependent on the physical security of the boundary, and the key to biosecurity is compliance with the standards, regardless of the type of enterprise. For village scavenging chickens the boundary can be set at the edge of the village, and the controls applied must be simple and readily understood, and agreed by all who are involved with poultry-related activities. Along market chains it is possible to separate different species of birds, to prevent contact with birds of unknown health status, and also prevent the build up of pathogens by applying appropriate hygiene measures. However, the numerous stakeholders make compliance difficult. Open systems are the most significant challenge, for example, free-range duck systems, for which it is almost impossible to apply biosecurity measures. As the HPAI programme has evolved, FAO and national partners have refined approaches to biosecurity in different environments, and with the participation of an increasingly engaged private sector have developed programmes that are fit-for-purpose and effective.

FAO'S GLOBAL SUPPORT TO BIOSECURITY

In 2010, FAO continued to promote biosecurity as the main line of defence for the prevention and control of HPAI and other emerging Infectious diseases (EIDs) in poultry production and along the marketing chain, through the activities of the OSRO/GLO/802/USA project. Much attention was given for the biosecurity and hygiene improvement in areas which had been previously neglected, such as live bird markets, collection yards, poultry transportation facilities and small-scale poultry production farms in Bangladesh, Egypt, and Indonesia. Many of the biosecurity-related activities involved collaborations between stakeholders from the public and private sectors, thereby ensuring broader acceptance and a stronger sense of ownership among those participating. This was particularly important for the introduction of the relatively novel concepts of biosecurity, cleaning and disinfection into live bird markets.

In Bangladesh, nineteen live bird markets across the country had previously been identified as potentially at risk of spreading HPAI to poultry farms and customers. This was due to risky practices and low levels of hygiene: consequently they were upgraded. New water lines and pumps were installed to ensure access to fresh water by all market stalls; and new drainage systems and the tiling of floors and walls facilitated effective daily cleaning and disinfection of stalls by trained owners. Additionally, the power supply to these markets was upgraded to ensure regular cleaning of the markets' public areas, crates and vehicles. They were washed with the high-pressure washers, detergent and disinfectant provided by USAID. The equipment was operated by trained cleaners who were initially supervised and paid by the FAO project team, but eventually operated under the responsibility of market committees. Furthermore, Department of Livestock (DLS) veterinarians were trained to monitor and audit market cleaning activities.

In Egypt, numerous training sessions were conducted during the year in HPAI-affected governorates across the country. Approximately, 3,000 farm workers received training in how to clean and disinfect their farms in the correct and most effective manner. Additionally, 200 farm managers and owners from the egg and meat industries received training in relation to farm biosecurity, and the correct handling and application of cleaning and disinfection chemicals.

In Indonesia, activities also focused on biosecurity improvements in live bird markets, collection yards and small-scale sector 3 poultry farms. Vehicle and crate washing facilities were constructed at strategic entry points to the greater Jakarta area, including at Palu Gadung in East Jakarta, at Rawa Kepiting and at Cakung slaughterhouses. These had washing and disinfection capacities of 30 vehicles per day for each washing station. Standard operating procedures (SOPs) were developed for operational and training purposes of these facilities, and over a hundred cleaners were trained.

During 2010, FAO has continued to promote the composting of manure and dead poultry as a safe, environmentally-friendly and economically viable method of disposal, particularly in countries where burial of dead birds represents a risk of water contamination, due to the high level of ground water.

To ensure the successful implementation of biosecurity concepts in central Asia, FAO conducted a three-day training session in Baku, Azerbaijan for government and private veterinarians from the region. Aspects of biosecurity, cleaning and disinfection, and composting were extensively discussed, and the workshop emphasized the importance and means of convincing producers about the cost-benefits of biosecurity implementation.

FAO'S REGIONAL SUPPORT FOR BIOSECURITY

ECTAD Bamako

The ECTAD unit in Bamako played an important role in improving the overall biosecurity along the poultry chain, through many biosecurity interventions on poultry farms and in live bird markets in the 23 countries² of western and central Africa (WACA). Following the regional training workshops (some organized in collaboration with STOP-AI³), multi-media modular training tools on biosecurity at farm level and at live bird markets were developed and disseminated. These tools were composed of training modules, pamphlets and technical brochures/sheets captured on CDs. The toolkit was tested by targeted users prior to its finalization. All poultry chain actors with the necessary computer skills, such as leaders of professional organizations, municipal authorities in charge of markets, veterinary and livestock agents, and extension workers are users of the toolkit.

A manual featuring guidelines to improve biosecurity at live bird markets has also been produced (after being validated by 50 participants during a stakeholder workshop in November 2009, in Abidjan, Côte d'Ivoire). The manual aims to build capacity among live bird market stakeholders (including veterinary agents, market traders and administrators, trainers, educationists and leaders of consumer groups) in Côte d'Ivoire and the sub-region on adequate measures and practices for improving biosecurity, through appropriate, cost-effective and efficient actions. The document, *Guides for good practices in live bird markets in Côte d'Ivoire* [French language], has been printed and can also be downloaded from ECTAD Bamako website: www.fao-ectad-bamako.org/fr/Guide-des-bonnes-pratiques.

² Benin, Burkina Faso, Cameroon, Cape Verde, Central African Republic, Chad, Congo, Côte d'Ivoire, Democratic Republic of Congo, Equatorial Guinea, Gabon, Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Niger, Nigeria, Sao Tome and Principe, Senegal, Sierra Leone and Togo.

³ USAID-funded STOP AI (Stamping Out Pandemic and Avian Influenza) Project

Public-private partnership developments have increased stakeholder awareness of the benefits of biosecurity. Biosecurity pilot operations were conducted on selected live bird markets in Benin (three markets in Cotonou), Burkina Faso (two markets in Ouagadougou and one in Bobo Dioulasso), Côte d'Ivoire (three markets in Abidjan) and Togo (two markets in Lomé). The selection of markets was made by, and the implementation of interventions to improve biosecurity conditions (including infrastructure, small equipment, and training/sensitization campaigns targeting market traders and administrators) have been designed by live bird market stakeholders and administrators, as well as the respective national veterinary services, with the guidance of the ECTAD Bamako. The work is completed, and around 60 market participants in each country are benefiting from these interventions, which have long-lasting and visible effects. It is expected that besides their immediate impact on the markets involved, these examples will foster similar operations countrywide. In addition, steps have been taken to enhance traceability and biosecurity along the poultry value chain with the introduction and testing of the regional zoo-sanitary certificates for poultry and poultry products within the Economic Community of West African States (ECOWAS) member countries area (participating members - Benin, Burkina Faso, Cote d'Ivoire, Ghana, Mali and Togo). This followed a key catalytic role played by ECTAD Bamako at the Abuja cross-border meeting in November 2008. The field test of the proposed certificate by the veterinary services of six countries commenced in July 2010. The next action is to scale-up the use of the certificates to all 15 ECOWAS countries.

Livestock handlers (producers, traders, transporters, etc.) have enhanced their knowledge and skills, to be able to effectively cope with disease-related constraints and improve the management of their flocks for safe animal production. Examples of significant impacts of the Regional Programme include: market sellers in Koumassi, Abidjan, Côte d'Ivoire, have agreed upon a charter for good biosecurity practices for live bird markets which all the approximately 40 traders must comply with; and the importance and value of diagnosis for protection of poultry chains was exemplified by the Ghana National Poultry Association's funding the activities of the Accra Veterinary Laboratory molecular diagnosis laboratory.

With the last reported outbreak in WACA in Togo in September 2008, all these interventions on biosecurity will assist to prevent any re-introduction of the disease, and spread along market chains.

ECTAD Gaborone

Prior to 2010, the regional office had commissioned an evaluation of surveillance and preparedness in the region and this included an assessment of poultry production systems and biosecurity. The four sectors identified were (i) industrial and integrated; (ii) commercial; (iii) small holder commercial; and (iv) village or backyard free-range. In SADC, the small-holder commercial, and the village or backyard free-range sectors are predominant. These sectors tend to be serviced by the responsible Ministries for Agriculture and are advised on best production practices through extension services. Live bird markets, present in most countries, are serviced by this low biosecurity sector, have generally low sanitary standards, and a rapid untrackable turnover of live birds: all of which pose threats for disease control.

The principal activity in 2010 was the engagement of a social anthropologist to visit border posts between the four countries in which ECTAD carried out the studies. The

anthropologist looked at trade related issues and at biosecurity in live bird markets near the border posts, and the capability of border personnel in checking for diseased birds. The study recommended more cross-border collaboration to manage poultry movements in the event of a disease outbreak, engagement with the private sector with vested interests in health poultry trade, improved hygiene and other risk management measures in markets, and more resourced and effective outreach from the veterinary services to educate farmers and other stakeholders in disease control matters.

ECTAD Nairobi

A series of national safe poultry production workshops were conducted in Burundi, Kenya, Rwanda and southern Sudan, utilizing training materials developed by FAO (e.g. the Training of Trainers manual *Good Practices in Small-Scale Poultry Production*). A series of workshops took place between November 2009 and March 2010, conducted by national consultants and backstopped by FAO. A regional poultry stakeholder workshop was conducted in March 2010 in Bujumbura, Burundi to discuss and make recommendations on how to improve the *Regional Poultry Biosecurity Guidelines*. The recommendations have been incorporated into the document and the final draft is expected to be completed early in 2011. A farmers' guide, *How to grow and breed healthy chickens*, was also translated into French for French-speaking countries under the ECTAD eastern Africa office (Burundi, Democratic Republic of Congo and Rwanda).

A broader study on small livestock biosecurity assessment was carried out in Rwanda. The overall objective was to provide information on current biosecurity practices in small-holder systems involving poultry, goats, sheep and pigs, in Rwanda, i.e. addressing biosecurity or more importantly good management practices at household level across species rather than focusing on one species only, which makes greater sense to most rural households as they manage more than one species. The study identified major constraints and made a list of recommendations including for poultry: the establishment of abattoirs for chicken, abolition of egg trays made of paper, and use of more hygienic chicken feeding troughs.

CASE STUDY 3.1

Development of a holistic approach to HPAI control in Chad

The FAO-implemented project OSRO/CHD/602/EC ('Intervention d'urgence pour la prévention, la détection précoce et la lutte contre l'influenza aviaire hautement pathogène au Tchad') has implemented activities to link the poultry sector more closely with the official animal health services. A more holistic approach to the issues of production improvements has been applied, similar in some ways to that undertaken in Viet Nam. A comprehensive review of the poultry sector has been completed along with census and geo-referencing of semi-industrial farms and markets within the country (the latter especially including markets located at the borders). The project has provided crucial support for the creation of the National Poultry Inter-Professional Association (IPAT) and also has provided technical and financial support to the National Organisation of Poultry Producers. FAO recognizes that in order to control outbreaks of disease in poultry it is necessary to be able to communicate with industry through a strong, technically sound and credible poultry association, thus support to strengthen such organizations is strategically sound.

To develop more direct links with poultry producers and at the same time reduce the overall risk of a disease outbreak, the programme implemented measures to raise awareness of biosecurity. Seven training and information sessions on biosecurity were held for commercial poultry producers and 200 sites (farms and markets) were identified for the implementation of biosecurity plans which were then monitored. Information packs on biosecurity and good practices were produced and distributed to both the commercial and the traditional production sectors. To reinforce the information campaign, further training was made available to commercial and traditional producers. The provision of two rounds of ND vaccination in the traditional poultry sector was another technical activity organized to further reinforce disease awareness and good production practices for family poultry raisers.

To support the increased awareness of the disease, a field investigation team has been established and equipped, and during 2010 conducted 10 field investigations of suspect outbreaks. Field surveillance has been strengthened through training of field agents and linking them to the central epidemiology unit by means of an alert system or 'Gateway'. The laboratory support to surveillance has been provided through provision of materials and equipment to the Laboratoire de Recherches Veterinaires et Zootechniques (LRVZ).

The above activities, together with strengthened capacity to monitor migratory bird populations, have led to an overall reduction in the risk of an introduction and amplification of H5N1 HPAI in the poultry sector of the Republic of Chad.

FAO'S NATIONAL SUPPORT TO BIOSECURITY

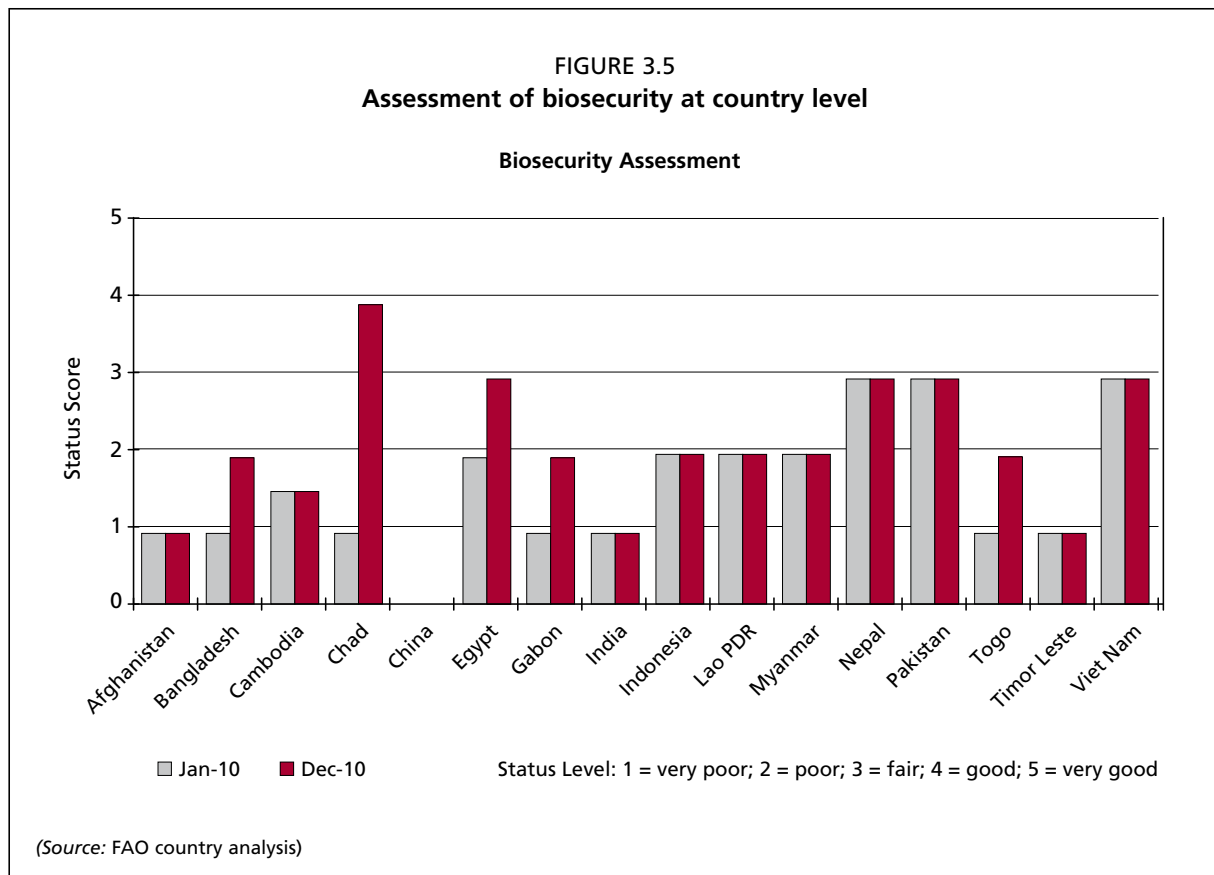
Biosecurity practices are seen as a major technical issue for the poultry sector in respect of disease control and so FAO continues to promote the principles, especially for the small-holder sector and also increasingly for live bird markets and market chains. Biosecurity activities at the national level were driven in some instances by global projects, whereas in other countries it has been a major activity in the country project funding allocation. The procedures which have been designed and implemented for markets and market chains not only benefit the poultry sector, but also have a public health impact by reducing the potential exposure levels for humans in live bird markets. Increasingly at the national level efforts are being made to inform farmers that improvements in biosecurity are not only aimed at HPAI control but also will bring benefits to the overall profitability of their enterprises. The national projects in Bangladesh, China, Egypt, Indonesia and Viet Nam all have components that deal specifically with biosecurity and are dealt with in Chapter 4.

Of the at-risk countries in Asia, the FAO projects in Cambodia, Lao PDR and Nepal did not have a specific biosecurity component, as USAID funded this activity through contracted companies. In Myanmar, the biosecurity component concentrated on the special high-density production zones created to remove poultry production from population centres in areas where outbreaks had previously occurred, and which therefore were perceived to be high risk. ECTAD reports show that there was a lot of biosecurity activity in the regional projects and some of this was carried out in the project countries of Chad, Gabon and Togo.

Country Assessment on Biosecurity

An assessment of biosecurity in the 16 countries with FAO HPAI projects indicated that biosecurity measures have been strengthened in five countries and remained static in 10. While the specific sectors were not identified in the survey it is likely that improvements to biosecurity are a reflection of changes in sector 3 (small commercial operators), together with some improvement in the live bird markets and market chains. That no result is shown for China is a reflection of the size of the country and the complexity of the range of production and marketing systems, thus it was somewhat meaningless to derive a simple score. During 2010, the relative FAO investment increased in seven countries, remained the same in seven and was reduced in one. The increased investment by FAO however did not always translate to an improvement in the country situation, which is a reflection of the scale of the issue, and which must be addressed mainly with private resources. In terms of whether current international and/or national financial support provided an appropriate level of input to improve the overall status of biosecurity for the sector, six countries thought that the level was appropriate, whereas nine regarded it as insufficient. All but three countries believed that international input was required to improve the overall biosecurity status of the sector, but only three considered that the private sector was showing enough engagement with the HPAI programme to support improvements to the overall status of biosecurity for the sector.

A significant change is required to improve the resilience of the sector in many countries, as the sector is vulnerable to the introduction of a highly transmissible and pathogenic agent such as H5N1 HPAI. In some cases the overall lack of intense trade probably has and



will continue to reduce the spread of HPAI. It would appear that in many countries – including some with moderately productive sectors important to the national food supply – there is little interest on the part of the private sector to invest in biosecurity aspects of marketing and production. In countries where there is a very basic standard of production and marketing there is little interest in investing to improve this aspect of the market chain. In other areas with significant levels of commercial production in sector 3-type operations, there is also limited interest in improvement or investment, and little incentive for the larger companies to do so, as they are still making their profits from feed and supply of day-old-chicks (DOC), regardless of the efficiency and hygiene standards of small producers. The issue of biosecurity and duck farms has also been considered and this appears to be a major conundrum for disease control if the virus becomes endemic in ducks. Generally, small farmers have not been introduced to the concept and so do not have a clear idea about the process of disease agent introduction to the production unit. On the positive side, it would appear that there is interest in improving hygiene in markets and this may be a better entry point, reinforced by the principle that what is being introduced are good production practices which will make even the simplest operation more profitable.

OTHER KEY TOPICS

Preparedness

As the H5N1 HPAI emergency is now somewhat dissipated and most countries are in the consolidation phase of the control programme, it would be expected that there is less activity in this area – although there is always the need for revival and/or review of preparedness procedures. In a number of countries, activities were undertaken to train more field staff to support response in high-risk areas which were included in active surveillance (Myanmar), or to revise and better document SOPs to deal with outbreak situations (Gabon and Nepal).

It was noted from the 2010 reports that a number of either regional or national simulation exercises were undertaken. Cambodia conducted three simulation exercises for farmers and officials during 2010, in the provinces of Kampong Cham, Sihanoukville and Svay Rieng. On the Cambodia/Viet Nam border, risk assessments involving national and local officials from both countries were carried out, in two high-risk areas. The acknowledgement of the various commodity price gradients was an important outcome in respect of understanding and managing the risks from cross-border trade. One simulation exercise was held in Lao PDR, in the province of Phongsaly which borders both Viet Nam and China; and Nepal conducted two exercises in districts with previous outbreaks, along with a comprehensive review of lessons learned.

In west Africa, several workshops and training courses connected to preparedness had been organized in 2009: simulation exercises in the field at Segou, Mali, in June 2009 for 10 countries; and desktop exercises in Bobo Dioulasso, Burkina Faso, in December 2009 for three countries. During 2010, follow-up consisted mainly of production and dissemination of related reports and support/training tools, such as a video on Segou's field simulation exercise made available online through FAO-ECTAD website. Simulation exercises were conducted in Togo (attended by CMC representatives from FAO Rome), and in Gabon, involving many layers of government to test the contingency plan and procedures. Togo also established a compensation fund in preparedness for any HPAI incursion, as well as updating the HPAI intervention plan and strategic plan.

In east Africa, to test national action/contingency plans for HPAI (including surveillance), the regional ECTAD unit in Nairobi assisted in the planning and implementation of desktop simulation exercises in Burundi, Kenya, Rwanda, Tanzania and Uganda. A regional field simulation exercise for East Africa Community countries was conducted in a town on the Kenya/Uganda border in April 2010.

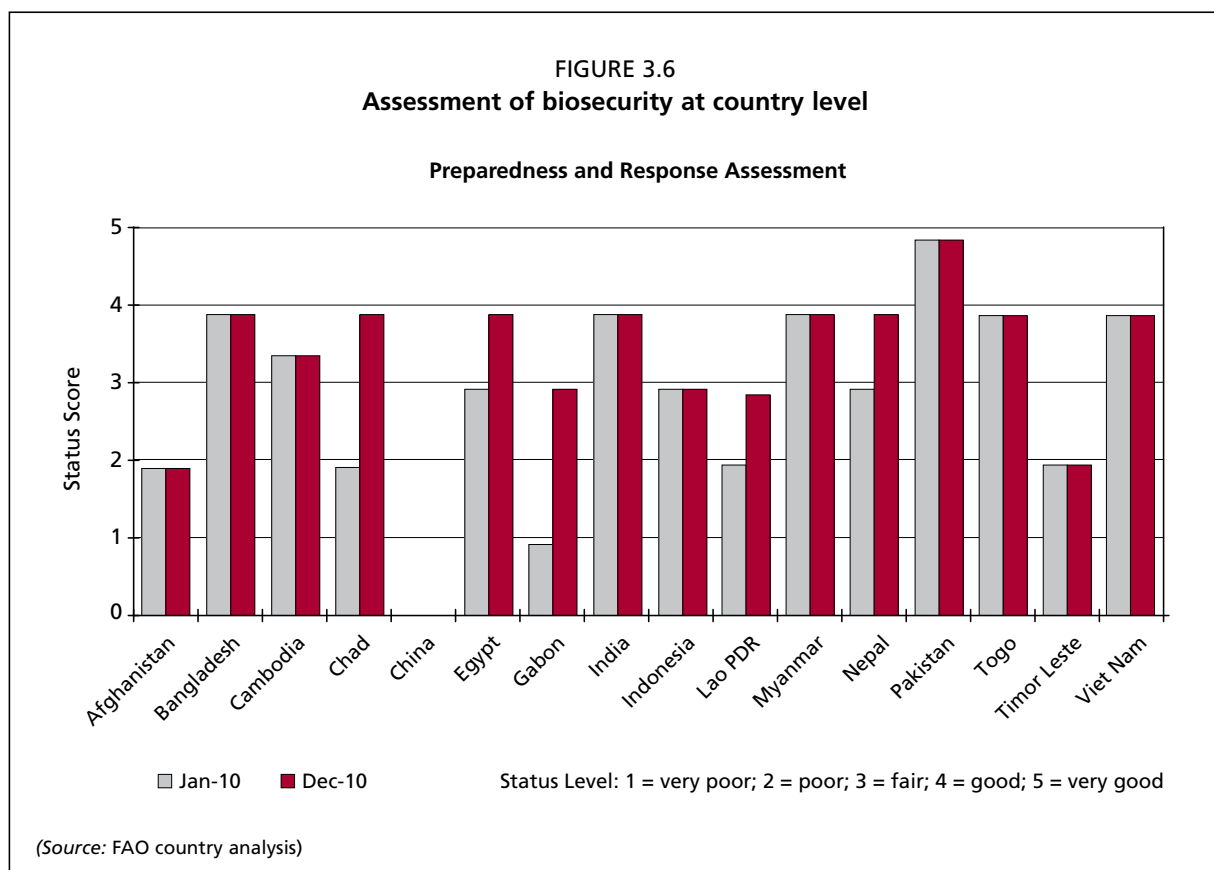
ECTAD Tunis organized a simulation exercise for avian and pandemic influenza in animal and human populations, from 7-8 March 2010 in Nouakchott, Mauritania. It was attended by 60 participants from different sectors at national and district level, including representatives from the Mauritanian HPAI Interministerial Committee, the Permanent National Commission for HPAI Surveillance and other relevant institutions and/or associations. The working group that participated in the training included epidemiologists, laboratory specialists and field staff from the animal and human health sectors, together with local authorities.

There remain constraints in some countries, associated with inadequate animal health legislation which does not support or allow for a comprehensive response to emergency animal disease situations, or which resulted in responses being constrained by the com-

plexity of processes. These matters are still addressed by FAO-ECTAD project activities, for example in Cambodia, Gabon and Nepal. Furthermore, the CMC-AH was involved in preparedness activities in 2010, sometimes in conjunction with response missions (see following section).

Country Assessment of Preparedness

Countries either improved preparedness and response capacity in 2010 or they remained static. In the case of Pakistan, the country team rated the preparedness and response capacity as excellent, but it was also noted elsewhere that resources had been diverted from animal health as a result of the emergency associated with flooding, and so the assessment needs to be carefully scrutinized further. At present, only two countries are rated as poor (and it must be taken into consideration that they are both resource poor, with one in a constant state of emergency). One country still lacks the necessary animal health law under which response can be implemented. In another country, it was noted that while the capacity to respond has been enhanced, the slow notification resulting from local political processes interfering with disease outbreak reporting, delays the entire response and constrains its effectiveness. In some countries there is also concern about the private sector concealing cases, which also constrains effective response. However, the overall conclusion is that the investments made through donor-assisted FAO projects has had a considerable impact on preparedness across Asia and also Africa, particularly considering that five years ago, at the beginning of the emergency, most countries would have been rated as poor or very poor (see status and ratings in [FIGURE 3.6](#) below).



RESPONSE

Emergency Response

From January to December 2010, the CMC-AH, operated by FAO in close collaboration with OIE and WHO, continued to assist member countries responding to HPAI and other TAD emergencies and emerging or unknown disease threats. The CMC-AH has worked in conjunction with donors and partners to meet evolving response needs. The depth and range of expertise that can be engaged in the CMC-AH response has been expanded by the development of partnerships with agencies that are willing to make available their own experts. The CMC-AH continues to engage with these partners and maintains liaison with them.

During this period, the efforts of FAO and partners focused on continuing to:

- plan, deploy and follow-up on **response support**;
- expand the Centre's range of **services and tools**; and
- strengthen CMC-AH **core and in-kind staffing**.

In addition to deploying response support directly for HPAI, the Centre's experience and work on AI has strengthened overall operational and technical capacities in combating TADs in general as a holistic problem requiring coordinated solutions. The CMC-AH has matched these growing capacities with an expanded range of services, tools and staff to complement and implement rapid response assistance.

In 2009, the CMC-AH had worked to develop an accessible stock of reagents to facilitate rapid laboratory confirmation in countries experiencing outbreaks. In early 2010, this work came to fruition, as stocks of key HPAI reagents were established in partnership with the United Nations Humanitarian Resource Depot for storage and shipment under appropriate cold chain conditions. The CMC-AH utilized this new tool by rapidly deploying rapid antigen test kits to Bhutan as a follow-up to the above-mentioned mission of March 2010. The Centre also identified reagents for other critical, non-HPAI TADs and made arrangements for procurement should funding limitations change.

The CMC-AH fine-tuned its ability to track critical events and manage possible responses through the creation of the Event Tracking and Management System (ETMS), which was started in 2009 and completed in December 2010. While other established databases track diseases, the CMC-AH employs ETMS for its own event management purposes. Supported in particular by the Canadian International Development Agency (CIDA), ETMS has improved the Centre's capacity to plan, manage and follow-up on emergency response activities, as well as strengthen post-mission analysis and reporting.

The CMC-AH began revising and expanding FAO's Good Emergency Management Practices (GEMP) in early 2010. The CMC-AH plans to incorporate into GEMP the Centre's previously developed and field-tested guidelines on disease response outbreak communication. The reinvigorated GEMP concept will provide ready access to a range of materials directly relevant to emergency animal disease response. Through encouraging adoption of these good management practices by member countries, the value that the CMC-AH's response support can add will be increased.

Response support

The CMC-AH continued to be placed on alert for critical animal disease events. Over the course of 2010 the CMC-AH – as the operational arm of ECTAD – has continued to provide rapid response assistance to countries experiencing HPAI and other TAD emergencies. Through this work the CMC-AH has continued to play its role in FAO's Global Programme for HPAI Prevention and Control.

CMC-AH missions

In 2010 CMC-AH conducted a total of 10 field missions as well as undertaking other assignments including liaison activities with donors and partner organisations. Three missions related to HPAI were conducted. The CMC-AH assisted five additional countries responding to critical situations involving other TADs: ASF, Anthrax, FMD, PPR and rabies (see [TABLE 3.1](#)). In particular, the mission to the Democratic Republic of Congo demonstrated the evolution of CMC-AH assistance, utilizing lessons learned from HPAI experiences (see [CASE STUDIES 3.2](#) and [3.3](#)).

SOCIO-ECONOMICS

The importance of managing value chains, defining trade patterns, understanding animal disease interventions, and influencing policy development are examples of the interlinking themes which the Socio-economic (SEC) Unit worked on successfully in 2010. Although much of the work within the unit is guided by the requirements of member countries, the SEC unit was able to consolidate and embark on innovative work in collaboration with disciplines, such as epidemiology, and with various field partners in-country, including veterinary services and research institutes.

It had become clear in 2009 that understanding the trade patterns and the dominant poultry value chains in parts of south and southeast Asia was vital to understanding, and

TABLE 3.1
CMC-AH missions in 2010

Date (2010)	Country	Disease
January – February	Congo, DR	Multiple TADs
March	Nepal	HPAI
March	Bhutan	HPAI
May	Belarus	ASF
May	Bhutan	HPAI
August	Congo, DR	Multiple TADs
September	Tanzania	PPR
October	Bangladesh	Anthrax
December	Mongolia	FMD
December	Azerbaijan	Rabies

CASE STUDY 3.2

Meeting evolving HPAI needs in Nepal

Nepal has worked with the CMC-AH to enhance HPAI preparedness and response since before the country's first outbreaks in January 2009. Government efforts yielded positive results, which were backed-up by CMC-AH rapid missions and their strategic recommendations. Despite continued work guarding against outbreaks, HPAI resurfaced in Nepal in early 2010.

The Government of Nepal acted quickly to control the new threat in the country, having worked progressively to increase its prevention and control capacity through FAO support and other international assistance. The March 2010 CMC-AH mission provided additional support in assessing the: 1) epidemiologic situation in the poultry sector; 2) potential involvement of wild birds; 3) relevance of biosecurity issues; and 4) gaps in funding or opportunities for the redirection of resources.

The CMC-AH team, which included a wildlife specialist from FAO's Regional Office for Asia and the Pacific, conducted field visits and engaged with a wide range of government and private stakeholders. Recommendations focused on: 1) improving disease surveillance and reporting; 2) enhancing regional response team capacities; 3) building public-private partnerships to implement biosecurity measures and raise awareness; and 4) conducting in-depth assessments of the potential role of wild birds in Nepal's HPAI outbreaks.

CASE STUDY 3.3

Bhutan experiences HPAI for the first time

When Bhutan experienced its first outbreak of HPAI in February 2010, authorities requested FAO assistance to: review control activities already underway; assess the risk of future HPAI introduction; and examine equipment and cost requirements. The CMC-AH deployed an epidemiologist in March 2010 to support the government's efforts, which included undertaking control operations on difficult-to-traverse terrain.

Following up on mission recommendations, the CMC-AH provided personal protective equipment, sprayers and rapid test kits; facilitated sample shipment; and promoted cross-border linkages. The Centre also deployed a second mission in late-May 2010 to build laboratory capacities and strengthen sub-regional cooperation. All mission costs, equipment and provisions were supported by USAID through FAO's Global Programme for HPAI Prevention and Control.

CASE STUDY 3.4

Addressing a multi-disease crisis in the Democratic Republic of Congo

The Democratic Republic of Congo is a large country with diverse animal resources. More than two decades of conflict have inevitably had major impacts, including weakening national veterinary services (as confirmed by several OIE assessment missions). Veterinary services have struggled to cope, especially in light of the upsurge in disease-related animal mortalities in the east of the country, in recent years. This has contributed to an animal health crisis precipitated by a range of diseases which are not being addressed.

The government requested FAO assistance in responding to a number of threats, including ASF, CBPP, FMD and PPR as well as to zoonoses, such as anthrax and rabies. Recognizing the need to help protect national efforts to rebuild the animal production sector, the CMC-AH deployed a team of epidemiology, socio-economic and market chain experts. The mission focused on:

- generating an emergency action plan for responses to specific, critical diseases;
- creating a roadmap toward a comprehensive animal health programme; and
- mobilizing resources to support the above-mentioned initiatives.

Grounding strategy development with field visits to affected areas, the CMC-AH mission worked with the authorities to develop an emergency action plan prioritizing immediate tasks and a strategic road map representing the first step in creating a national animal health programme. The team also designed two short-term projects geared to support the government's overall efforts to improve animal health and production.

Following-up on the above-mentioned roadmap and mission outputs, the CMC-AH deployed a response veterinarian in August 2010 to work with authorities to draft a comprehensive, five-year, national animal health programme, which included HPAI prevention and control components. The CMC-AH expert facilitated the preparation of the plan for presentation to potential donors.

therefore tackling the periodic re-emergence of HPAI. The SEC Unit, together with in-country partners, undertook a series of cross-border poultry value chain studies to identify and understand specific seasonal and geographical patterns of trade, the actors involved, the types of value chains in the region, and the risk factors of animal disease transmission associated with the value chains. Much of the work was accomplished through a series of workshops at border regions, which allowed people at the border to enhance their understanding of and how they could manage their own risks. The studies also opened up discussion about uncontrolled trade and the need to manage it. It also became clear that significant constant or seasonal price differences for poultry products are a main risk factor for uncontrolled trade. Cross-border trade provides income for traders with otherwise relatively low labour opportunity. This coupled with the general difficulties in enforcing bans

on cross-border trade of small animals such as poultry, the differing enforcement capacities, and economic pulling factors such as price differentials, are identified as inevitable risk factors for movement of HPAI to new locations. This was also reflected in work completed in east and west Africa on trade patterns, where price differentials and very porous borders allowed for a volatile and fluid trade pattern, which remains difficult to monitor.

In Egypt, an HPAI endemic country, the work has concentrated on the internal trade and movement of poultry. The task here has been to describe and understand the linkages within and between the different poultry chains. Having identified at least six different chains, that at times overlap, it is important to better understand how they interact and what the risk factors are, in order to better target interventions. The experiences of Egypt illustrate that certain management practices and production goals are maintaining the disease, and changing these with the people involved is the challenge within this work.

Such work as described above reveals that it is costly and difficult to monitor value chains from the outside, therefore innovative solutions are being sought to allow people to manage their chains from within. In other words, options are being looked at to ensure that the efficiency produced by animal health interventions is translated to the various risk managers, such as traders and producers in the chains. Understanding people's motivation for being part of the chains and understanding the limits and the opportunities they have to manage, the systems themselves thus become crucial. The team in Egypt is experimenting with a traceability system for hatcheries, while in west Africa, a zoo-sanitary system is being set up for the region. Public private partnerships also form an important link, and are being explored as a means of cost sharing and leveraging in, for instance, surveillance.

Moving beyond trade, but still concerned with managing value chains, the SEC unit also dedicated time to understanding and providing options to policy makers in relation to specific disease prevention and control measures, such as vaccination and surveillance. Given the generally limited budgets of countries, work must be undertaken to look at the most cost-effective investment options. Kenya examined the potential financial implications of adopting a vaccination strategy – as well its feasibility – considering the prevailing response capacity of the National Veterinary Services. This assessment demonstrated that while vaccination may be cheaper (in terms of vaccine and delivery costs) than a stamping out and compensation strategy, the countries lack sufficient response and monitoring capacity to implement the programme to ensure sufficient coverage. In Viet Nam, a cost-effectiveness assessment for vaccination, culling and surveillance was designed and supervised by the SEC unit and was implemented to gather evidence on strategies for HPAI vaccination. The cost-effectiveness analysis was also crucial in providing policy makers with information on the potential financial implications of changes to current vaccination strategies.

Finally, a crucial area of work for the SEC unit has been in building capacity within countries to integrate socio-economics within the veterinary services. This has been undertaken through the development and support of socio-economic networks in west and north Africa, where specific socio-economic focal points within veterinary services were appointed with the support of CVOs, and who are now being technically supported by the SEC unit. The unit also developed a specific socio-economic module and delivered training for FETPV at RAP in Bangkok. Work is ongoing in east Africa to develop a similar training module for the veterinary services. The aim of all these initiatives is to build the capacity of personnel

CASE STUDY 3.5 Cost effectiveness of vaccination

Viet Nam started using mass vaccination of poultry for H5N1 HPAI in 2005 and has experienced a significant reduction in poultry losses and human cases from HPAI since then. However, the Government of Viet Nam wishes to progress with HPAI control and assess options to reduce the financial burden of funding mass vaccination campaigns. A two-year USAID-funded project was initiated to gather evidence for a transitional strategy (GETS) which would reduce the use of resources for HPAI vaccination. Together with epidemiological studies, a cost-effectiveness study was designed and implemented to assess the financial implications of varying vaccination strategies in five different provinces. The costs of vaccine delivery and administration, surveillance and outbreak response were assessed together with the epidemiological evidence gathered to assess the effectiveness of the different vaccination strategies. The willingness to pay for HPAI vaccine by poultry owners was assessed by monitoring the uptake of vaccine made available to poultry owners for purchase. Differing incentives for the involved administrative levels to withdraw vaccination were identified. The bi-annual revision of national vaccination strategy by the Government of Viet Nam was largely based on information resulting from the cost-effectiveness analysis.

within these services to use socio-economic data and concepts to target their interventions more efficiently and to improve their ability to influence policy makers on strategic matters.

At the country level, Myanmar has found the market chain approach to be a very useful entry point to the concept of risk management. The HPAI project developed a new conceptual framework for risk assessment/management incorporating supply chain studies, which has been enthusiastically adopted by veterinary services, and has been applied in border areas (Bangladesh, People's Republic of China, India and Thailand), as well in high-risk production and market areas. The improved understanding of risk has been a major achievement. In addition, a gender study on poultry production was completed, and gender concepts for activities evaluation have been introduced to the veterinary services. The considerable biosecurity activities in Bangladesh and Egypt are described in Chapter 4.

PUBLIC PRIVATE PARTNERSHIPS

The public private partnerships project (known as the 'PPP' project) commenced in July 2009 and continued until the end of September 2010 (OSRO/INT/805/USA). The project aimed to overcome the lack of or limited trust and collaboration between the public and private sectors involved in poultry production and marketing, as this lack of cohesion has negatively affected the capacity to prevent, detect and control HPAI. From this perspective, the PPP project has been successful in paving the way for further dialogue and collaborations between the public veterinary services and the private sector. In this context, the sec-

tor includes private veterinarians, poultry producers, poultry associations, input and service providers and also members of academia and NGOs in the HPAI endemically affected countries of Bangladesh, Egypt and Indonesia. A wide range of issues related to animal health and production were discussed in meetings and workshops. While topics such as vaccination, diagnosis, compensation and biosecurity have been identified as areas of interest and potential points of interaction between the public and private sectors, there was significant shared interest in biosecurity. Therefore, biosecurity was used as an entry point and as a driver for future PPP activities, such as the development of compensation plans, farm registration and licensing programmes, zoning and compartmentalization.

In Bangladesh, the project developed the comprehensive *National Biosecurity Guidelines for the Commercial Sector* in October 2009, during a three-day workshop. Representatives from the public, private, NGO and university sectors participated in its formulation, and it was approved and endorsed by the Secretary of the Ministry of Forestry and Livestock in April 2010. The Guidelines were translated into Bengali and 3,500 copies printed and distributed to livestock officers, poultry associations and producers across the country. In support of the guidelines implementation, a five-day Training of Trainers (TOT) session for biosecurity auditing trainers was held in June 2010 with the participation of 26 public veterinarians from the DLS. The participants learned how to develop an auditing plan and system, and how to conduct an effective farm audit. It is expected that these trainees will play an important role in the training of district and *upazilla* livestock officers, thereby ensuring the correct implementation of the national biosecurity guidelines.

In collaboration with the Bangladesh Poultry Industry Association (BPIA), over eight hundred poultry industry input suppliers were trained across the country in matters related to biosecurity. Participants committed to transferring this knowledge to their customers, mainly small-scale poultry farmers of sector 3.

A socioeconomic study of live bird markets was undertaken to assess the cost benefits involved in market improvement through the implementation of biosecurity and hygiene measures. Additionally this study analyzed whether market performance correlates with engagement in such activities. This study clearly demonstrated the consumers' preference for markets with upgraded biosecurity and hygiene standards. Traders who invested in improvements to their stalls reported a sharp increase in their customer base, turnover and income. The PPP project received extensive local media exposure in Bangladesh and activities were often reported in the print and electronic media. The high profile nature of the project encouraged the Bangladesh Society for Veterinary Education and Research (BSVER), to adopt the topic of 'Public-Private Partnership: Development of Livestock Entrepreneurship in Bangladesh' for their 16th Annual Conference.

In Egypt, the PPP project organized two successful workshops for the development of *National Strategic Plan for HPAI Compensation* and *National Biosecurity Guidelines for the Commercial Poultry Industry*. Both workshops were well attended by participants from the public sector (General Office of Veterinary Services [GOVS], and the National Laboratory for Quality Control on Poultry Production [NLQP]) and the private sector (the Poultry Union and poultry companies). The workshops generated comprehensive draft proposals which were presented and accepted by all participants. The proposals included detailed components such as programme principles, programme operations and recommendations

for the formation of joint working groups and committees with well-defined roles and responsibilities for the implementation of the compensation plan and biosecurity guidelines. Both proposals were presented to the Egyptian Minister of Agriculture and Land Reclamation for endorsement and implementation. Unfortunately at this point in time, the comprehensive compensation plan has not been endorsed for public sector support. In a subsequent initiative, the Poultry Union, which represents the large companies which own registered farms (30 percent of the total farms in Egypt), developed another compensation plan which excluded unregistered farms. It is not clear if public funding support for such a scheme would result in more farm registrations and consequently improved production and hygiene standards throughout the sector.

In collaboration with local service providers in the Al Fayoum Governorate, an intensive biosecurity training programme was conducted. Over a six-week period, approximately 600 small poultry producers and 45 local government veterinarians from districts were trained in simple and affordable biosecurity measures which can significantly reduce farm exposure to HPAI and other EIDs. During the training, the formation of grass-roots level poultry associations was promoted as a tool for the improvement of collaboration between producers. This could serve as a useful platform for the dissemination of information regarding disease control and better farm practices.

COMMUNICATION

Global Support to public awareness and communication

Communication, advocacy and awareness raising activities are a core component in disease preparedness and prevention campaigns. The range of stakeholders is wide, and the communication strategy is shaped by the regional and development setting, disease drivers, disease impacts, and the options to reduce risk that are available to farmers, traders, consumers, and others at critical control points in the food animal chain. FAO supports the development of coordinated and collaborative regional and national advocacy and communication strategies, responses and activities, and in 2010 developed regional strategies for the Asia-Pacific, southern Africa and eastern Africa regions. The ECTAD Communication Unit at FAO headquarters plays an important role in the overall communication effort. A major new advocacy initiative, initially in the Asia-Pacific, and north Africa regions was launched in 2010 (OSRO/GLO/707/USA). The initiative has engaged national authorities and other stakeholders in identifying gaps in communication capacity and developed a programme to enhance core capacities, competencies and skills in advocacy and in-country communication in response to HPAI and EIDs. The programme also works to establish or enhance regional/national collaborative partnerships, including with the private sector and the media.

An innovative media partnership project was completed in 2010 (OSRO/GLO/702/CAN). The multi-media products – including print, video, radio, photography and graphic arts – from 40 media practitioners in Egypt, Indonesia, Nigeria and Viet Nam were consolidated into a process guide on engaging the media in animal disease reporting. Materials from the project have been utilized as training, advocacy and communication materials for a range of audiences, including policy-makers, senior public health officials, national veterinary services, donors, etc in workshops and broadcast at international meetings.

FAO collaborates with key partners WHO and OIE, including on tripartite projects related to risk/outbreak communication, and social mobilization. FAO's role for example, included completing a project in Nigeria (OSRO/INT/702/UNJ) related to capacity building for prevention and preparedness for HPAI. The project focused on promoting biosecurity in smallholder production systems through establishment of community-based participatory disease search mechanisms. A key aspect of the project was the engagement of community stakeholders (such as poultry farmers, traders and live bird market authorities) and sub-national level government veterinary staff in dialogue to find local biosecurity solutions for the prevention and control of poultry diseases. The project also strengthened disease coordination across sectors and stakeholders, and provided insight into the socio-economic impact of HPAI. Evaluation of the project determined that communities were mobilized to undertake partnerships with veterinary services, thereby establishing a feasible public-private partnership for service delivery at the community level. Overall, the project was judged to have improved Nigeria's preparedness against a future incursion of HPAI and response to poultry disease epidemics by integrating resource-poor community members and stakeholders into mainstream disease reporting for early detection, reporting and containment. Women were empowered through the project to implement safer poultry production. The project represents a positive model of multidisciplinary collaboration, combining the expertise of communication, biosecurity, socio-economic and animal health specialists.

FAO has continued to contribute to developing risk communication competencies and leadership among Ministries of Agriculture, including through participation in, and partnering with, WHO's Working Group on the International Health Regulations Risk Communication component and Global Health Security Communication Network to finalize indicators and benchmarks for core risk communication capacities. At the regional level, FAO supports the development of coordinated and collaborative regional and national advocacy and communication strategies, responses and activities. FAO HQ assisted in the development of the communication programme for east Africa (see below). In the Asia-Pacific region, FAO plays a key role in advocating to donors and partners on the strengths, achievements and impact of the HPAI Programme, including at major international meetings, such as the International Ministerial Conference on Animal and Pandemic Influenza (IMCAPI) in Hanoi, Viet Nam, in April 2010.

FAO is recognized as playing a key role in translating technical and scientific understanding into communication strategies and being best suited to lead and implement the development of regional and national strategic frameworks for communication and advocacy concerning diseases in livestock species.

Regional Support to public awareness and communication

Since 2007, ECTAD RAP has been facilitating an email circulation list 'AI-Network-Asia'. Currently, there are more than 350 subscribers, the majority being epidemiologists (47 percent) and laboratory scientists (23 percent). In 2010, a total of 96 items were circulated through this system. The materials circulated included disease information (70 percent), publications (21 percent) and other activities (9 percent).

During 2010, a study on the veterinary extension situation in the Middle East was carried out and presented in the OIE Regional Seminar on Communication held in Muscat,

Oman on 20-21 April 2010, focusing on FAO extension activities with regard to veterinary services. In addition, the RAHC contributed to the dissemination of scientific information produced by FAO related to animal diseases to veterinary authorities in the region, in particular on H5N1 HPAI and Pandemic (H1N1) 2009.

The communication specialist from ECTAD Nairobi provided expert support to the continent-wide AU-IBAR-led formulation of an integrated regional coordination mechanism (IRCM) for the prevention and control of TADs and other zoonoses, and contributed to the 'One Health' concept, to be anchored within the regional economic communities (RECs) in Africa. This inter-agency process has enabled FAO to play a synergizing role in the uptake of the proposed mechanism in collaboration with AU-IBAR, OIE and WHO. Following missions conducted in most of the RECs in Africa, the proposed mechanism is awaiting finalization by AU-IBAR, following an inter-agency consultative meeting held in Bamako, Mali, in November 2010. One of the key findings during various IRCM missions undertaken in the continent is the limited resource allocation to animal health communication, coupled with a lack of experts in animal health communication within national veterinary services. FAO will, therefore, need to strengthen and augment its communication capacity to remedy this situation.

With the EU-funded regional project (OSRO/RAF/802/EC) at an advanced phase of implementation, the communication component of the project has continued to receive appropriate backstopping and technical inputs from the ECTAD Nairobi Communication specialist. This support has enabled the strengthening of the programmatic outreach and visibility channels, such as management of the regional ECTAD Nairobi website, production of advocacy materials, and production and dissemination of a regional bi-monthly ECTAD Newsletter, etc. A monthly newsletter is also produced in ECTAD-RAP for dissemination in the region and beyond.

ECTAD Tunis has upgraded its website (<http://www.fao-ectad-crsa-an.org>) to improve access to relevant information and documentation and enhance coordination/interaction between the REMESA countries of the region. This website, facilitated by FAO/ECTAD experts, allows a flow of essential local and international information on topics related to laboratory diagnosis, epidemio-surveillance, communication, etc. of HPAI and other priority TADs in the region.

WILDLIFE

The FAO EMPRES Wildlife Unit has significantly expanded its global activities building on the experience gained from the epidemio-ecology approach of livestock-wildlife-public health interface issues and avian influenza. New efforts encompass a broader diversity of EIDs specifically focused on examining the role of wildlife in the emergence, persistence and transmission of diseases that threaten livestock health, human health and agricultural livelihoods. Current activities include supporting bat disease surveillance and ecology studies in the Philippines and southeast Asia, bushmeat and zoonotic disease transmission issues in central Africa, PPR and other TAD surveillance in small wild ungulates in east and north Africa, FMD studies in Asian steppe ungulates, and RVF and other TAD surveillance at the cattle/buffalo interface in southern Africa.

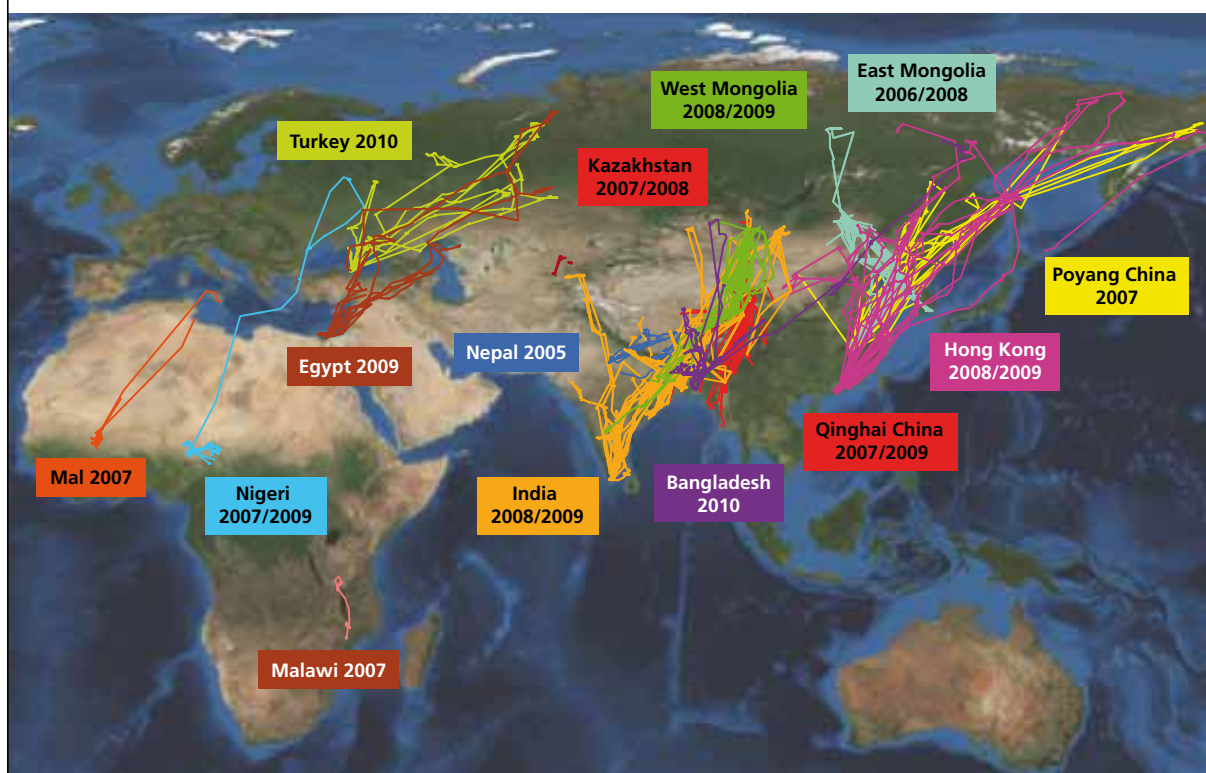
The Unit's work on the disease ecology of AI continues with capacity building, wild bird surveillance, and migration studies utilizing transmitters to mark birds and address the

role of wild birds in the maintenance and spread of H5N1 and other pathogens. Previous studies with marked birds have provided greater insight into the potential movement of AI viruses from India/Bangladesh to the Tibetan plateau and Qinghai Lake region in the People's Republic of China, and on to Mongolia, where AI outbreaks appear to be linked temporally and spatially with wild bird movements in the eastern part of the central Asian flyway. Further analysis of these migration pathways and identification of high-risk disease transmission sites among domestic and wild species is currently being addressed.

During 2010, capacity building courses and wild bird surveillance activities were conducted in Bangladesh, Egypt and Sudan. In the People's Republic of China, farmed wild duck and goose surveillance yielded positive results for several LPAI viruses, identifying this less regulated sector as a potential bridge for viruses crossing from wild birds into domestic animal species and back again. Continued studies on the husbandry and marketing of farmed wild birds are currently underway.

In Africa, the Unit partnered with AU-IBAR to conduct a series of Wildlife Capture and Surveillance Workshops for almost 50 countries. Four regional workshops were conducted in east, west, central and southern African attended by both wildlife specialists and live-stock veterinarians. The workshops focused on avian and mammalian capture techniques

FIGURE 3.7
Global waterfowl migration patterns obtained from satellite telemetry
of migratory birds during 2005-2010



(Source: AI disease ecology programme implemented by FAO, United States Geological Survey [USGS] and other partners includes satellite tracking data from 551 transmitters deployed in 12 countries on 24 species)

CASE STUDY 3.6

Wild waterfowl and the dynamics of H5N1 virus ecology

The EMPRES Wildlife Unit has undertaken significant surveillance and radio-tracking of migratory waterfowl in the major global flyways overlying areas where HPAI is endemic (see Figure 3.7). This data has been used in a combination of analyses incorporating spatial and temporal aspects of waterfowl migration, local habitat use, characterization of agro-ecological systems, and risk modeling to provide FAO and collaborators with a more concrete understanding of linkages between poultry, waterfowl, and disease spread. Furthermore, additional insight has come from adding virological data to the analysis of disease outbreak patterns.

Disease and migration ecology studies have shown that some of the 2009 H5N1 outbreaks during Spring migration correlated with wild bird movements from India to Bangladesh into the People's Republic of China and to Mongolia. Satellite-tracked birds revealed a direct spatio-temporal link between the H5N1 HPAI hot-spots identified in Bangladesh and India through the risk model, and the wild bird outbreaks in May, June and July 2009 in the People's Republic of China (Qinghai Lake), Mongolia, and Russia. Additionally, risk analysis with migration data of satellite-tracked wild waterfowl along the central Asia flyway has been used to identify the association between the virus persisting locally and long-distance dispersal of the virus. Related studies have shown that the main risk factors for areas in Asia with a high risk of H5N1 HPAI persistence in domestic poultry, were the population of domestic ducks and the human and chicken population density. These studies have linked the two phenomena.

This suggests that the continental-scale dynamics of H5N1 HPAI may be linked to areas with large domestic duck populations where the virus persists, leading to occasional but rare transmission through migratory waterfowl. However, it is not known how H5N1 HPAI virus transmission is taking place between domestic poultry and wild birds, even if data suggests that the virus is moving in both directions. It is interesting to note that this pattern of wild bird movement of virus along the central Asia flyway in a northerly direction during the northern hemispheric Spring migration, is a phenomena that is not apparent further east in the east-Asian Australasian flyway. The reasons for this difference in epidemiological patterns is the focus of further work currently underway. In other efforts in central Asia and Russia, a crucial crossroads for waterfowl migration in Eurasia, FAO and partners have uniquely combined historical data derived from over 80 years of bird ringing with recent satellite tracking data to delineate migration routes, movement chronology and habitat use patterns of waterfowl. This effort has confirmed migratory linkage between breeding and moulting areas in northern Kazakhstan and southern Siberia, with non-breeding areas in the Caspian, Black and eastern Mediterranean Sea basins, as well as with south Asia.

and consisted of classroom instruction, problem-based learning exercises, and fieldwork involving live animal capture, handling and sampling. In total 94 veterinarians and biologists throughout Africa received hands on training in wildlife disease surveillance techniques.

As part of its capacity building programme, the Wildlife Unit focuses efforts at national and regional levels to ensure that a One Health approach is being utilized to investigate and understand emerging infectious diseases. Intensive One Health short-courses were held in Thailand and South Africa, bringing together professionals from the Ministries of Agriculture, Health, and Environment/Forestry to discuss wildlife health issues. The short course consisted of both instructional lectures and problem based learning activities which required the three disciplines to work together in a multi-sectoral approach to address disease outbreak response, epidemiology, and surveillance strategies. As a result, participants gained knowledge about important emerging diseases; the importance of an inter-ministerial approach and multidisciplinary collaboration; and the agricultural, biological, ecological, and epidemiological factors important in identifying risk for disease transmission between wildlife and livestock and when relevant, people.

The Avian influenza Task Force convened in March 2010 and released the document, *HPAI H5N1 and wild birds: reviewing the global issue and assessing future priorities*, summarizing the latest knowledge and making recommendations. The Wildlife Unit is also working with CMS to prepare for the 2011 'Year of the Bat' by engaging CMS bat experts as instructors for One Health Training and through inputs on a new FAO Animal Production and Health Manual, *Investigating the Role of Bats in Emerging Zoonoses: Balancing Ecology, Conservation, and Public Health Interests*.

Chapter 4

Detailed endemic country analysis

INTRODUCTION

While the FAO HPAI programme continued in 16 countries during 2010, this chapter provides details of the programme activities in five key countries, Bangladesh, the People's Republic of China, Egypt, Indonesia and Viet Nam. These countries are given prominence in this chapter as they are currently at the centre of the agro-ecological zones where H5N1 HPAI is endemic and which were discussed in Chapter 3. In addition, with the exception of the People's Republic of China these countries have major project portfolios being managed by FAO. The country details presented in this chapter feature three principal areas of information: (i) FAO's contribution to the national HPAI response in 2010; (ii) progress with developments of country capacity over the past 12 months; and (iii) observations on the impact of FAO's contribution in the country. Each section also contains a case study or a key development for each country. A further detailed analysis of the disease situation and FAO's overall contribution to the national HPAI response in each of the five countries can be found in the Annexes.

BANGLADESH

FAO's contribution to the national HPAI response in 2010

FAO has continued to support the efforts of the Government of Bangladesh to prepare for and control HPAI, through projects directed at prevention, detection and control activities. Capacity building has also been an important target for the programme. Activities have included training for field veterinarians in disease control and inputs into the laboratory network. The global project on PPPs has been particularly active in Bangladesh mainly through the entry point of providing biosecurity training for industry and government, and also through the activities related to disinfection and restructuring of live bird markets. These PPP activities are facilitated through a close relationship with the Bangladesh Poultry Industries Association (BPIA).

During 2010, the number of *Upazilas* covered by the FAO's active surveillance programme increased from 150 to 260 (out of a total of 492), and the number of CAHWs increased from 450 to 780. The SMS Gateway System was improved by upgrading from a stand-alone system to a web-based system, which allows wider access from the field. In addition to active surveillance using the SMS Gateway System, conventional passive surveillance continues through the regular veterinary services. Surveys of free-ranging ducks and chicken in backyards in the vicinity of farms recently affected by HPAI has begun under

an FAO initiative aiming to identify hidden reservoirs of HPAI H5N1 virus circulating within the country. To enhance the surveillance capacity, FAO provided 20 veterinary officers of the DLS with Applied Epidemiology Training. During six months in 2010, there were 1 793 swab samples collected from free-ranging ducks and chicken, in the absence of any clinical diseases in backyards within a 1 km radius of commercial farms affected in nine locations in the past (2007-2010). One sample from a free-ranging chicken in Cox's Bazaar collected during the continuing outbreaks in February 2010 was found to be positive for H5N1. This virus has not been sequenced.

The upgrade to being web-based has increased the power of the SMS Gateway to handle traffic. This surveillance system provides real-time feedback to the field and also enables data on negative events to be recorded, i.e. evidence of where the disease is not present on any particular day. As with Indonesia, the rate of households with clinical disease per day is very low. Considerable input is required for this system to be successful. Resources must be invested into training and retraining the CAHWs and the supervising veterinarians, and in addition, the activities of CAHWs must be monitored through periodical checking for compliance with performance standards. At all levels of the system, users must be trained to transmit messages in the correct format, and it is important that there is a swift response from the Livestock Office to any suspect event. The reduction in paperwork is an important factor for the successful engagement of ULO in this surveillance system. Regional interest in the system was demonstrated when four veterinarians from Nepal came to observe the system and receive introductory training in its operation.

FAO provides coordination for various national level activities, for example, the core donor meeting and the laboratory committee meeting. While FAO has not had funding for equipment and consumables for the laboratory system, to support the laboratory operations, core staff members of two key veterinary diagnostic laboratories were sent to attend a regional Biosafety Management Training held in Singapore from 25-29 October 2010, and organized in collaboration between ECTAD-RAP and the Asia-Pacific Biosafety Association (APBA).

In order to engage with the private sector, biosecurity guidelines for commercial farms were prepared and distributed and biosecurity auditing training was provided to 25 veterinary officers in the DLS. In addition, CAHWs have been provided with guidelines so that they comply with biosecurity standards when visiting farms for surveillance purposes. A programme commenced to upgrade hygiene and biosecurity standards in live bird markets, and another for cleaning and disinfection was introduced at 24 live bird markets around the country, including the provision of power pressure washers and high pressure sprayers. In order to understand more about the industry structure, a significant exercise was undertaken to log the location of all commercial enterprises in the country with global positioning system (GPS) devices and to enter the information on a geographic information system (GIS) database.

FAO also provided training for veterinary officers (VOs) working under a USAID-funded project 'Strengthening of Support Service for Combating Avian Influenza (SSCAIB) in Bangladesh' for active surveillance. Thirty seven VOs were recruited by the SSCAIB to work in District Offices to support District Livestock Officers. They are part of the active surveillance programme and utilize the SMS Gateway system. They underwent a training programme to

integrate their activities with the extensive programme implemented by CAHWs and AVSs in *Upazila* Livestock Offices.

Country Capacity: progress over the reporting period, impact and areas for attention

The results of a survey completed by the country team on six key areas are shown in TABLE 4.1 below.

Overall, the FAO inputs have made a significant impact on the capacity of the DLS to detect and respond to disease outbreaks and this has resulted in a decrease in the incidence of disease. The FAO programme has made inputs to the national preparedness and response capacity and capability by undertaking a review of the procedures for outbreak control, outlining detailed roles and responsibilities for those involved, and providing training as appropriate. FAO has also undertaken to provide this training to support the government-implemented AIPRP (under the WB programme). The expansion of the SMS Gateway has brought more *Upazilas* into the network and so increased the active surveillance coverage. However, on a daily or weekly basis there are still a lot of farms that are not covered in the programme, thus surveillance will not always detect all cases. The high numbers of participants in the poultry sector is one factor that constrains effective surveillance. The monitoring work that is taking place with the duck population, and the detailed outbreak investigations are beginning to yield information which has the potential to provide insights into potential silent reservoirs of the disease.

The FAO programme has significantly strengthened the capacity of the veterinary services in field data management and analysis. This will in turn lead to increased understanding

TABLE 4.1
Progress for Bangladesh in six key programme activities/indicators in 2010

Activity/Indicator	Assessment (as of December 2009)	FAO's contribution to this result	Evolution over the previous RP	Evolution over the current RP 2010	FAO's contribution to this result
Preparedness	3	S	→	↗	S
Surveillance	4	S	↗	↗	S
Response	5	S	↗	↗	S
Laboratory capacity	5	C	↗	↗	C
Compensation	5	NC	→	→	NC
Biosecurity	2	S	→	↗	S

Level:

1 = very poor; 2 = poor; 3 = fair; 4 = good; 5 = very good

Contribution:

S = significant; C = collective (financial input shared with other partners and/or the country); NC = no contribution

Evolution:

↗ = capacity has increased substantially; → = no substantial change in capacity;

↘ = capacity has decreased substantially

CASE STUDY 4.1

Live bird markets as a showcase for improved biosecurity

Beginning in June 2009, 24 live bird markets have been renovated and upgraded, with market personnel trained for maintaining a higher level of biosecurity and hygiene in markets, both within Dhaka and other parts of the country. A live bird market is a hub where large numbers of poultry are brought from all over the country, and thus can act as a reservoir of virus, infecting birds passing through the market. Markets are normally physically and culturally located at the centre of communities, and so are also hubs for human activity, with many consumers visiting daily. Markets were used as a showcase for the benefits of improved biosecurity, as the improvements made can be readily perceived by the general public. Consumers in Bangladesh traditionally buy live poultry and have them slaughtered and eviscerated at the market, and this tradition will persist for some time in the future. Thus, the challenge is to make the live bird market system work, while reducing some of the risks for disease transmission. Interventions are aimed at making the interface between humans and poultry safer by controlling virus levels in the markets, and reducing the risks of onward transmission of virus from markets back to communities.

Eight markets in Dhaka and 16 in other parts of Bangladesh were selected using the following criteria: they were in areas where at least one outbreak of H5N1 HPAI had occurred in the past; they were located along a transportation route of poultry or at geographically important borders; and they had multiple vendors all situated in sheds, with concrete floors already existing, to maximize cost efficiency. With a limited budget (US\$ 575,000), the renovations only comprised tiling floors, providing a water and power supply, drainage for sewage, and small slaughter room. Training was conducted for veterinary officers in charge of markets and market personnel, on the use of power-sprayers and high-pressure washers for decontamination/cleaning of floors at the end of the day, as well as vehicles used for transportation of poultry. The inauguration of one of the markets was celebrated in Dhaka on 27 April 2010 and included invitation to various stakeholders and government officials. The event was highly praised by participants and attracted substantial attention from media outlets including national television, and demonstrated that the renovated live bird markets are an excellent tool for advocating the importance and benefit of biosecurity and hygiene for prevention of H5N1 HPAI and other diseases, as well as providing consumers with a better source of poultry from the perspective of food safety.

of the factors which contribute to outbreaks and so result in better policies and strategies for disease control. It is evident from the mapping work carried out that this capacity building has very immediate practical applications, however, in Bangladesh this capacity building in epidemiology and information management requires long-term technical and material support as the veterinary services were strengthened from a very low base in this area. Activities in the cross-border regional project and those in Bangladesh linked to this project

have resulted in much more constructive dialogue on disease control with neighbours and have led to now closer cooperation in looking at the issue of HPAI in the entire zone, rather than on a strictly country basis, with the international border being a constraint to disease control efforts. In relation to Bangladesh, India has offered technical and material support to assist with issues of mutual interest, such as H5N1 HPAI virus characterization. The work with the private sector in markets and also with the biosecurity programme has brought the various players closer together and increased dialogue with government services. This is an important step for the future as effective dialogue is required between both sectors for the success of the programme. The market restructuring project has an impact on public health, and has now captured the interest of a number of additional markets not originally included. These steps are important in the long-term aim to improve the public health aspects of live bird markets in major population centres.

The active surveillance carried out by the 780 Community Animal Health Workers (CAHW) engaged by the program and involving the SMS Gateway visits about 30-50 households per CAHW per day, but it is recognized that there is a low chance to find a disease at low prevalence on a household basis. At the same time the SMS gateway surveillance records the absence of clinical disease at the locations visited so it provides data on where disease is not occurring. However, the overall conclusion is there is not a clear picture of just how much H5N1 infection is occurring in poultry in the country and work must continue with surveillance at the village and small farm level to maintain the present level of control.

Activities undertaken related to Pandemic (H1N1) 2009 and other TADs

FAO has conducted sample collection for sero-typing and genotyping of FMD viruses. Bangladesh has been recording passive surveillance data on FMD cumulative incidence by area and month. In 2010, there were 39,269 affected animals reported throughout the country. Based on DLS data, 219,532 vaccine doses were administered. Bangladesh is at Stage 1 on the Progressive Control Pathway for FMD (PCP-FMD), focusing on adopting a comprehensive plan for obtaining a complete understanding of the epidemiology and socio-economic features of FMD in the country. FAO has submitted a Strategy Brief to the government based on the results of a Rapid Appraisal carried out in October 2009. The strategy has four components: surveillance, vaccination, animal movement management and communication management. The strategy is currently with the government for further review and approval.

FAO is also participating in efforts to improve rabies control in Bangladesh. A programme is being initiated by the Humane Society International and a local NGO to implement an effective reproductive control programme to replace inhumane killing of stray dogs, to control rabies. A meeting of interested parties, including agencies from the Ministry of Health and Ministry of Fisheries and Livestock was organized to launch a survey of the dog population in Dhaka.

Conclusion

Bangladesh has contained H5N1 HPAI to acceptable levels and this is a considerable achievement given the significant constraints faced by DLS and the poultry sector, and that

this situation has been reached without resorting to a vaccination programme. FAO continues to be a lead institution in supporting Bangladesh's efforts at prevention and control of HPAI and plays a key role in coordinating technical inputs from various donor sources. In the future greater coordination with neighbouring countries is expected, to develop a regional approach to control, in view of the frequent cross-border movement of poultry in the Gangetic Plain region.

For some periods of the year virus circulation is at a level where it is not detectable by the surveillance systems in place and it would appear that a reservoir population may be involved in maintaining the virus between the epizootic peaks. FAO and DLS are working to gain a better understanding of the factors which influence the prevalence of infection and disease, so that the effectiveness of control efforts can be increased. An additional programme component has a direct impact on hygiene and food safety in the poultry marketing system and it is recognized that this part of the value chain must be improved if disease control is to be strengthened: the role of public-private partnerships is paramount in this respect.

THE PEOPLE'S REPUBLIC OF CHINA

FAO's contribution to the national HPAI response in 2010

The field activities of the programme in China took place in three provinces in southern China (Guangxi autonomous region, Hunan and Yunnan), together with Chongqing Municipality. The latter was included in this phase in order to support the development of additional activities on risk assessment and more specifically address the concept of disease free zones and compartments.

The ECTAD China Team regularly produces bulletins/publications that are shared with the main national stakeholders including the MoA and donors. A monthly bulletin, the *China Monthly HPAI Highlights*, reporting on key activities and events continues to be produced, and the technical bulletin, *China HPAI Situation Update*, provides information and in-depth analysis of the HPAI situation, together with information on PRRS and FMD as the circumstances require. The second issue of a larger publication, the *Project Achievement Report*, was finalised in late-2010 and is available to wider national and international audiences.

FAO has a strategy to promote PPPs on biosecurity, and the global project leader conducted a mission in mid-June 2010 to assist ECTAD China prepare a concept paper for an approach to improve biosecurity in live bird markets. This concept, including examination of compartmentalization, was incorporated into the next phase of funding for the China programme.

To strengthen epidemiology and surveillance functions, activities have been carried out at different levels to enhance the capacity of the national services to gather information and investigate outbreaks, as well as to apply best practice solutions in analyzing existing data pools. Consultant expertise has been utilized to finalize the ongoing analysis of the HPAI environmental risk factors in China and the potential role of live bird markets in HPAI spread. Together with the ECTAD team, the results of the market chain analysis studies conducted in 2009 were reviewed and applied to social network analysis (SNA) to gain additional insight on disease risk assessment and management. Work was also carried out on disease risk mapping techniques and modelling. In applying these techniques the consultants also conducted a workshop with colleagues from CAHEC to introduce them to the analytical approach. Similar level training was conducted in risk assessment for veterinary staff in Chongqing. In relation to the role of live bird markets, cross-sectional and longitudinal surveys have been carried out on markets in the three project provinces and Chongqing Municipality. Local veterinary officers were trained to conduct these surveys. An associated plan for a poultry sector review in Hunan and Yunnan provinces was prepared and submitted for review by the MoA.

Curriculum development was an important aspect, including conducting needs assessments and setting the framework and guidelines for the FETPV. This initiative was launched in November 2010. In addition to this national initiative, two national veterinary epidemiologists also participated in the regional FETPV in Thailand.

At the field level, training workshops on disease outbreak investigation and surveillance protocols were conducted in Guangxi, Hunan and Yunnan involving a total of 75 veterinarians and animal health officers (of whom 28 were women). In addition, the initial training

on GIS for four provincial veterinary officials and staff (including two women) in Chongqing was completed.

In relation to ongoing activities to enhance the understanding of virus transmission capability between domestic and wild waterfowl and the overall HPAI epidemiological cycle, ECTAD China coordinated meetings between FAO's Wildlife Unit, the China Forestry University and the Jiangxi Provincial veterinary authorities, to develop a detailed plan for a field study at Poyang Lake in Jiangxi Province. A field study was conducted at this wild bird/ domestic poultry interface in January 2010.

During 2010, EMPRES-i Asia, a regional animal health information system was launched with significant input from the ECTAD China team. It is anticipated that this information system will be widely used by a range of professional institutions and individuals in Asia, as well as veterinary epidemiologists in the public and private sectors internationally.

A mission was conducted to strengthen international cooperation with the OFFLU global network. Workshops covering theoretical and hands-on training in biosafety, management and test validation were conducted at two partner laboratories (Chongqing Municipality and Nanning and Guangxi Provincial laboratories). In the Nanning laboratory sequencing activity was performed and OFFLU sequence primers and SOPs were shared with the participants. A total of 60 veterinary officers/staff (34 women) participated in the training sessions.

ECTAD China also provides technical support to the HPAI control programme in Mongolia and during 2010, two missions were conducted: the first concerning the design of an Incident Response Information System (IRIS) to manage surveillance, early warning and response for AHL; and the second to conduct an HPAI risk assessment for the introduction of the disease in Mongolia.

Country Capacity: progress over the reporting period, impact and areas for attention

The results of the country team survey on the six key areas are shown in [TABLE 4.2](#) below. As indicated above the FAO contribution is strategic and focused both in relation to the technical area as well as geographically. However, the FAO view is that there is significant capacity in China for the national services to replicate the inputs widely once their application is accepted and understood. It is also recognized that progress must be incremental and the inputs are required at a number of levels to ensure synchrony in application and understanding. In this respect the training programmes are delivered either simultaneously or in sequence to the various stakeholder levels.

The scores shown in the progress table to some extent, with a large country such as China, have to be seen in the context of the FAO project activity and the institutions with which FAO ECTAD engages. The FAO activity is currently limited to the three project provinces and to the municipality (other than the inputs that are made centrally with MoA agencies and the CAHEC in Qingdao). However, the input model applied at the provincial level is beginning to see significant dividends as there is increased engagement and application of technical approaches with surveillance and epidemiology applied to the live bird market system. It is noted that to make changes in these systems will take some time but the policy directions will derive from the knowledge that accrues from the surveillance now being systematically undertaken. The FAO programme underpins the process. Ultimately, the live

bird market surveillance activities that took place in the three provinces helped the government in strengthening national and local surveillance capacities, and more specifically: 1) enhanced identification and understanding of the circulation dynamics of HPAI strains; 2) improved the understanding of the potential increased risk of waterfowl and spent hens for disseminating HPAI; 3) increased knowledge of market-level risk factors which contribute to the persistence of HPAI in markets; and 4) created opportunities for close collaboration between public veterinary services and the private sector in a synergistic manner, which is critical to improve the national and local capacity to respond to infectious diseases.

In achieving these outcomes central, provincial and local veterinary staff have been trained in various disciplines, including: 1) laboratory good management practices and biosafety (58 people trained); 2) disease risk analysis (45); 3) disease modelling (20); 4) disease outbreak investigation (68); and 5) GIS (15). This training provides capacity building in areas that are key to the ongoing development of the national HPAI programme in China. With respect to an assessment of laboratories, there is likely to be a range of levels across the country. While Harbin is an OIE International reference laboratory for HPAI, the provincial laboratories required inputs to upgrade standards and significant strengthening has been achieved, although there are also possibly other laboratories where similar upgrading in capacity is necessary to level the overall national standard.

The FETPV has made good progress, and with suitable monitoring will develop into a very important tool to strengthen the epidemiology capacity of the veterinary services, especially at the provincial, and later, the prefecture levels. In addition, work on the analysis of epidemiological data and the development of models adds to the understanding of disease patterns and provides opportunities for the modification of strategy to better fit the

TABLE 4.2
Progress for China in six key programme activities/indicators in 2010

Activity/Indicator	Assessment (as of December 2009)	FAO's contribution to this result	Evolution over the previous RP	Evolution over the current RP 2010	FAO's contribution to this result
Preparedness	3	C	↗	→	C
Surveillance	4	S	↗	↗	S
Response	4	C	→	↗	S
Laboratory capacity	5	C	→	↗	C
Compensation	3	-	→	→	-
Biosecurity	2	C	→	↗	S

Level:

1 = very poor; 2 = poor; 3 = fair; 4 = good; 5 = very good

Contribution:

S = significant; C = collective (financial input shared with other partners and/or the country); NC = no contribution

Evolution:

↗ = capacity has increased substantially; → = no substantial change in capacity;

↘ = capacity has decreased substantially

ecology of the disease. The introduction of the social network analysis has proved to be a very useful tool in China as it has demonstrated clearly the significant networking in the market systems and therefore the presence of a large and effective conduit for the spread and recirculation of H5N1. Work at the wildlife interface is also providing insights into the potential routes for transmission of H5N1 into domestic poultry from wild birds, and also in some instances for the reverse movement to occur.

The project also contributed to enhancing understanding of HPAI ecology in China, by completing a risk mapping and modelling study based on outbreak and surveillance data collected since June 2007. The analysis suggests that there are three broad zones for consideration in the disease control strategy: one in which the virus is maintained (where there are most ducks); another where the virus moves to regularly (where there are most chickens); and finally, where the virus only occasionally appears. The output of this model can now be used to design surveillance to test whether the underlying hypothesis is correct and if this is so could lead to specific strategies to create compartments to control the disease.

The commissioning of EMPRES-i Asia was a significant milestone. By improving monitoring of priority infectious diseases and building up an effective early warning and response mechanism, this information system will help to mitigate the risk of emerging and re-emerging zoonotic and non-zoonotic TAD threats across Asia.

Activities undertaken related to Pandemic (H1N1) 2009 and other TADs

FAO ECTAD has established a United Nations working group to monitor diseases at the animal-human-ecosystem interface and have organized two meetings to discuss significant issues: on a new bunyavirus discovered in China; and on rabies. The team also provided situation updates for PRRS and FMD which were shared with GLEWS. At the regional level, the ECTAD China team provides technical consultancy and advice to a World Bank project in China and Mongolia, and has taken the main responsibility to develop a regional TCP project on TADs, involving China, Mongolia and Russia.

Conclusion

H5N1 HPAI is still endemic in some parts of the country despite efforts by the government to improve the surveillance and control of the disease. Vaccination is used widely throughout the country to bring the disease under control, however the virus is still circulating in some production systems where the programme is not fully effective. This may be due to efforts required to implement the policy, in that regulations are difficult to enforce in some production environments, or the production system is not fully amenable to control of infection, such as in free-range ducks.

FAO is making a major contribution to strengthening the national programme through strategic inputs to surveillance and epidemiology capacity building. The uptake of FAO inputs is encouraging and the new China FETPV will have a major impact on the building of capacity in this important area. Some key national institutions are also beginning to develop expertise in data analysis and interpretation which will lead to more real time translation of information into control strategy. The project will progressively move towards the One Health approach, promoting the concept of high-impact disease prevention and control at the human-animal-ecosystems interfaces.

EGYPT

FAO's contribution to the national HPAI response in 2010

National projects are concerned with the field situation and control issues; and on molecular characterization of H5N1 viruses and the selection of candidate vaccine strains. The development of PPPs were also a major activity during 2010 (as described in Chapter 3).

During 2010, the strategy for the control and eventual elimination of H5N1 from the poultry sector in Egypt was revised by FAO (HPAI Animal Health and Livelihood Sustainability Strategy) and then adopted by the Government of Egypt. A wide group of stakeholders contributed to the process of revision, including international agencies and donors. National interest inputs were provided by the General Organisation of Veterinary Services (GOVS), the National Laboratory for Quality Control on Poultry Production (NLQP), the animal production sector, the Central Laboratory for Evaluation of Veterinary Biologics (CLEVB), regional laboratories and veterinary directorates, and the Egyptian Poultry Producers Association.

The new plan emphasizes the need for longer-term risk reduction interventions – as opposed to an emphasis upon measures such as stamping out in the original plan from 2006 – and measures such as biosecurity, improving market chain management, and strengthening veterinary services, and addressing the underlying issues which affect the socio-economics of disease control (including enhancing understanding of the poultry value chain and its socio-economic challenges). Critical risk points along marketing chains will be identified, where the potential for intensive virus propagation (heavy viral load) and risk of virus spread is high. To assist with the implementation of the plan, a new national Animal Health Technical Committee (AHTC) for HPAI has been established by a Ministerial decree, under the direct leadership of GOVS. The committee is composed of representatives from national and international organizations, with FAO serving as the secretariat. The main role of the AHTC is to provide science-based technical advice to the Ministry of Agriculture and Land Reclamation (MoALR) and the National Avian and Human Influenza Supreme Council (NAHISC). During the latter part of 2010, activities of the strategic action plan began to be implemented, including establishment and equipping of 50 (of a planned 120) decentralized epidemiology units. Programme findings and planned activities are communicated through the *Monthly HPAI News Review* and the Strengthening Avian Influenza Detection and Response (SAIDR) project (OSRO/EGY/701/USA) website.

Substantial efforts have been made to improve biosecurity measures in order to reduce virus circulation in poultry populations, and reduce bird-to-human transmission. LOAs were signed with high-risk governorates to implement a biosecurity programme according to a set of guidelines prepared by the FAO global project, and monitoring of the implementation of LOAs indicates steady progress. Training sessions on biosecurity practices have been conducted for a total of 90 trainees, from 12 governorates. The training was designed to assist GOVS in forming district-level biosecurity teams in HPAI high-risk governorates.

In order to strengthen HPAI surveillance, the CAHO programme was established, involving the deployment of a network of trained (participatory skills) field veterinary practitioners. The CAHO teams work closely with local communities to increase awareness of HPAI and undertake disease outbreak surveillance and investigation. The establishment of CAHO

involved substantial needs assessment, training and evaluation. A total of 108 CAHO qualified practitioners currently operate in 15 governorates. During the period from July-September 2010, CAHO teams visited 460 villages and detected 29 HPAI-suspected cases. Of these, nine outbreaks were RT-PCR confirmed HPAI positive. In general, 24 percent of confirmed HPAI outbreaks from the household poultry sector were reported through the CAHO programme. A web-based CAHO database system has been created to enable decentralized data entry (by CAHO), and collation and analysis by the GOVS epidemiology unit.

Wild bird surveillance activities have also taken place in collaboration with GOVS and NLQP. Domestic ducks residing near important migratory bird resting sites around wetlands in Lake Manzala were also tested. Laboratory consumables were supplied to support the various surveillance activities. An HPAI hotline service was established within the premises of GOVS and staff received practical training on hotline system operation.

Significant efforts were made to strengthen the disease outbreak investigation and response capacity of governorate veterinary services. LOAs were signed with 22 governorates to enable them to cover the running costs for field operations. Eight training courses were conducted involving field teams engaged in disease investigation and response activities. Personal protective equipment (PPE), disinfectants and ancillary equipment were also provided to governorate veterinary services.

The Avian Influenza Vaccine Efficacy Project (AIVEP) has undertaken activities in the following areas: screening and evaluation of genetic and antigenic variants among existing H5N1 HPAI field strains (previously collected from 2006 until early-2008); intensified collection of H5N1 HPAI field isolates from newly confirmed outbreaks (since mid-2008); challenge testing of antigenic variants in specific pathogen free (SPF) birds vaccinated with avian influenza (AI) vaccines currently used in Egypt, and; controlled transmission trials in the laboratory on birds raised and vaccinated in commercial poultry farms. Backstopping is provided by the OFFLU team at FAO HQ and the work is conducted in close collaboration with USDA's South East Poultry Research Laboratory in Athens, Georgia as well as with the Erasmus University in the Netherlands.

Country Capacity: progress over the reporting period, impact and areas for attention

The results of the country team survey on six key indicators are shown in [TABLE 4.3](#) below. It is recognized that there are gaps in the control programme implementation in Egypt (see the endemic country assessment in Chapter 5), but the new strategy adopted by the government is expected to make incremental gains in addressing these. The inclusion of socio-economic issues in the strategy is recognition of the need to engage as effectively as possible with the disparate group of stakeholders involved with the poultry sector, and whose 'buy-in' is essential to successful strategy implementation.

The programme assessment affirms that the establishment of the CAHO network and the support to governorate veterinary services has been a fruitful approach to improving disease surveillance and outbreak response capacity. There has been a sharp rise in outbreaks detected, and control measures implemented. As in any other endemic country, there is an intrinsic difficulty in establishing an effective and efficient surveillance system. The activities of the CAHO network, in conjunction with other measures, will gradually

TABLE 4.3
Progress for Egypt in six key programme activities/indicators in 2010

Activity/Indicator	Assessment (as of December 2009)	FAO's contribution to this result	Evolution over the previous RP	Evolution over the current RP 2010	FAO's contribution to this result
Preparedness	3	S	↗ (3)	↗ (3)	S
Surveillance	3	C	↗ (3)	↗ (4)	S
Response	2	C	↗ (5)	↗ (2)	C
Laboratory capacity	5	S	↗	➔ (5)	S
Compensation	3	S	n.a.	n.a.	n.a.
Biosecurity	2	C	➔ (3)	↗ (3)	S

Figures in brackets in each box after the arrow are score for Dec 2010

Level:

1 = very poor; 2 = poor; 3 = fair; 4 = good; 5 = very good

Contribution:

S = significant; C = collective (financial input shared with other partners and/or the country); NC = no contribution

Evolution:

↗ = capacity has increased substantially; ➔ = no substantial change in capacity;

↘ = capacity has decreased substantially

reduce the level of H5N1 that is circulating. The network and other activities are also having an impact on the overall coordination of disease control. Nevertheless, while the CAHO network is an important development, it is still limited in capacity to detect disease. It is expected that there will be significant number of disease incidents that go undetected or unreported until such a time as poultry producers fully participate in the process.

The work on virus characterization is increasing understanding of the relationship of field viruses to vaccines strains, and developing the confidence of commercial producers and the government in the efficacy of vaccines, and so for the former encourages the use of this control tool, as it is an additional cost to production. The interaction with international collaborating partners also builds technical capacity in the national laboratory system, facilitates the maintenance of quality in diagnostic processes and encourages the sharing of key information.

With regard to the biosecurity programme, preliminary assessment results indicated that approximately 65 percent of poultry producers who participated in FAO training events have made substantial improvements in the biosecurity status of their farms. This is believed to have multiplier effects as other producers observe the general benefits to production of improving farm biosecurity practices.

The review of the national programme undertaken by FAO has resulted in some important insights and changes to the approach to be used in controlling the disease in this endemic country. The following issues are common to the endemic countries, but in particular are raised by ECTAD Egypt as important lessons learned from the experience of H5N1 HPAI control to date.

Lessons learned

- (i) Where a combination of multiple risk factors exist, and where veterinary services are weak, surveillance and culling does not succeed in controlling HPAI.
- (ii) Mass AI vaccination of household and scavenging poultry is inefficient and unsustainable.
- (iii) Poultry producers, from large-scale commercial enterprises to households, are reluctant to cooperate in reporting outbreaks of disease, as they fear the consequences.
- (iv) Deficiencies in veterinary services are a major contributory factor for H5N1 HPAI to become endemic.
- (v) Achieving sustainable HPAI control in endemic countries requires a long-term approach.

Activities undertaken related to other TADs

ECTAD Egypt, in collaboration with GOVS and governorate veterinary services, has begun implementing a new project (MTF/INT/003/EEC) on FMD. This project is a continuation of the support provided under the FAO-funded TCP project (TCP/3105/EGY) implemented during the previous year. The proposed actions in the new project are in line with the concept of the Progressive Control Pathway for FMD (PCP-FMD). In this concept, insight is achieved with respect to virus circulation in large and small ruminants on a national basis to complete Stage 1 activities. This includes improving epidemiological analysis of FMD outbreaks, and gaining more insight into the efficacy of the national vaccination campaign in order to make the first steps to reduce virus circulation in Egypt, and enter Stage 2. After evaluation, the next phase is foreseen as providing a broader basis for justification of PCP Stage 1, and to take the necessary steps on the pathway for Stage 2. The latter includes continued passive and active surveillance, outbreak analysis, and continued laboratory twinning for implementation of PCP Stage 2 assays (under ISO 17025 accreditation). It has three main components:

1. Increased passive surveillance in most governorates with isolation of field viruses, vaccine matching, and further characterization of field isolates by Pirbright World Reference Laboratory (WRL) in the UK.
2. Active surveillance in most governorates consisting of campaigns with a one-year interval to establish baseline data about FMD (sero) prevalence and identify high- and low-risk areas, in line with the requirements of Stage 1 (the first campaign foreseen under this project proposal).
3. Strengthening laboratory capacity to support FMD monitoring/surveillance and control programmes.

Project implementation commenced in the final quarter of 2010.

Conclusion

The partnership between FAO and the government has been considerably strengthened and the adoption of a widely canvassed disease control strategy will provide a common platform for the partnership to further develop. The strategy also provides a clear framework for existing and prospective donors to channel support and to assess the impact of

CASE STUDY 4.3

Animal Health and Livelihood Sustainability Strategy, Egypt, 2010

The revised strategy for HPAI control in Egypt is a development from the previous one, but with changes having significant implications. Firstly, it recognizes the long-term nature of the approach, with three interlinked phases to the strategy and five years for the control phase. Such prolonged activity can only take place if it is economically sound and socially acceptable. Preventing outbreaks by cost-effective means and limiting virus transmission along the poultry value chain in ways which do not impact negatively on peoples' livelihoods are given a greater emphasis than the emergency intervention of responding to outbreaks by mass culling. Secondly, it emphasizes the need to improve veterinary services and such investment needs to bring benefits not just to the poultry industry but to the prevention and control of other TADs and EIDs, including zoonoses, in Egypt. The key areas of improvement include: strengthened planning of HPAI prevention and control efforts; epidemiological expertise applied to strategic and tactical planning; coordination between the different levels of government veterinary services; and regulation of livestock movements and veterinary public health and food hygiene in slaughterhouses and retail markets. Thirdly, the proposed strategy calls for greatly improved collaboration between government veterinary services and poultry producers, in all production sectors. Without producers' and relevant private sector engagement, the changes required in improved biosecurity of poultry production and compliance with more effectively regulated market chains will simply not take place. Producers need to be involved in decision-making and empowered to engage, including at the level of small commercial producers.

The goal of the strategy is to achieve a situation where H5N1 HPAI no longer represents a significant threat to human health, and in which measures implemented by producers and supported by regulatory authorities minimize the impact of the disease on the industry, in a cost-effective and socially acceptable manner.

The measures will be directed at achieving two key outcomes:

- Improving biosecurity in the context of poultry production, to progressively reduce the incidence of HPAI; and
- Managing the movement of poultry and products along the value chain, to minimize the opportunities for spread of HPAI viruses.

The strategy has three – sequential but overlapping – phases: a control phase that is an extension of the current phase, mainly concentrating on building information on key issues such as social engagement; a consolidation phase during which the various biosecurity and regulatory measures will be introduced; and an elimination phase where, if the measures are effective the incidence will be reduced to a level where an all-out effort will eliminate the virus.

this support. The strategy will facilitate better engagement with the private sector and foster stronger coordination of efforts by the various institutions involved in the control programme. Challenges remain but with the measures presently put in place and expanding, the current endemic balance should be maintained at current levels, before a gradual period of elimination of the disease agent.

INDONESIA

FAO's contribution to the national HPAI response in 2010

Substantial, ongoing support is provided to the national response, directed through PDSR activities in 29 of Indonesia's 33 Provinces, and through 31 Local Disease Control Centres (LDCCs). These LDCCs directly utilize 36 percent of the budget of the OSRO/INS/604/USA project and are now responsible for reporting more than 90 percent of HPAI outbreaks detected in Indonesia. The district government-based PDSR teams, managed by the LDCCs, undertake routine surveillance of villages (active surveillance), as well as investigate poultry mortality reports or rumours received (passive surveillance). In the second quarter, for example, PDSR teams undertook 2,448 village visits and confirmed 171 cases (an overall detection rate of 7 percent) and all but four of the cases were the result of 'passive surveillance'. During 2010, a total of 1,473 cases were confirmed and a total of 19,511 village surveillance visits conducted. The PDSR system is currently being redesigned with greater emphasis on passive surveillance and disease prevention with refresher training scheduled for the second half of 2011.

A number of initiatives were undertaken to investigate ways to modify the PDSR approach to surveillance. The programme is working to integrate PDSR activity with other local government animal health activity and a field trial is underway in Sulawesi to include other diseases of national importance in surveillance activities. Selected LDCCs are also supporting market surveillance activities, and during the World Bank AI Project, community vaccination coordinators were included in the LDCC operation in four provinces. A structured survey was undertaken in a number of districts in Java to compare the PDSR passive surveillance system with a 'best estimate' of disease prevalence, in order to determine if significant under-reporting was occurring and to estimate the cost-effectiveness of PDSR surveillance activity. The FAO programme continues to advocate for support for PDSR activities from local government sources. In conjunction with these approaches, additional activities were undertaken with the Directorate General of Livestock Services (DGSL) to develop a strategy for strengthening national veterinary services.

In relation to the entry of HPAI into poultry market chains, longitudinal monitoring of live-bird markets and collector yards was carried out using a sentinel bird system, together with environmental sampling, in 231 live-bird markets in Jakarta and its surrounds. One risk factor for HPAI entering the market chain appears to be native chickens and one particular collector yard in Central Java that handles the supply of native chickens to the Jakarta market has been identified as a critical control point. Cleaning and disinfection stations for transport vehicles and recyclable poultry transport cages was introduced into two urban collection points and this is being expanded to three more. The FAO programme has provided training on cleaning and disinfection procedures as well as high-pressure washers, detergent, and disinfectant, and has delivered awareness raising communication to vendors and traders in 43 collection yards and 14 live bird markets in the greater Jakarta area, leading to regular cleaning days now being undertaken at the 14 markets. In terms of food safety/consumer issues, a programme on market hygiene and sanitation is being promulgated, along with refurbishment of slaughterhouses and assistance with market restructuring and trader relocation. In addition a campaign to promote healthy Halal chicken meat is being initiated.

The programme has a number of activities that are designed to engage the commercial sector in the HPAI control programme and to demonstrate the benefits of control. Trials have commenced with a limited number of medium-sized egg producers in Central Java to identify cost-effective biosecurity and management practices to improve productivity and reduce HPAI risk. The findings of these trials will then be incorporated in commercial production and biosecurity training and outreach materials. An international technical adviser with expertise in commercial poultry health has been engaged to work on issues of concern to the commercial sector and specific training has been provided to government officers working on biosecurity matters with the commercial sector. Continued technical, logistic and operational support was provided in collaboration with partners for targeted vaccination of small-scale layer producers in Yogyakarta, Central Java and West Java under the InVak intensified vaccination programme. The programme has also supported the

CASE STUDY 4.4

Engaging the poultry market chain to better understand and control HPAI in Indonesia

Market chain activities form an integral part of the HPAI Control Programme in Indonesia. Over the past year, significant progress has been made in working with public and private sector stakeholders along the poultry market chain to reduce risk of virus spread to both humans and poultry, as well as to better understand HPAI epidemiology in Indonesia through market-based surveillance.

To reduce disease spread between farms, FAO has worked closely with the Ministry of Agriculture to construct vehicle cleaning and disinfection (C&D) stations and train cleaning workers at wholesale poultry collector yards throughout greater Jakarta. By cleaning trucks as they exit the collector yards, the risk of virus spreading via the yard to farms is decreased. Two C&D stations are now fully operational with five additional stations in the pipeline, and staff at 43 collector yards have been trained and equipped for effective C&D. To reduce H5N1 risk to humans, FAO is also working with market vendors and local government veterinary public health services in live bird markets throughout the greater Jakarta area to provide C&D equipment, train workers, and rehabilitate facilities as needed. As a result of these activities, regularly-scheduled market cleaning days are now being performed at 14 live bird markets throughout greater Jakarta, with further expansion expected next year.

In order to better target control activities at source and assess control programme efficacy, FAO has also supported the local governments of greater Jakarta to conduct longitudinal environmental surveillance for H5 subtype virus at live bird markets, as well as to conduct targeted surveillance at poultry collector yards. This surveillance has already elucidated a high-risk trading network for native chickens and identified an upstream critical control point where risk reduction activities can be implemented. Establishment of an appropriate market chain surveillance system to identify high-risk farming areas is expected next year.

development of a national poultry quality improvement programme to facilitate collaboration between the private and public sectors. A trial of a private sector-funded culling compensation programme is also under development as part of the national poultry quality improvement programme.

Concerning vaccination, the programme is working with the DGLS to overcome the restrictions on the use of vaccines in ducks. Data collected in 2010 indicates that ducks are at least one reservoir of H5N1 within the poultry ecosystem in Indonesia, however further studies are required to fully quantify this risk. There is also much effort being made to implement antigenic cartography as a routine procedure for the virology laboratories in all the Disease Investigation Centres, so that viruses obtained from field investigations can be characterized in a timely manner for antigenic relatedness to vaccine strains in use.

Country Capacity: progress over the reporting period, impact and areas for attention

The results of the country team survey on the six key indicators are shown in [TABLE 4.4](#). The preparedness and response of the local animal health services has notably improved due to project inputs in areas such as Bali, Kalimantan and Sulawesi, and showing low or sporadic incidence of disease. This is encouraging because it indicates that all the stakeholders are more aware of the disease, quicker to report and respond and local control measures are preventing substantial outbreaks from developing. There is also increased understanding in the commercial sector of the risk posed by introducing stock from areas with a high prevalence of H5N1, in part due to programme communication and activities that engage with the private sector. There is still an ongoing issue with the DGLS to approve trialling a targeted duck vaccination programme, but FAO is working closely with DAH to overcome the impediments to control of infection in ducks.

The PDSR approach continues as a major activity of the programme. There have been several modifications to field activities, management, and the data collection system since the programme started and these have increased programme efficiency, local ownership, and the utility of the data. At present it appears that a poultry mortality report initiated from the community is the most effective means of detecting HPAI in village poultry (passive surveillance). It is recognized that outbreaks are now not a common event and so active disease searching is not as efficient at locating outbreaks as it had been. It is hoped that by integrating the PDSR HPAI programme with the surveillance for other important diseases, it will become more institutionalized within the routine activity of the local government animal health service. The PDSR programme has made steady and consistent progress in understanding the ecology of the disease, given the independence of the provincial and district administrations; the lack of effective regulation of a very large poultry sector from a disease control and public health perspective; the limited interest of the commercial sector in coordinated disease control efforts; the generally low understanding of disease and best management practices by small producers; and the extensive initial geographic spread of H5N1. Another impact of the programme has been the intensive, reinforced training which has resulted in the animal health services developing greater understanding of the problems faced by their clientele, and in a stronger rapport with them. The FAO programme overall also has an impact on the issues arising for national disease control from the lack of

TABLE 4.4
Progress for Indonesia in six key programme activities/indicators in 2010

Activity/Indicator	Assessment (as of December 2009)	FAO's contribution to this result	Evolution over the previous RP	Evolution over the current RP 2010	FAO's contribution to this result
Preparedness	3	I	↗	↗	S
Surveillance	4	S	↗	→	S
Response	2	C	→	↗	S and C
Laboratory capacity	4	C	→	→	C
Compensation	1	NC	→	→	NC
Biosecurity	-	-	-	↗	S and C

Level:

1 = very poor; 2 = poor; 3 = fair; 4 = good; 5 = very good

Contribution:

S = significant; C = collective (financial input shared with other partners and/or the country); NC = no contribution

Evolution:

↗ = capacity has increased substantially; → = no substantial change in capacity;

↘ = capacity has decreased substantially

integration of veterinary services, especially through the activities of the nationally staffed HPAI Campaign Management Unit.

The laboratory system has been incrementally improved during the HPAI programme, and inputs are made from both FAO and other agencies to implement a proficiency-testing programme to improve the reliability of the diagnostic services. There are still some constraints from the FAO perspective regarding the uptake of the full level of support available from international partners through OFFLU, concerning virus characterization and vaccine strain selection.

The efforts to improve biosecurity are focused at the production level, on the mid-commercial sector and at the market chain on cleaning and disinfection (C&D) activities associated with transport systems for live-bird markets. The uptake of the C&D has been promising once initial negotiations over location and other operational issues were overcome.

FAO is also now supporting the development of a private sector-funded culling compensation scheme in Indonesia. In general compensation can only be an effective support to disease control where there is a high level of commitment from the producer community to control the disease. There is still some way to go in this regard in Indonesia.

Activities undertaken related to Pandemic (H1N1) 2009 and other TADs

Training courses were conducted in Indonesia in June 2010 on surveillance and laboratory diagnosis of H1N1 and other influenzas for staff of the DGLS as part of the regional project TCP/RAS/3211 (E), 'Emergency assistance for surveillance of novel influenza A subtype H1N1 viruses in pig and poultry production sectors in high risk Southeast Asian countries'.

FAO re-initiated consultation with the DGLS on the provision of strategic coordination, epidemiological and community awareness raising support for the Bali dog rabies control

campaign, through a TCP. There is the likelihood of high-level DGLS support for a partnership with FAO in the rabies control programme.

In respect of interest to broaden the focus of PDSR activities, FAO is assisting DGLS in the design of a new animal disease surveillance system which will monitor and report on a number of nationally identified priority diseases, some of which are also regionally important TADs.

Conclusion

The 2009 real-time evaluation outlined the strengths and weaknesses of the FAO HPAI control programme in Indonesia and the ECTAD unit has begun to address the problems and build on the strengths. The problems facing Indonesia for control of important animal diseases are considerable, not only for the control of HPAI, but also other diseases, such as rabies in Bali. It is difficult to obtain support for animal disease control in isolation: it needs to be linked to an important economic or social issue for a control programme to gain the necessary political traction. Political support was aroused when the first HPAI human cases occurred, but to some extent the interest level has decreased in this issue. The popularity of the PDSR system with constituent communities has bolstered political support for animal health services locally, but less so at the national level. Moreover, as most of the outputs of animal production in Indonesia are consumed at home, there is little incentive to improve to meet international standards. The gradual improvement in veterinary services will be driven by increased national income and with that increased consumer demand for safe food.

VIET NAM

FAO's contribution to the national HPAI response in 2010

During 2010, the USAID project supported the DAH at the central level, as well as intensified surveillance and control activities in five provinces (Ha Nam and Hung Yen in the Red River Delta, Quang Tri in the Central region, and Can Tho and Kien Giang in the Mekong River Delta). In addition, there were countrywide activities dealing with biosecurity, and some focused follow-up in two border provinces to the regional cross-border project. FAO supports the the Post-Vaccination Monitoring (PVM) and the Virus Circulation Surveillance (VCS) programme which is monitored at the central level by DAH but implemented at the provincial level. The PVM and VCS are carried out in 18 and 8 targeted provinces, respectively (some of which are the five pilot project provinces). Project OSRO/VIE/801/USA is entitled 'Gathering Evidence for a Transitional Strategy (GETS) for HPAI H5N1 Vaccination in Viet Nam'. The GETS project is implemented through the Provincial Sub-Departments of Animal Health (SDAH) in five provinces, four of which compare a modification of the standard vaccination approach (Nam Dinh and Ninh Binh in the Red River Delta and Soc Trang and Hau Giang in the Mekong River Delta) and one (Quang Binh in the central region) in which there is complete withdrawal of the government vaccination programme in a selected number of districts.

The project 'Immediate Technical Assistance to Strengthen Emergency Preparedness for Highly Pathogenic Avian Influenza (HPAI) to Viet Nam' has been the principal source of technical assistance to the government from FAO and has been extended on a number of occasions. At the central level, the project provides support to the disease information management system used by DAH (TADinfo) and for the national disease reporting hotlines. The project undertook a major review and revision of the disease response manual with the preparation of specific job cards to guide operational roles in controlling and investigating outbreaks. Training was conducted in the pilot provinces and the procedures evaluated before the manual was handed over to the DAH for adoption. For the field aspects of this project, activities to strengthen control were implemented in five pilot provinces. A risk-based approach for improving the early detection of suspicious cases was developed and tested. This new model of active surveillance focused on disease searching in higher risk areas (defined using agreed criteria) through involvement of Commune Animal Health Workers (CAHWs), but does not involve routine sample collection unless there is suspicion of unusual events in poultry. In targeted high risk communes, CAHWs carry out field visits in each village once or twice a month (respectively during low- and high-risk periods) to meet with key informants, and to monitor the sales of veterinary medicines in veterinary drug shops as an indirect indicator of a potential unusual event in the poultry sector. The project collaborates with other partners in the delivery of an intensive communication and advocacy campaign to support surveillance activities, and to increase awareness of good practices in production and marketing.

This project also continued to provide technical support to the government HPAI vaccination programme by continuing evaluation of vaccine efficacy against current outbreak strains, and reframed the sampling design for post-vaccination sero-monitoring and virus circulation surveillance. In October, the project team and the GETS team contributed to a

DAH workshop on the new strategy for the vaccination of poultry against H5N1 HPAI in Viet Nam, and provided a technical evaluation of the proposed amendments to the existing approach.

The FAO technical support to the WB-funded VAHIP (UTF/VIE/034/VIE) has focused on five sub-components:

- strengthening veterinary services with improved capacity and reliability of laboratory diagnosis;
- enhanced disease control with upgrading of markets and slaughterhouses, better control of smuggled poultry and recommendations for improved use of vaccine in young ducks;
- improved epidemiology and surveillance with cross-sectional and purposive surveys to better understand disease incidence and the prevalence of infection;
- preparation for industry restructuring by strengthening the Department of Livestock Production (DLP), providing biosecurity standards for disease-free certification of farms and developing model farms;
- improved emergency preparedness with increased public awareness, better reporting and investigation of suspect cases, the provision of emergency response materials and the conducting of simulation exercises.

During 2010, work was undertaken to extend the approaches to understanding poultry production systems in various provinces and how to develop and implement better production practices, including biosecurity. The project supports the regular meetings of the Biosecurity Working Group (BSWG) which includes representation from the DLP. Outcomes of the BSWG work and some consultant input included a broadening of the approach to disease control to include other issues besides H5N1 HPAI, and the inclusion of private sector service providers in this effort. Meetings were held which included key private sector stakeholders to enable engagement in the process, and extension materials are being produced to assist private sector operators. An ancillary activity being undertaken is the registration of hatcheries in the target provinces. In generating a risk management approach to HPAI control, an important tool for the provincial SDAH and DLP is the *Atlas of Poultry Production* which was produced by FAO.

In addition to technical support to monitoring vaccine efficacy, the project continues to provide guidance and material inputs to the operation of the laboratory network and supports laboratory network meetings (Epi-LabNet) to discuss issues relating to diagnosis and field-related issues. There is also collaborative effort with the laboratory component of the VAHIP project for strengthening the reliability of laboratory performance through proficiency testing and the associated calibration of laboratory equipment. The project also supported the production of a *Laboratory Biosafety Manual* for the diagnostic laboratories handling H5N1 submissions.

The GETS project involves a significant amount of stakeholder consultation to obtain the necessary agreements and engagement of the various levels of stakeholders involved in project delivery in the field. Through this mechanism, the GETS project determined that in the high-risk provinces of the river deltas the main focus of the project would be to intensify the vaccination of ducks, as these play an important role in virus maintenance,

and to monitor this vaccination programme closely. In one high-risk province routine vaccination of poultry by the government programme was to be withdrawn, but variations on the government-supported vaccination of poultry were to be implemented in the other three provinces. The project endeavours to manage risk of HPAI outbreaks with a package of ancillary measures aside from vaccination, and these include improved understanding of a range of issues related to attitudes of traders and producers to disease, as well as socio-economic impacts of the control measures implemented. The monitoring programme for the GETS project is intense and to establish it properly a lot of training was required for the CAHWs. One important activity carried out by CAHWs has been to monitor the presence of mobile duck flocks in the commune and to vaccinate any that are detected. There are large numbers of these migrating through the project districts and many are unvaccinated. Circulation of virus in the duck population is monitored by an extensive network of sentinel flocks. Using supply chain analysis the project has also looked in depth at the market system, and how this can be a source of risk for spread of disease to poultry units. A surveillance system has been initiated to detect virus circulation in markets and a system for trace back and further investigation at the source has been designed. The various activities in the project are supported by an intense public awareness campaign.

In April 2010, during the IMCAPI meeting, the GETS project arranged for a visit of the US delegation to the USAID project sites in Ha Nam and Nim Binh. In October 2010, the project presented preliminary findings to a workshop conducted by DAH to review the current HPAI vaccination programme and these findings were a major contribution to the amendments proposed by the government. The project is also exploring the needs for policy change in response to project findings and how information from the project can be best incorporated into the national HPAI policy framework.

A significant issue for FAO is to effectively coordinate with other operators in the field, particularly commercial contractors delivering services through the provincial and not the central, DAH. In the past there have been different approaches to technical issues as well as competition for human resources at the delivery level.

Country Capacity: progress over the reporting period, impact and areas for attention

The results of the country team survey on the six key indicators are shown in [TABLE 4.5](#) below. In general Viet Nam continues to make steady progress with HPAI control. The issue of disease surveillance remains one for continued examination and refinement. FAO and the DAH have reviewed how to adjust post-vaccination monitoring as FAO was concerned about the epidemiological relevance of the sampling approach which tends to be a measure of activity and not so much the efficacy of the programme. The changes proposed by FAO in 2010 to the monitoring have been implemented. The remaining issue is the real-time feedback of monitoring results and follow-up on corrective actions to determine the root causes for less than satisfactory results. As the government is also proposing changes to the vaccination strategy it will be increasingly important to have a post-vaccination monitoring programme which is more sensitive to the changes in the immune status of the general poultry population. The overall management of the vaccination programme, from procurement to distribution, to application of vaccines and the management of informa-

TABLE 4.5
Progress for Viet Nam in key programme activities/indicators in 2010

Activity/Indicator	Assessment (as of December 2009)	FAO's contribution to this result	Evolution over the previous RP	Evolution over the current RP 2010	FAO's contribution to this result
Preparedness	3	S	↗	↗	S
Surveillance	4	S	↗	→	C
Response	4	S	↗	→	C
Laboratory capacity	4	C	↗	→	C
Compensation	2	NC	→	→	NC
Biosecurity	2	NC	↗	↗	S

Level:

1 = very poor; 2 = poor; 3 = fair; 4 = good; 5 = very good

Contribution:

S = significant; C = collective (financial input shared with other partners and/or the country); NC = no contribution

Evolution:

↗ = capacity has increased substantially; → = no substantial change in capacity;

↘ = capacity has decreased substantially

tion from the programme, together with monitoring, remain a significant overhead for the animal health departments at central, provincial and district level. The GETS project (see Case Study below) has set out to provide evidence about ways to modify the vaccination programme to reduce overheads, and work will continue with electronic systems to monitor vaccination delivery.

The problems associated with the informal movement of poultry and poultry products from China continue and it is very difficult to police such activity. To minimize risk, work has to focus more on regional approaches to understanding and management of the value chains. The work which is currently being undertaken with the poultry sector in key provinces will contribute to filling gaps in knowledge and assist in improving biosecurity at the borders.

The deficiencies with biosecurity and general production practices in Viet Nam will take some time to be rectified. The drivers for change will come in the form of improvements to market chains and consumer needs for safe food product as the live bird market begins to shrink. All of the activities bringing good production practices and biosecurity guidelines will assist those better producers who want to remain in the system and supply the big urban markets, to adjust to the new environment. At the small producer level uptake is slow and it is likely that these enterprises will not survive once the market place becomes more competitive in respect of quality and hygiene standards.

Monitoring vaccine efficacy is an ongoing technical matter and FAO will continue to guide this work, although gradually the National Centre for Veterinary Diagnosis (NCVD) laboratory can take more responsibility for this activity. However, this is a critical function and FAO has made a major contribution to the effectiveness of the vaccination programme through this work.

The work carried out with preparedness and response has been effective at the project level and now it remains for the government to be able to roll-out the mechanisms on a larger scale. However, there have been large numbers of people trained already and it seems clear that this effort has had a significant impact on the capacity of the official veterinary services to contain outbreaks. The inputs to the Applied Veterinary Epidemiology Training programme will make slower inroads on the lack of capacity in some aspects of disease control, but nevertheless, the impact will be realized with time.

Activities undertaken related to Pandemic (H1N1) 2009 and other TADs

Viet Nam was a participant in the FAO regional project to monitor the impact of Pandemic (H1N1) 2009 in the swine industry. The final workshop of this project in Bangkok in November 2010 was attended by officers from the DAH. At the national level, FAO also assisted the DAH to develop capacity for Pandemic (H1N1) 2009 diagnosis by adaptation of existing H5N1 test systems. During 2010, there was also the finalization of the TCP national activity to gain better understanding of PRRS epidemiology and diagnostic procedures.

Conclusion

The relationship with the government continues to mature and FAO is recognized as a valuable partner in the ongoing effort to build capacity to deal with HPAI and other important diseases of Livestock. FAO made a solid contribution to the first phase of the *Integrated Operational Plan for Avian and Human Pandemic Influenza* (the *Green Book*) and has made an important contribution to the assessment of that programme and the development of the next phase that will include an eco-health (or One Health) component. The role that FAO has played in understanding biosecurity issues at the local level will continue to develop and contribute to the gradual improvement in the standards of management of poultry at the small-scale level. The GETS project has the potential to cement further the understanding of the role played by vaccination in the control of the H5N1 in Viet Nam and the most effective ways to modify the programme. In Chapter 5 issues pertaining to the endemic state of H5N1 in Viet Nam are discussed and it will be clear that long-term inputs are required to keep this disease under control until there are the necessary adjustments to the production sector to enable more effective control and ultimately elimination from domestic poultry.

CASE STUDY 4.5

The Gathering Evidence for a Transitional Strategy project in Viet Nam

FAO is implementing a USAID-funded operational research project entitled 'Gathering Evidence for a Transitional Strategy' (GETS), which is playing an important role in the design of the government's new poultry vaccination programme against H5N1 HPAI. Viet Nam has been practising mass vaccination of poultry twice-yearly since 2005 to control H5N1 HPAI. Although the programme, along with other control measures, has been instrumental in decreasing the number of outbreaks in poultry, it is recognized that this control strategy is not sustainable over the whole country in the long-term. Mass vaccination requires significant financial resources from the government and ties up human resources in the agriculture sector. The GETS project has played a significant role in assisting the government in identifying an alternative targeted vaccination strategy and programme.

The GETS project is trialling a number of alternative vaccination strategies for H5N1 HPAI in five provinces in Viet Nam. The project partners with the central, provincial, district and commune veterinary authorities to ensure sustainability of project activities. These activities have been implemented across 43 districts and 717 communes within the five districts, which cover over 3 500 villages and 50 000 households raising domestic poultry. The project uses a multidisciplinary approach to gathering data consisting of a targeted vaccine intervention which incorporates public awareness, training and surveillance field activities, a cost effectiveness component, a sociological behavioural component and a policy analysis component.

Preliminary results from the GETS project indicate that a targeted vaccination strategy focused on age-based vaccination of ducks and removal of vaccination from chickens, implemented in conjunction with other disease control measures has not resulted in an increase in HPAI disease spread.

Chapter 5

The poultry sector in H5N1 HPAI endemic countries

The poultry industry is the most flexible and fastest growing of all livestock sectors. The industry is supported by technological advances in genetic selection, feed manufacturing, production and processing techniques which has enabled annual growth to outstrip all other agricultural commodities. This is mainly due to poultry being the most efficient meat producing domestic species with the lowest feed-conversion ratio. The sector has been particularly responsive to market pressure created by urbanization and the increased demand for animal protein by urban dwellers who have improved standards of living. However, one of the issues in the endemic countries is that many operators who entered the sector are not necessarily well-informed about the need to balance all aspects of production and are often vulnerable to incursions of infectious disease agents. Where these are amenable to control by specific agent vaccination, this enables production in less than ideal circumstances. In addition, use of antimicrobial drugs is followed as a norm, but this is to some extent a direct replication of the production approach in developed economies.

The endemic countries generally have a large poultry sector which generates significant internal economic activity, but does not generate foreign exchange, and so in some cases it is not regarded as a significant economic sector by government and a priority for further investment or regulatory oversight. Where there is international trade and associated business investment involved, governments have a greater tendency to apply the necessary resources and supports to ensure control and elimination of H5N1 HPAI in the poultry sector. A case in point was the eradication of H5N1 HPAI from the commercial poultry sector in Thailand. However, it is also important to recognize that in the endemically infected countries there is very significant investment by the private commercial sector in poultry production, and even at the level of small operators the product of this investment may well be a significant component of economic activity and economic growth which is not related to foreign currency earnings. In countries which have high levels of economic growth, such as China and Viet Nam, the smaller entrepreneurial investors are risk takers without significant financial reserves and often without proper technical support, access to extension services and advice so they have probably been hardest hit by HPAI, both from direct losses and market shocks. The impact of the disease on overall economic activity therefore should not be underestimated. It is also sometimes difficult to draw distinct lines between what is commercial and what is subsistence or household poultry production, and in some instances there is flux between the two. However, in relation to the key issues of food security, poverty alleviation and sustainability of livelihoods the poultry sector has a potential and powerful role to play and H5N1 HPAI has had a multi-faceted impact on these key indicators of human welfare.

There are probably few environments where poultry production is totally non-commercial and generally villages in all parts of the developing world are characterized by some sort of poultry sector trade, and therefore exchange of birds from one place to another is common. It is not definite what happens with H5N1 HPAI where there is a low density of poultry and where contact rates are low, but it is generally hypothesized that the virus will not sustain itself because of its fragility in adverse environments. One exception is in locations where there are significant populations of ducks. In general the environments where the agent is endemic are characterized by a high density of poultry and human populations, mixed standards of poultry enterprises sharing locations, and vigorous live bird trading through unregulated markets. It is also important to note that across the globe many small-scale producers accept deaths in poultry as the norm. This is a key constraint, implying that HPAI will not always be reported or even be seen as a problem, especially in low-input farming systems and in areas where Newcastle disease is endemic. Moreover to decrease mortality and increase output in such circumstances requires some additional investment and the accepted form of risk management is to keep financial investment to a minimum. Another constraint on improving hygiene and disease control is that germ theory is generally not well understood nor accepted by some sections of the community and this has a significant impact on the reception of messages which attempt to effect behaviour change and introduce appropriate production practices.

It is inevitable that the poultry sector will continue to grow and remain a vibrant and dynamic force in food production. An important consideration for the future of HPAI control is how quickly economic growth in endemic countries can act as a stimulus to safer and sustainable production, marketing and processing practices. As part of this process there is also the requirement for the private and public sectors to understand more of each other's roles and rights in the business of food production and disease control. Furthermore, the quality of both public and private services provided to the poultry sector need to be improved and focused on appropriate outcomes.

MAIN CONSTRAINTS ON DISEASE CONTROL IN THE POULTRY SECTOR

The three main factors identified which inhibit progress toward elimination of H5N1 viruses from endemically infected countries are: (1) the structure of the poultry sector; (2) the quality of public and private veterinary and animal production services; and (3) the level of commitment on the part of the poultry sector and governments to the elimination of H5N1 HPAI viruses.

The first factor is that the poultry sectors in endemically infected countries generally have highly complex and fragmented production and market chains, and these are also concentrated close to areas of high human population density. In these systems a high proportion of poultry are reared and sold under conditions which afford little protection from influenza viruses (or other pathogens). In addition, many large populations of ducks present do not show signs of disease when infected, and often chickens can pick up infections in market places or collector yards and be dispersed, while still appearing to be healthy. In connection with the small commercial producer sector, supporting institutions such as producer and service provider associations are weak or non-existent. Changes are being made to the poultry sector (covering both production and marketing) which will reduce the

risk of infection with H5N1 HPAI, but they will not eliminate all high risk practices (such as free-grazing ducks) or prevent all cases of infection with H5N1 HPAI viruses.

The second factor is the quality of public and private veterinary and animal production services, which have limited capacity to identify and respond to all cases of infection, fully understand the drivers of value chains and implement needed changes to production and marketing systems. The capacity for systematic outbreak investigation is inadequate and disease investigations and tracing rarely identify the source(s) of infection. In most endemically infected countries limited linkages exist between the public and private sector, especially between government sanitary regulatory authorities and the large commercial sector. Disease monitoring and surveillance systems only provide a partial and biased picture of disease/infection status. Disease reporting systems rely on reports of disease from producers, many of whom are wary after negative past experiences with government veterinary services, especially those which carried out mass culling or offered poor compensation for poultry destroyed. Border controls and laboratory capacity are also affected by the quality of veterinary services although the latter, in particular, has been subject to considerable investment and improvement in recent years.

The third factor is the level of commitment within the poultry sector, governments and the public towards the elimination of H5N1 HPAI viruses. In respect of the level of commitment, it may be a question of availability of the necessary resources to implement an effective programme or it may be the priority given to the necessary programme by the government or private sector operators. The fear of H5N1 HPAI does not necessarily translate into concrete plans for virus control and elimination. Among the exceptions are those producers who perceive economic benefits in keeping their poultry infection-free, especially if this determines access to markets. Support for the type of measures needed to eliminate H5N1 HPAI from zones or entire endemically infected countries will be half-hearted until most farmers regard H5N1 HPAI as a serious threat to their livelihoods and well-being. Strong public support is a prerequisite for the elimination of the virus from endemically infected countries.

Although measures have been introduced in all endemically infected countries to address these three factors, all require further long-term commitments and investment if the virus is to be eliminated. It is now generally accepted that this is unlikely to happen for the next ten years at least, because it will take many years for all constraining factors to be overcome and the necessary preventive measures to be introduced universally. The investments made in affected and at-risk countries were highly reliant on external sources for funding to build capacities; and while it can be argued that national investments are required for sustainability, a counter-argument exists that non-affected countries and those which have much to lose should H5N1 HPAI occur in their poultry production systems, could or should contribute financially in the implementation of national or regional strategies to further eliminate H5N1 HPAI where it exists.

As has been seen in Asia, countries which are generally free from H5N1 HPAI are at risk of virus incursion either from infected poultry or, in some situations, wild birds. Movement of the former across borders is known to occur in places where the import of poultry is illegal or tightly controlled, but where price differences provide attractive financial rewards for successful smugglers. Ways need to be examined to regulate rather than prohibit such

cross-border trade (which may be facilitated by compartmentalization and also by overall regional improvements in disease status) and apply effective and appropriate risk management procedures to such value chains. This approach is one which has theoretical appeal, but requires a major effort to engage the various parties and implement such a programme. Again the role of the consumer is one which is critical to this process. Moreover, early in the global epidemic there were instances of virus-infected wild birds being transported over long distances internationally. Clearly this sort of smuggling is motivated by specific factors which are not amenable to alternative approaches based on socio-economic principles, and can only be best dealt with by severe penalties.

REALISTIC GOALS FOR THE NEXT FIVE YEARS

Bearing in mind that the virus will not be eliminated during this time period, it is clear that it is not possible to have a 'zero tolerance' approach to H5N1 HPAI virus in the poultry sector of the endemically infected countries. At the same time to have a 'high tolerance' approach to H5N1 HPAI is not compatible with strategic objectives because of the considerable global public health risk associated with re-emergence of the disease and the impacts of H5N1 infection on production. At present the infection and disease in these countries can be considered to be in a state of 'endemic balance' with the control measures plus the risk mitigation measures introduced by producers at all levels maintaining the level of disease where it is currently acceptable to both public health and animal health services. To gradually shift the endemic balance, each endemically infected country will be supported in developing a five-year framework or pathway for consolidation of the disease situation and the progressive shift to containment and reduction of the virus in the production environments. The implementation of a pathway for the progressive control of the disease and the reduction of its impact on production and health is considered a key to success and this must also be accompanied by strategic development of the policy environment to enable the process. In part where compartmentalization or zoning is possible then this can be explored as a mechanism to develop partnerships between the public and private sector and increase engagement in the programme. This is already possible in Thailand¹, parts of Indonesia and the People's Republic of China.

The FAO submission to the review of Viet Nam's integrated operational plan for avian and human influenza for the period 2006-2010 (the '*Green Book*') set out clear milestones for future actions which, when adopted, will provide a pathway towards elimination and would clearly demonstrate the achievements made in moving forward from 2010 to 2016. Similar plans could be developed for other endemically infected countries. The Association of Southeast Asian Nations (ASEAN) is developing a roadmap for HPAI freedom in ASEAN-member countries by 2020.

¹ Though not an H5N1 HPAI endemically infected country, Thailand maintains a disease-free state in a high risk environment. Compartmentalization offers international commercial opportunities to safeguard the confidence in its commercial links.

UNDERSTANDING THE SOCIAL AND ECONOMIC FACTORS WHICH DETERMINE DISEASE DYNAMICS

The economic drivers of disease and disease control are pivotal to the future of the H5N1 HPAI control effort and these are likely to have as much influence on the outcome as direct control measures which can be introduced through animal health services. In the rapidly growing economies, a range of social, political and economic factors are already coming into play to alter the sector, which will have a significant impact by causing shifts in production and marketing. In assisting countries with the development of policy it is now fundamental that FAO inputs take into consideration the economic drivers of disease.

It is accepted that elimination of virus from some traditional systems requires some form of restructuring or rehabilitation, however, top-down approaches generally are not effective. At the same time it is not clear to what extent a bottom-up approach can achieve this outcome, especially if participation involves voluntary investment. FAO has noted that one of the key stakeholder groups in the value chain is the consumer, but in general consumers have played a limited role in changing standards and behaviour in response to HPAI in the endemic countries. In some instances policy changes have had an impact on marketing and this also has affected consumer preferences and so the top-down pressure has been important. However, it is also understood that economic development influences consumer choice for quality and safety standards of product, and price. When the burden of poorly controlled human diseases is reduced through economic development and associated improvement in health services, people become more concerned about manageable hazards such as those related to food safety. In other words, increasing affluence should favour the establishment of a regulatory environment which includes proper disease management (especially for a zoonotic disease such as H5N1 HPAI). FAO will develop approaches in various settings which bring consumer preferences and other aspects of marketing to bear on H5N1 HPAI prevention and control.

UNDERSTANDING THE AGENT

At the global level there is a substantial amount of information about H5N1 HPAI: FAO contributes to the analysis and dissemination of this information through the OFFLU network, the EMPRES Wildlife Unit, and GLEWS. Virus tracking studies show the connections between populations of viruses infecting birds and in some cases can suggest the pathway for the virus movement. In addition, the work done in Indonesia and Egypt to study antigenic changes in the virus is important to maintain the efficacy of the vaccines in use (this sort of work must take place assiduously in any situation where vaccines are used to support control). It is important that resources continue to be committed to the laboratory studies which are necessary to monitor the on-going evolution of the agent. One issue of concern which requires continual attention is the propensity for influenza viruses to re-assort – that is for mixing of gene segments to take place during co-infections, so that novel viruses emerge with genes from other influenza A viruses. While the outcome of the process cannot be predicted, it is likely that any change in infectiousness of H5N1 for humans will be as a result of a re-assortment event.

ANIMAL HEALTH SERVICES

One of the key outcomes of the One Health approach and also the lessons learned from the HPAI epidemic is that veterinary services have a definite public good role to play. Some of the national development policies implemented in recent times have resulted in considerable dismantling of animal health programmes, facilities and capacity. It now seems evident that investment into these services must take place within a structured approach which has clear goals to provide defined public good outcomes, and that the veterinary services are provided with the skills to measure these outcomes and report progress against them. This is a necessary paradigm shift for the ongoing maintenance of viable, effective and credible animal health services, otherwise it will not be possible to sustain the investments which have been made through the HPAI Global Programme.

It is important that the mistakes of the past are not repeated, both in terms of reducing resources to animal health services which have been built up in the last few years, or building animal health services which are not relevant to the needs of the stakeholders in animal production systems and are a burden on the public purse. Two of the key areas for animal health services to address are disease surveillance and continuous risk analysis. Feasible and appropriate early detection of disease problems is one aspect of disease management, but introduction of hundreds or thousands of surveillance workers in the animal health system is unlikely to be viable even in the short-term if the activity does not add clear value to the production sector and the public health system. It is important to understand what is meant by strengthening veterinary services and how to go about this in the context of some endemic countries. It might also be necessary to recognize that the level of public investment and services required today might be much greater than that required in the future, as the respective production sectors become stronger and the quality of private sector services improves.

INNOVATIVE APPROACHES TO MEETING GOALS

Overcoming the constraints to HPAI control will be a lengthy process and governments and donors must understand that there are no 'quick fixes' to the various institutional and structural problems which led to the disease becoming endemic in the first place. The approach to meeting goals will be based around progressive control, which has formed the foundations of the FAO response until now. One key issue will be cross-border and regional strategies in east Asia, the Greater Mekong Sub-Region and the Indo-Gangetic Plain. Associated with these strategies will be well-designed integrated studies for improved understanding of farming systems, the socio-economic background, production and market chains and the epidemiology of the disease. It is necessary to develop more holistic health services for smallholder poultry owners, covering entire communities and going beyond avian influenza (but possibly incorporating development of 'AI-free Communities'). It is clear that smallholder producers are concerned about a range of issues which affect their enterprises and HPAI is often not regarded as very important. Authorities need to be advised of the advantages in developing better systems of compensation, such as high value compensation paid rapidly as part of stamping out campaigns (for example, in the case of Nigeria). Other issues related to veterinary services capacity – in particular with respect to outbreak investigation and information management, decision-making processes, professional pay

scales and the interaction these have with professionalism, dedication and ethical governance, vaccines, communication and advocacy, private sector engagement and even the quality of veterinary education – have to be factored into the overall programme of disease control. In addition, there are a number of areas for research which should be addressed at the global level. These include the possible development of genetically resistant birds, better vaccines which are easier to deliver; more innovative means of monitoring the poultry population for the presence of virus; and methods to influence changes in behaviour which promote better hygiene practices.

GOOD PRODUCTION PRACTICES

FAO has been undertaking activities at global, regional and national level under the banner of biosecurity. However, the term used could be broadened to 'Good Production Practices' as the concept of biosecurity may not be applicable to some production systems which are prevalent in areas where HPAI is endemic. While it is not particularly desirable to change the focus of control efforts away from HPAI it may be beneficial to emphasize to smallholder producers, for whom it is not feasible or desirable to invest in making production biosecure, that certain management practices will reduce disease generally and improve output. It is however, a major challenge where people are poor and relatively uneducated to achieve changes to time-honoured practices for poultry raising and risk management. It should be considered that the low input-low output systems which do not participate in the market network systems do not play a major role in the maintenance of H5N1 HPAI infection, although this must be balanced with the fact that when introduced to the household production units, the virus is in close association with humans.

THE ROLE OF STAKEHOLDERS IN DETERMINING STRATEGY AND POLICY

It is not possible to have a universal zero tolerance approach to the presence of H5N1 virus in the poultry sector and the level of tolerance for the presence of the virus is a balance between the threat to human health, the threat to poultry health and productivity and the economic resilience of the sector. To date, the virus remains a low threat to human health generally and in the landscape of health issues in most societies it is a minor issue. However, there is the unpredictability of the evolution of the agent and the potential for a variant to emerge with greater infectivity and transmissibility in the human species. This concept has a low penetration with poultry producers in the endemic countries and also with the general public. The ongoing developments in strategy and policy therefore must be generated by an amalgam of interests from producers to human health officials, to the wider range of individuals with a stake in the outcome. For the longer-term process, the milestones must be clear and achievable and not based on external notions of what might be ideal. Support from global sources is necessary until such time as the threat of a pandemic driven by H5N1 is eliminated or reduced to a level where it is no longer a major concern. Given this requirement the global community remains a stakeholder in the efforts to control the disease and so for example through the UN agencies will of necessity continue to engage in the programme.

The role of consumers in determining strategy

The consumer preferences for poultry products have a significant influence on the strategy for control of infectious diseases. The totally integrated systems, where there is close control over the birds from egg to plate with nearly 100 percent of product being handled through supermarket systems allow for more systematic monitoring of the health status and also implementation of disease control measures. It would seem that the success with HPAI control and eradication in the commercial sector in Thailand was related to the shift to vertical integration. In addition, the acceptance in Thailand of processed product is linked to consumer confidence in the governance of the food industry. In many of the countries attempting to control HPAI there are issues with food safety in general and the market systems which exist and evolved to limit the impact of hygiene practices on the quality and safety of food. In several of the endemic countries the role of consumer organizations is very limited and in some they do not exist because of the predominant political structure. In association with this factor, across the countries there is a consumer preference for certain style of poultry meat, but it is also clear that price will determine consumer action if the consumer is confident in the product.

The role of poultry producers in determining strategy

The general approach that has evolved for FAO, particularly as a result of lessons learned about the importance of socio-economic factors in determining outcomes of disease control efforts, is that producers roles and aspirations must be central to strategy development. It also has to be recognized that in some cases change must take place in the production system(s) and therefore producers must be guided and to an extent supported to make the necessary changes. The linkage between agricultural and economic policy and strategy is immutable and so the policy environment for the particular country and the part of the poultry sector must be clear, transparent and well-constructed. The principle that the poultry sector is multi-dimensional, is fundamental also to strategy development. It is not possible to look at the various scenarios in this chapter, but only to point out that FAO concept development is rooted in this axiom.

IMPORTANT LESSONS LEARNED REGARDING CONTROL PROGRAMMES IN ENDEMIC COUNTRIES

The experience with HPAI has informed FAO (and the international community) on how complex the drivers of a new disease are and what is involved in making headway with its control.

Across the five endemic countries which are used as a basis for discussion there are some commonalities but also each has some unique characteristics which the national authorities have taken into consideration in designing or developing the disease control programme. National authorities understand aspects of the local situation which international advisors are not familiar with in the first instance. There are also aspects of production systems which national authorities do not necessarily have a full understanding of, if there has not been a close association between the animal health service and the full gamut of systems represented by a poultry sector which can be convoluted and complex. The HPAI programme in most of the endemic countries is now in a consolidation phase and to determine the way forward requires further reflection and analysis.

The above issues need to be taken into account in conjunction with the following simplified lessons learned from the efforts to control HPAI to date.

- (i) *Where a combination of multiple risk factors exists and where veterinary services are weak, surveillance and culling does not succeed in controlling HPAI* - in endemic countries the disease generally moved ahead of the efforts to stamp it out for a number of reasons and this strategy was costly and generally ineffective. It might be argued that in the non-endemic countries the control efforts were greatly assisted by factors such as a lower density of people and poultry and less complex market chains.
- (ii) *Mass AI vaccination of household and scavenging poultry is inefficient and unsustainable* - there have been a number of factors which have worked against vaccination in this sector and so in some countries it has been set aside until it is likely to be more strategically and effectively applied (or new tools become available). In respect of the small commercial operators, it is valid to question whether the introduction of vaccines brings with it an attitude among producers that it is possible to live with the disease, given that with most of the serious endemic poultry diseases, vaccination is necessary for effective control.
- (iii) *Poultry producers, from large scale commercial enterprises to households, are reluctant to cooperate in reporting outbreaks of disease, resulting from a fear of the consequences* – the governance of veterinary services and control policy needs to be well developed for effective and equitable control to be accepted by all stakeholders. Where culling is not effective in control, but is nevertheless applied, then it can have a negative impact on the control programme. In particular, it weakens the credibility of the animal health services with both the private sector and within the public political process. Producer groups and rural associations must be part of the disease management decision-making process so as to enhance the likelihood of compliance.
- (iv) *Deficiencies in veterinary services are a major contributory factor for H5N1 HPAI to become endemic* – covered in the above paragraph. To successfully control epidemic diseases of livestock veterinary services must have a wide range of technical competencies and management competency, as well as the funding required to function adequately in an emergency response phase. In many countries where there are decentralized administrative systems, veterinary services at provincial or district level can be supervised by non-technical persons and this leads to a breakdown in the line of technical command and direction. This also has the impact of diffusing the regulatory authority required to effectively control epidemic diseases.
- (v) *Achieving sustainable HPAI control in endemic countries requires a long-term approach* – there are a number of areas which must be addressed, not least clear strategy and policy development. In some instances it is not appropriate to apply all OIE guidelines for disease control which are historically designed for elimination of infection in high-production commercially-oriented environments so as to regain in the shortest time possible, recovery of trade opportunities.

BANGLADESH AND THE INDO-GANGETIC PLAIN

Overview

This agro-ecological zone covers Bangladesh, the West Bengal State in India, and Nepal, however, in the context of countries at risk, Bhutan is included. Myanmar is also a natural fit as it is a bridge country for animal disease between south Asia and southeast Asia although most of the early introductions of H5N1 into this country can be traced to movements of live birds from China. The information available on virus distribution indicates that within the poultry sector of this zone, there is one clade of virus which circulates and must be considered endemic. The pool of H5N1 here is a threat to the poultry sector in the remainder of India and possibly further west and as has been shown it can threaten the sector in Bhutan. Of particular importance is that H5N1 viruses of clade 2.3.2 have appeared in Nepal in 2010 but the precise source of this introduction has not been determined to date. As the global pool of this clade is currently centred on China, it may be from migratory birds (the outbreak being near a migratory bird site) or possibly, but less likely from imported poultry products or live birds. While this introduction is in the highlands of Nepal, there remains the potential for it to leak into the larger poultry ecosystem of the Indo-Gangetic Plain. Such an introduction is likely to further complicate control efforts. At the same time every effort should be made to track its movement if introduced, as such information will be very useful to understanding the role of particular market chains in disseminating virus.

Bangladesh is predominantly an agriculture country, with 30 percent of the country's GDP from this sector and where 60 percent of the total labour force is employed. The crop sub-sector contributes 72 percent of the total agriculture production, and the fisheries, livestock and forestry sub-sectors contribute 10.33, 10.11 and 7.33 percent respectively. Prior to H5N1 HPAI incursion into Bangladesh, the poultry industry had been growing at an annual rate of about 20 percent with an annual turnover of US\$ 1 billion. The poultry sector directly or indirectly employed five million people. Due to the devastating HPAI outbreaks, the poultry sector plummeted resulting in a significant setback in progress toward achieving the national Millennium Development Goals (MDGs) – which aim to ameliorate poverty, achieve full employment and reduce hunger. HPAI has had a significant negative impact not only on the industrial sector which produces more than half of the country's requirements in poultry and eggs, but also on the backyard poultry on which the livelihoods of more than five million families depend.

Bangladesh reported its first case of H5N1 HPAI in March 2007 and since then new cases have been reported each year. The disease peaked in 2008, with 226 reported outbreaks between January and March, and the first human case was reported in May 2008. The incidence and frequency of reports waned during 2009 (32 reported outbreaks). After three months' absence, outbreaks began again in January 2010. During 2010 a total of 31 outbreaks were reported.

A seasonal pattern is discernible with fewer cases in the autumn. As of December 2010, 358 outbreaks had been reported: 304 in commercial farms and 54 among backyard poultry. Of 64 districts, 49 have reported cases of H5N1 HPAI since March 2007. The number of affected *Upazila* is 142 and Metro Thana is 14. It is highly likely that the reported cases represent only a proportion of the total cases of infection and disease (see constraints).

by smallholders has been assisted by politically and socially prominent models for micro-financing through the activities of some large, institutionalized NGOs. This is one example where very significant development of the poultry sector has taken place which has not actively engaged the public sector. It is also noteworthy that the Government of Bangladesh took a decision not to vaccinate and to date this decision has proved to be a sound one. While outbreaks still occur the incidence of disease is low enough that immediate outbreak control measures can be managed with national resources.

Factor 1: Structure of the poultry sector

The total poultry population is about 260 million (more than 84 percent chickens and 15 percent ducks) with over 80 percent of farms being small commercial (FAO sector 3) or backyard/household (sector 4) operations. Few biosecurity measures are implemented in these farms. Because of the heavy density of poultry and land scarcity the often close association between scavenging poultry and commercial poultry and low understanding of the concepts of infectious diseases increases the risk of disease transmission and maintenance. As a result of the predominance of smallholders and also the importance of eggs as a dietary source, production units are exposed to many potential sources of infection related to marketing, i.e. egg collectors, vehicles, egg trays, chicken boxes, etc. With so many individual producers in the market chains, it is a major exercise to effectively contact and engage with them to promote HPAI control. The overall levels of hygiene in the production units and markets favour the persistence of pathogens. The larger commercial producers and their Poultry Association do not have a close or trusting relationship with the official animal health and production services, and working to improve this has been an important part of the FAO country portfolio. The animal health service does not have the necessary understanding of the market chains nor is there an overall repository of information about the actual distribution of production units, although as is typical of the sector in Asia people move in and out of production regularly and this flux cannot be practically captured. Most meat poultry is marketed through live bird markets without any regulation concerning source or health status. Within the country there is a significant domestic duck population with ample opportunity for contact with wild waterfowl, including migratory species. The presence of clade 2.2 suggests a wild bird introduction in the first instance, and any increase in clade 2.3.2 in wild birds in China might also be a threat to Bangladesh. Because of the dominance of traditional production and especially marketing, there is limited investment by both public and private sector in the infrastructure necessary to allow for changes in high-risk practices.

Control of HPAI outbreaks in poultry to date has been by depopulation and associated control measures. Initially this meant all poultry (including commercial flocks) within a five km radius of the confirmed case. This approach had a major impact on the level of reporting, and many poultry were reportedly sold off before the cull started. Initially the level of compensation paid was not sufficient to encourage reporting and there were also problems with dispersal of the funds available. Improvements to this system have been made. From May 2008 a cull was initiated on the basis of a positive field test, and the culling policy was changed. In the case of an infected farm, all poultry on the farm were culled, followed by a stand down period of three months. In some cases, enhanced surveillance was conducted around the farm, but neighbouring farms were not culled. In the case of infection in a

backyard flock, stamping out of all poultry was carried out in the 'infected zone', defined as within a radius of 500 metres. This was accompanied by a stand down period of three months, with enhanced surveillance in markets close to the outbreak location. A total of approximately 1.3 million birds were culled.

Factor 2: Veterinary and animal production services

The animal health services are not financially well-resourced and while there is a reasonable manpower base, the technical capacity of the veterinary services is limited in key areas for disease control, such as epidemiological skills (investigation, surveillance and analysis) and laboratory diagnosis. The animal health officers at the local level are under the direct administrative control of the central department of livestock and this enables a degree of efficiency in supervision of key disease control activities. There is still reluctance on the part of some local officers to investigate disease outbreaks and submit samples to the laboratories for diagnosis although this might in fact reflect that the public animal health laboratories have limited diagnostic capability and capacity. In addition, there are veterinary posts at the local level which are not filled, creating gaps in surveillance. It has been noted that training programmes to improve field operations have issues with monitoring and evaluation, and especially with maintaining quality and control of multiplier training programmes such as training of trainers (TOT). In respect of veterinary public health activities, there is inadequate supervision of live bird markets and slaughter points and generally a weak regulatory enforcement. The animal health services typically do not have access to commercial farms or much interchange with the more industrial segment of the commercial sector.

Factor 3: Commitment

There is sufficient commitment from the animal health services at the central level to the task at hand, but there are issues with resources which has an impact on the implementation of the control programme. The investment through FAO into CAHWs and surveillance is accepted and supported by the government. In the market sector, where FAO has been able to support project activities to bring about some structural changes, while initially there was reluctance to engage, now with demonstrable benefits market owners/supervisors are now keen to engage. The entry point for the HPAI programme to the private sector has been to through providing training on biosecurity and disinfection and this has brought the public and private sector closer together. The main paradigm for most poultry producers is financial survival, so there is not always a total commitment to compliance with all of the measures associated with suspected disease incidents. This assessment applies to all levels of the sector and so the level of cooperation between public and private sector still needs enhancing. At the regional level there is more commitment to engage with partners in India and Nepal to collaborate on matters related to cross-border controls.

Moving forward with disease control in Bangladesh

Bangladesh has managed to exert a level of control over the disease by making the reporting and response time significantly shorter through the deployment of an SMS Gateway system and culling of the infected and in-contact birds, based on the findings of the rapid antigen detection test and the clinical manifestation fitting the case definition. Under-

reporting, absence or limited movement control and incomplete post-outbreak decontamination are the main challenges to further improvement of the situation. Diverse poultry husbandry practices and a complex marketing system with very little scope of tracing backward and forward has made understanding the disease transmission cycle difficult. The duck population might also play a role in sustaining virus circulation, but this is a question yet to be substantiated through research. Good community-based networking involving community based organizations (CBOs), local government agencies, schools, religious leaders, and NGOs, for reporting sickness of poultry may improve the reporting system. This same system can be utilized for reporting on other zoonotic diseases and so forms a potential foundation of a One Health approach in Bangladesh. Communities must have an incentive to report poultry diseases and which is motivated by perceived economic benefit, together with public health issues. The active surveillance system will target representative duck populations, backyard poultry and small-scale farms and will be supported by a poultry disease diagnostic system, further strengthened for analysis of surveillance samples and outbreak samples. Absence of a mechanism allowing bordering districts of neighbouring countries to share information about outbreak or suspicion at local level, lead to the failure of instituting pre-emptive measures to prevent disease incursion. Despite some efforts, little improvement has so far been made on early information-sharing and these efforts must be continued to allow local level officials to share information at the earliest opportunity. The application of compensation in this environment is to be encouraged as it will enable local foci of active disease to be eliminated. Whether it will be cost beneficial in terms of the overall control is not presently clear, but must be used as an adjunct to prevention of diseased birds from entering market chains.

In the situation where the disease is endemic, then compensation will be limited as it becomes too costly. Compensation has to be strategically applied in such situations.

Application to the broader context of the agro-ecological zone

While the poultry sector and the disease situation in Bangladesh has some particularly unique characteristics, many of the key issues for disease control are shared with the neighbouring part of the agro-ecological zone, especially with the West Bengal State of India. Recently FAO has commenced a project to strengthen the epidemiology component of the national control effort, one outcome of which might be to develop new guidelines for culling in endemic zones. The current guidelines of five km culling were not risk-based, were cumbersome and time consuming, and so greatly extended the time from cleaning/disinfection to restocking, making them unpopular with farmers, especially the poor. The culling approach in Bangladesh was restricted to affected premises and immediately at-risk poultry, and this approach is much more pro-poor and has less impact on the livelihoods of individuals not directly affected.

The endemic presence of H5N1 HPAI in the Indo-Gangetic Plain is a major challenge to the veterinary services of the area and a continuing threat to poultry production further afield in India, and in Bhutan and Nepal. It is necessary for the long-term strategy to strike the balance which prevents a big upsurge in disease incidence and continuing a control programme which gradually reduces the incidence to the point where a concerted effort might eliminate it altogether.

SOUTH-EASTERN CHINA AND EAST ASIA

Overview

The first known Asian-lineage H5N1 HPAI virus was detected in geese in Guangdong province in 1996. The next year, a severe outbreak affecting humans and poultry occurred in Hong Kong SAR. H5N1 HPAI viruses similar to the ones first found in 1996 continued to circulate and evolve but it was not until 2004 that reports of disease due to this virus were officially recorded from across the country. Further outbreaks occurred over the following years but none have been reported since May 2009. Human cases also occurred in every year during 2003-2010, with the exception of 2004 (although in 2010, only one case was reported, in May). However, active surveillance in live poultry markets and environs have established which viruses continue to circulate, with the most recent positive results reported in April 2010 in domestic poultry and July 2010 in a wild bird.

Vaccination has been used in China for a number of years and was officially sanctioned in 2004 when it was deployed in a five km zone around the three km stamping out zone which surrounds outbreak sites. A 'universal' vaccination campaign was enforced towards the end of 2005, when vaccination became compulsory for all poultry, using the H5N1 Re-1 (A/Goose/Guangdong/1/96-PR8) vaccine strain and the vaccine was made available free of charge. China has an active programme of vaccine development and has produced effective vaccines which are well-matched to circulating strains of virus. Over 15 billion doses of vaccine were used in 2008. Nine modern plants are licensed to produce H5N1 vaccines.

Mass vaccination campaigns are conducted several times a year for small flocks of poultry, with supplementary vaccination in some cases. Commercial farms vaccinate poultry at the appropriate age. As with all vaccination campaigns, the programme is hampered by concurrent diseases in vaccinated flocks, and although it is compulsory there is evidence that not all poultry, especially ducks, are vaccinated (Chen 2009). The Ministry of Agriculture is convinced that vaccination has helped reduce the number of disease outbreaks and the quantity of circulating virus.

A wide range of H5N1 HA clades, including all first and second order H5N1 HA clades, have been detected in China, including Hong Kong SAR. Recent information on gene sequences demonstrate that clade 2.3.2 viruses now appear to be encountered more frequently in poultry than clade 2.3.4 or clade 7 viruses. Viruses from other clades (including clade 2.2) have not been reported in 2009-2010 in poultry.

The H5N1 virus was found in wild duck droppings during routine surveillance in Hokkaido prefecture, Japan, in October 2010 and in a weakened tundra swan in Tottori prefecture in November. In addition, in November an outbreak was reported in commercial poultry in Yasugi city, Shimane prefecture. This is the first outbreak of H5N1 in Japanese poultry since 2007, although wild birds with H5N1 infection were reported in Japan in 2009. In December deaths of mute swans were reported in a wildlife park in Toyama prefecture and one hooded crane died in Kagoshima prefecture. In South Korea, H5N1 was detected in wild ducks and then in commercial ducks in early December. A little while later the virus was found in two dead eagle owls and at the end of the month in Baikal teal.

Context of the endemic country

The sheer size of both the country and the poultry sector means that China dominates the HPAI picture in East Asia. It also has significant implications for the HPAI situation in neighbouring countries because of the tendency of viruses to leak across borders due to trade. The role of the interaction between wild birds and domestic poultry in the dissemination of new clades of H5N1 to new locations is not fully understood.

The vaccination programme is a key part of disease control and there is active monitoring of the antigenic and genetic makeup of viruses. However, as elsewhere there is not good data on vaccination and the impact is not fully understood. To alter from the current blanket vaccination approach will require much greater understanding of infection and transmission dynamics in situations where the virus persists. There is presently limited understanding of disease outbreak dynamics, and few mechanisms for tracing backward and forward, making it difficult to acquire a national and holistic picture of the disease situation. As the country is so large presently there is incomplete understanding of the dynamic pattern of poultry production systems, value/supply chains and trade in poultry and poultry products within China. When there is insufficient epidemiological knowledge and understanding of the risks present in various poultry production systems and along market chains it is difficult to refine the control strategy (including the vaccination strategy).

It is likely that for east and south east Asia the medium-term control of the disease will be markedly affected by the success of the disease control programme in China and the success of regional approaches to disease control. Importantly it is suggested that the robust economic growth taking place in China might eventually have an effect on H5N1 prevalence, as this will cause accompanying restructuring of the commodity chains due to a range of pressures including consumer demand.

Factor 1: Structure of the poultry sector

The standing population of poultry in China in 2008 was approximately 5.6 billion with about 4.6 billion chickens, 760 million ducks and 300 million geese. A high proportion of poultry are still reared outdoors and there is considerable variation in the poultry sector both within and between provinces. There is much opportunity for interaction between domestic waterfowl and migratory species. In addition, there are farms which raise domesticated wild geese and ducks, and these also will attract wild birds of the same species to farm sites. The domesticated wild bird farms have been expanding rapidly.

Many birds are sold through live poultry markets and there is considerable inter-provincial trade in poultry with birds being moved over long distances. Some market chain studies have provided improved clarity on the complexity of value chains and the extent of poultry movement in some parts of the country. While some markets have in recent times embarked on programmes to improve infrastructure and hygiene, these improvements are by no means universal.

The bulk of the commercial production of poultry is concentrated on the eastern seaboard and in the south eastern provinces, areas where there are very high poultry and human population densities. In this commercial sector many farms operate to the highest standard of biosecurity, but this is not a universal standard across the sector. There are

still very large numbers of poultry raised in low biosecurity settings and in household or backyard systems.

Factor 2: Veterinary and animal production services

The last decade has seen significant strengthening of the veterinary services in China, and marked improvements in the implementation of animal health services. The overall veterinary service in China has a multilayered structure where the central Ministry of Agriculture provides the technical overview and guidelines for the animal disease control programmes, and the execution is carried out by the veterinary services at the provincial and sub-provincial levels. Generally such a system has inherent constraints to deal with. The national level reporting of disease incidents is dependent on the flow of information from the local level through to the central Bureau of Animal Health. At the same time the implementation of national disease control guidelines is dependent on the reverse of this process. It is also recognized that local authorities may interpret guidelines differently to the central authority and so implementation can have variations in different locations. Where vaccination is used, H5N1 HPAI is unlikely to appear in its typical form and therefore there is potential for cases with low-level mortality or egg drop not to be reported or investigated further. In addition, the animal health and animal husbandry services are provided by the government at province and county level. Therefore, quality and the scope of these services are to some extent dependent on the wealth of the province and also the role which the agriculture and livestock sectors play in the local economy.

Most provinces have a well equipped veterinary diagnostic laboratory and there is a network of research institutes within the Ministry of Agriculture which also provide some diagnostic services. In addition, there are poultry disease research and diagnostic facilities associated with universities and these have played an active role in the HPAI programme. As yet there is not a common platform for data-sharing among the various components in the network. Efforts are underway to strengthen coordination between line ministries which have jurisdiction over aspects of HPAI control – for example wildlife matters are under the jurisdiction of the State Forestry Administration.

Factor 3: Commitment

At the overall national level the Government of the People's Republic of China has invested significant resources into HPAI control and will continue to do so for the foreseeable future. There may be some differences in the interpretation of guidelines so that in some places local governments may not have the same level of commitment as their central counterparts. In the commercial sector the 'high-end' operators have a strong commitment to disease control which will be a variable mix of vaccination and good management, including biosecurity measures. There is also appropriate commitment from the commercial sector to establishing disease control or disease-free zones. In relation to making adjustments to market systems etc, there is the potential for resistance to changing what has been functioning according to the expectations of the stakeholders, as changes inevitably require investment, while some individuals will not be able to adapt. At the smallholder level, the commitment to HPAI control is variable, but generally not a high priority

Moving forward with disease control in China

FAO will play a key role in assisting national authorities in reviewing their national programme, and more specifically address the limited epidemiological capacity available in the country. Indeed, it is recognized that the veterinary services are not yet able to apply some of the more advanced modelling and analytical techniques to the complex animal production systems within the sector. China is a large country which requires major efforts to create a pool of competent veterinary epidemiologists. A systematic and long-term approach is needed for training in this area. Through the FETPV, launched in November 2010, FAO is able to mentor and support development in these areas and assist with the higher level strategy development which will arise from strengthened capacity, but for the programme to be successful a 10-year timeline must be planned and financially secured. The overall coordination and management of disease surveillance has to be strengthened and this is an issue also linked to the accumulation of epidemiological understanding.

Vaccination will continue to play a role in the prevention of H5N1 HPAI as long as the threat of infection persists. Modifying vaccination programmes requires better information on the level of threat posed to individual farms within particular areas. More effort is required to provide decision-makers with evidence-based data to review the strategy for mass vaccination and shift to targeted vaccination.

The development of a suitable vaccine for short-lived meat type ducks is a priority for HPAI control. Relatively quick development and distribution of new vaccines is possible provided programmes are in place to identify antigenic variants among viruses, and the research facilities linked to vaccine companies have the capacity and capability to develop and test new antigens. Of its own accord China will continue to monitor the evolution of the virus and the suitability of vaccine strains to control the disease.

Whether it relates directly to the local disease situation or has an independent dynamic, virus circulation in migratory species which accumulate in some of the significant water bodies in China is of importance to other parts of the globe and there is a strong argument to continue monitoring these populations as an early warning of possible incursions of H5N1 at points further along migration pathways.

Application to the broader context of the agro-ecological zone

China has a large poultry population in which H5N1 HPAI is endemic and so this provides an opportunity for the virus to mutate and evolve. Livestock production systems in areas where there is potential for some cycling of viruses between pigs and poultry also provide the substrate for reassortment to occur and the propensity for new viruses to emerge in China has been amply demonstrated to date. It would also appear likely that the proximity between wild birds and domestic poultry provides one site for the exchange of avian influenza virus genes (between H5N1 and others, for instance) strains between the two populations and so emergence of new clades or other strains for dispersal along migratory pathways.

Due to the concerns about the propensity for cross-border trade to spread viruses, it is important that neighbouring countries, such as Lao PDR, Myanmar and Viet Nam, have functioning and manageable agreements to control cross-border trade.

EGYPT

Overview

Egypt has an estimated 79 million people, the majority who live near the banks of the Nile River where the only arable land is found. The large areas of the Sahara Desert are sparsely inhabited. About half of Egypt's residents live in urban areas, with most spread across the densely populated centres of greater Cairo, Alexandria and other major cities in the Nile Delta. Cairo has a human population of 7.8 million spread over 453 square kilometers (175 sq miles), with an additional ten million inhabitants just outside the city. This makes it the largest metropolitan area in Africa and the eleventh-largest urban area in the world. In essence the agro-ecological zone under consideration is the Nile Delta, and totally within Egypt.

The disease has had a higher incidence in the winter months as demonstrated by the four waves of outbreaks, but between them H5N1 HPAI was still occurring regularly across a large area of the Delta. It is accepted that H5N1 HPAI is endemic throughout the country and all production sectors. Vaccination was introduced very quickly because of both the production concerns and the situation with the disturbing number of human cases occurring. It continues to be applied in the commercial sector. Most of the vaccine used is produced in China and based on the A/Goose/Guangdong/1/96 strain of H5N1.

Context of the endemic country

The pattern of H5N1 HPAI in Egypt was similar to other newly infected countries in the epizootic, in that the disease became evident when it gained access to the commercial broiler sector where large numbers of farms were affected and mortality in improved breed birds was significant. At what point in the national epizootic the smallholder sub-sector became affected is not clear, but the infection is now endemic in both and probably to some extent cycles between them. Egypt would appear to be one of the endemic situations where there is not a robust demarcation within the overall poultry sector, so that the virus can spread from one sector to another, thereby increasing the difficulty of control efforts. In the complicated production environments in Egypt, the cost of controlling HPAI is substantial, and since implementation of the decision not to pay compensation for birds culled in control activities, the veterinary services consider that there is now likely to be considerable under-reporting. The abovementioned change in disease incidence is likely to be a result of this policy and as in other areas human cases are reported in the absence of detected outbreaks of H5N1 HPAI in poultry. This implies a declining level of reporting and does not necessarily demonstrate a progressive reduction in disease incidence.

The complex situation of large populations of urban poultry living in close association with people, who conduct small commercial enterprises based on roof-top poultry production, is an important feature of poultry production in Cairo and environs, and other urban areas in Egypt (although not exclusive to Egypt, as such systems are also found in Khartoum, Sudan and elsewhere). The system has evolved as a result of the interaction of social, cultural and economic factors, and to interrupt the cycle of infection in such systems is difficult, in part because it is difficult to identify and disassemble these factors in order to build effective and equitable disease control approaches.

With respect to vaccination, initially there was a government-supported mass vaccination of household poultry, but there were concerns about the programme from many quarters. A recent study by FAO and the General Organization of Veterinary Services (GOVS) indicated that mass vaccination of household poultry was not effective as delivery was poor, with less than 20 percent coverage and less than 10 percent of flocks with protective immunity levels. Huge numbers of household flocks make such exercises highly labour-intensive and the lack of age-uniformity and frequent changes to flock numbers through additions and sales make it impossible to sustain high level flock immunity. Additionally the poor hygiene practised by the vaccination teams may have contributed to virus spread. In late-2009, GOVS made a decision to stop mass AI vaccination in the household poultry sector. There is little or no data on vaccination in commercial farms as no monitoring has been done. Current vaccines cannot be successfully applied before one week of age and two immunisations are required, limiting its usefulness for short-cycle poultry, such as broilers. A range of vaccines have been used and antigenic variants have been detected in Egypt. The constraints of vaccination as a key tool in the control strategy in circumstances where it is very challenging to manage the vaccination programme are clear.

The capacity of government veterinary services to undertake surveillance, investigate outbreaks and implement containment is challenged by the high number of outbreaks and some of the issues with the structure and coordination of the veterinary services, as well as technical capability.

To further address the problems of the disease environment, the three key factors identified are considered.

Factor 1: Structure of the poultry sector

Egypt has a poultry population estimated at between 800 and 1,400 million birds, of which 90 percent are housed in commercial enterprises, while the remaining 10 percent in household (backyard or rooftop) production units, which are abundant in cities and villages. Forty percent of chickens are produced in mid-sized farms (5,000 to 50,000 birds) while small farms are the source of 70 percent of other poultry meat such as duck and turkey. Chickens comprise approximately 50 percent of birds kept by households, with ducks accounting for 25 percent and pigeons, geese and turkeys making up the remainder. Six governorates, all in the immediate environs of Cairo, have about 75 percent of the total poultry population, creating a very high-density of both humans and poultry.

It appears that many of the proposed risk factors for HPAI in Egypt are interrelated, where population density and activity is governed by the area of irrigation from the Nile River, the majority of the population is involved in agriculture and the majority of families keep poultry. Thus, human and poultry populations, the density of roads, irrigation canals and agricultural land are related to HPAI incidence, with 65 percent of recorded HPAI outbreaks having occurred in the six governorates which contain 73 percent of the national commercial poultry population. Factors distinguishing infected areas are mainly related to abattoir capacity, commercial farm density and cultivated areas, which highlight the role of trade and the production chain in HPAI transmission. Risk factors for the maintenance and transmission of H5N1 virus appear to include movements from table egg layer farms,

broiler fattening marketing through abattoirs and live bird markets and informal trading activities of the household poultry sector.

There is a vigorous live bird marketing system which accounts for the majority of poultry sales for direct consumption and enables mixing of fomites from the commercial and household production systems as well as inadvertent contact between humans and infected birds, whether that contact takes place in the market or in the home.

A deficiency in producer associations in the different poultry production sectors makes development of consensus on acceptable measures very difficult to achieve and this is a particular problem for the very large number of small-scale poultry production units. The very large numbers of household producers also means that any disease control activity, from vaccination to communication to training, is made more demanding and complex as it is difficult to get good penetration and uniform uptake. As the disease is widespread and endemic, it is likely to be more effective to assist industry to prevent infection of flocks than it is to undertake unpopular reactionary measures in the event of outbreaks. It is unrealistic to expect producers to report suspected outbreaks of HPAI if compulsory culling does not attract appropriate compensation.

Factor 2: Veterinary and animal production services

Veterinary services to the poultry sector are provided by both the public and private sectors, although private sector veterinarians tend to be employees of the larger companies. The public sector veterinary service has traditionally had a reasonable level of interaction with the mid-level producers through the provision of extension services, but limited contact with the household producer group through provision of clinical services at district and village levels. There is a limited partnership between government veterinary services, commercial interests and communities, for example, the decision to stop widespread vaccination of household poultry was not communicated to all stakeholders or groups with vested interests and this manifested itself in an apparent resistance to its enforcement.

A recent OIE Performance of Veterinary Services assessment indicated that there were issues with the connectivity between the GOVS and the decentralized veterinary services under the jurisdiction of the governorates, and also some uneven spread of technical capacity and capability in key areas. There are concerns with legislation and enforcement, and the process of consultation with stakeholders in the animal health and food safety areas. While there are the foundations of a veterinary laboratory system, further efforts are required to develop SOPs and a performance agreement for the different suppliers of diagnostic services to the control programme.

Critical areas where veterinary services fail are in achieving rapid detection and culling of infected flocks - with compensation - before secondary spread occurs; controlling poultry movement both in regular markets movements and in outbreak containment; and inadequate veterinary public health engagement in markets and slaughterhouses.

Factor 3: Commitment

Eliminating H5N1 HPAI is a long-term process, with varying levels of commitment to control and eradication. It has proven difficult to get all stakeholders to work towards common goals with a common strategy. There is variable engagement of the veterinary services in

the programme and the lack of coordination also affects the morale and commitment of staff. Engagement of the large commercial sector in the overall disease control effort is still weak. Poultry producers at most levels are reluctant to engage in the control effort (for example, to report disease) because of fear of the consequences. In 2010, FAO and partners organized a series of coordination meetings involving a range of stakeholders from the public and private sector at various levels. These efforts partly helped to bridge gaps and limit mistrust, as well as harmonizing activities of various authority levels within the public sector. In the process, a degree of improvement in the commitment of various players was witnessed. These included a willingness to review the HPAI strategy and associated structures. The establishment of an animal health technical committee under the direct leadership of the CVO and a dedicated avian influenza unit within GOVS are important illustrations of the renewed government commitment to implement the revised HPAI strategy and the joint United Nations assessment recommendations. However, there are still other core areas where functional partnerships and commitments are needed to enable tangible achievements in progressive control of HPAI in Egypt.

Moving forward with disease control in Egypt

It is now considered axiomatic that to achieve sustainable H5N1 HPAI control in endemic countries a long-term approach is required. National governments, international support agencies and donors accept this reality and it is now appropriate to institute a longer term revised strategy in Egypt. FAO is working in partnership with other key stakeholders and provided such a strategy to the Government of Egypt. It will be imperative that the strategy is both economically-sound, as well as socially and politically attractive. Two key principles will be applied in altering the approach in Egypt. One will be to analyse carefully and implement ways to increase the level of biosecurity or risk mitigation measures which can be effectively applied to different production units. The second will be to improve the management of poultry and poultry products along the market chain to reduce the risk of introduction and spread of H5N1 HPAI. Control of the disease will require improvements in veterinary services, including epidemiological and strategic planning capacity, technical knowledge, competence and commitment of field personnel. In addition, there must be effective veterinary hygiene measures along the poultry value chain and strong and effective partnership between industry and government veterinary services.

The overall goal will be to achieve a situation with H5N1 HPAI in Egypt where the disease no longer remains a significant threat to human health and in which the measures implemented by the producers and supported by regulatory authorities minimize the impact of the disease in the industry.

Application to the broader context of the agro-ecological zone

The poultry sector in Egypt is essentially isolated from the rest of Africa and the Middle-East by desert, so that lateral spread in a continuum of the poultry population is not possible. However, H5N1 has shown a great propensity to spread by trade and it is likely that the spread of the disease to distant governorates along the Nile would have been from trade. It is also possible for the disease to spread into northern Sudan and eastern Africa as a result of such trade. There may also be some informal movement of poultry and products to

the east to the Gaza strip and Lebanon as well as to other destinations. The risk of further spread of H5N1 HPAI to non-infected countries, including to eastern and western Europe, possibly through migratory wild birds, remains a concern.

INDONESIA

Overview

HPAI was first recognized in Indonesia in August 2003 and the Government of Indonesia officially declared HPAI infection to OIE in January 2004. In late-2003 the epidemic had spread rapidly across Java, into Bali, Kalimantan and southern Sumatra. By the time the disease was officially recognized, it was already widespread and well-entrenched. In 2006, HPAI spread further east, infecting Papua and much of Sulawesi for the first time. Since 2004, HPAI outbreaks have been documented in 31 of Indonesia's 33 provinces. Based on available surveillance data, HPAI appears to be endemic on the island of Java and parts of Sumatra. Lampung on Sumatra Island, and Yogyakarta, Central Java and West Java on Java Island appear to be the most heavily affected provinces. Outbreaks are detected less frequently in South Sulawesi, with only sporadic outbreaks detected on Bali, the remainder of Sulawesi, and Kalimantan. Eastern island chains, such as East and West Nusa Tenggara, appear to be free from disease at this time.

Vaccination was introduced by the private sector in response to the severe losses which were occurring in 2003. Initially vaccines and their usage was unregulated and essentially taking place without official sanction. A number of Indonesian companies are now producing vaccines and in more recent years the government has brought in measures to coordinate the virus strains in use. There have been differing professional opinions about the use of vaccine in Indonesia, especially regarding effectiveness of vaccinating scavenging chicken populations with relatively rapid turnover, where there is often low vaccination rates achieved despite major efforts undertaken. However, at present, vaccination appears essential for disease prevention in long-lived birds such as breeding stock and layers flocks, which have a high risk of incursion because of management practices and generally poor biosecurity.

The control effort faced major constraints by the time H5N1 HPAI incursion became officially recognized, as a result of the extent to which it had already spread, the size and diversity of the country, and the large, complex and weakly-regulated poultry sector. There was not a 'whole of government' response to the emergency or sufficient preparedness in the private or public sectors. This compounded the lack of human and financial resources to address the scale of the problem. However, when the first human cases of H5N1 HPAI occurred in June 2005, and there being such a high case-fatality rate, the level of national and international interest in the problem escalated.

Smallholder management of poultry die-offs has developed over the years in response to outbreaks of Newcastle disease (ND) and also alongside the acceptance of such die-offs by official services. The common tactics with such incidents for a backyard flock are to salvage the flock by immediate consumption or sale. This familiarity with and approach to ND is likely to have applied to small commercial operators as well, and to some extent still continues unchecked. A lack of compensation for losses due to HPAI disease and the control measures introduced, are likely to compound this salvage strategy for small-scale

intensive farmers. In general, the poultry sector in Indonesia has grown rapidly over the last 20 years with little oversight from government and little interaction between the public and private sector. The integrated companies have also shown little interest in improving production standards on their contracted growing farms.

Biologic characterization and phylogenetic analysis which have been conducted (through the OIE/FAO network on animal influenza [OFFLU]) on virus isolates from samples representing 98 of Indonesia's 450 districts has shown that all Indonesian isolates are HA clade 2.1 viruses, with the majority (78 percent) classified as clade 2.1.3. This suggests a single introduction event with subsequent evolution in-country. The oldest lineage (circa 2003) comprises viruses in clade 2.1.1, which was still detected in 2007 samples from Bali. The HPAI sub-lineages distributed in Indonesian poultry continue to evolve as shown by the recent detection of antigenically diverse viruses from West Java and identification of a potentially new third order clade among 17 percent of viruses from 2005-2007 originating in Central Java and Bali.

Context of the Endemic Country

The specifics of the three main factors identified as constraints in the endemic countries are outlined below for Indonesia. In addition, some attention needs to be given to a number of other important factors.

As in all endemic countries efficient disease surveillance and then effective and appropriate response are major issues. The surveillance system in place will always be dependent on producers reporting disease incidents which might be HPAI, but where ND is also endemic this represents a considerable amount of response activity focused essentially on one disease. The PDSR programme which works at village level will effectively detect and diagnose HPAI when there are reports of village poultry deaths by household keepers and small-scale producers to the local veterinary service. It is likely that the PDSR programme has an impact on the disease and is one of the mechanisms in high prevalence areas which affect the endemic balance because of the control measures applied. However, it is recognized that with the participatory approach the response which is applied is more likely to protect people at risk from infected birds and less likely to completely arrest the spread of the agent in the village environment and so eliminate the cycle of infection. The PDSR programme does not apply to the commercial sector or the market chain. The programme continues with international donor support and a transition strategy has been developed to better integrate the programme into a National Veterinary Service, with more focus on passive surveillance and cost-sharing with local government, and to address a wider range of priority diseases. On the broader disease control front, stamping out has been limited to individual infected flocks in villages since 2008, but continues to be hampered by the lack of an appropriate compensation scheme. Although a range of control measures have been put in place, poultry movement between provinces is still largely unregulated and outbreaks in commercial poultry are not reported nor controlled, providing a major constraint to country-wide elimination of the virus. Some areas of the country with low human and poultry density have had smaller numbers of outbreaks and with minimal control interventions the virus did not persist in these areas. It was also observed that when PDSR was initiated in the three higher population provinces of East Java, Bali, and South Sulawesi, outbreaks

were frequent, but now are rare to sporadic in these three provinces. This may be due to improved detection and response but importantly combined with decreasing poultry movement from highly endemic areas.

In 2010, the disease continued to cause human deaths, but the reported incidence of disease shows a declining trend (see Chapter 3) to a level which has probably reduced the political and public concern about the problem. It is important to note also that the Island of Java has one of the highest human population densities in the world and so control of H5N1 in this environment where chicken meat is an important dietary component (it is estimated that one million live birds pass through the market system for Jakarta alone each day) in an important public health goal. It is also of concern that a proportion of human cases occur in the absence of diseased, or any live poultry in the vicinity. The risk factors for such human exposures are not fully elucidated. However, the overall tactic to deal with H5N1 would have to change if there was a reversal to this incidence trend and the number of human fatalities increased, and especially if there was any evidence for low grade human-to-human transmission. The poultry sector is a very important supplier of food and so any strong measures to control and restrict poultry sales and marketing would have significant repercussions all along the food chain.

The introduction of vaccination with minimal involvement of the government may initially have resulted in an attitude among small commercial producers that HPAI is now an endemic disease, as with others which have to be vaccinated against, and so has become part of the 'landscape'. An important issue for control is that there is a large population of poultry which cannot be vaccinated and a significant population of ducks on Java which are not included in regular vaccination programmes. At the moment the central animal health authority has no effective process to monitor the use of vaccine in either time or space in the private sector. However, a programme known as PVUK (*Petugas Veteriner Unggas Komersial* – Commercial Poultry Veterinary Officer) is now being piloted to improve engagement between local government veterinary services and poultry farmers and this may help to address this issue. As mentioned earlier (Chapter 3) the OFFLU project is heavily involved in Indonesia monitoring virus isolates from the field in order to detect any antigenic changes which might affect the efficacy of the vaccines in use. The government has introduced a process to approve new vaccines and new vaccine strains. This is an important development but there are some concerns that it is proving difficult to administer and so in its initial implementation is somewhat inflexible and potentially not responsive to needs.

Factor 1: Structure of the poultry sector

Government figures estimate that the total standing population of poultry was approximately 1.5 billion (and rising) in 2009, made up of about 1 billion broilers, 35 million ducks and 116 million layers, and nearly 300 million village poultry. Another estimate is that the annual off-take is approximately 1.5 billion broilers, which might indicate a slightly smaller standing population. Regardless of the figures, there is a very large, dynamic and multi-faceted poultry sector. About 80,000 farms with 60 percent of the broiler and layer poultry population are located on Java. The market preference is for live birds and there are estimated to be about one million broilers passing each day through the live bird market system which supplies Jakarta. These birds are sourced mainly from Java and predominantly

West and Central Java as well as from Lampung on Sumatra. Large numbers of vehicles, cages and people are involved in these market chains, and until recently very scant zoo-sanitary procedures were applied to prevent transmission of disease along the chains.

As there is no export market for poultry, the commercial sector is not dependent on the public sector to support efforts to trade internationally and so there is no interdependence between public and private veterinary services (as is seen in countries with large export-orientated poultry sectors). This also means that there is no incentive for the commercial industry to try to comply with international standards for disease control, thus these standards are not passed down to suppliers by export orientated-processors.

Factor 2: Veterinary and animal production services

The animal health services have a decentralized governance system which includes devolution of the responsibility for controlling animal diseases to more than 450 autonomous districts/municipalities. At the local level, the operational responsibility for animal disease control may not actually be in the hands of a veterinarian. There is also, as was evidenced initially with the outbreak of HPAI, little influence over the local disease control activities by the central animal health authorities. The PDSR programme has attempted to bring some uniformity to disease control activities through the establishment of provincial-based Local Disease Control Centres (LDCCs), development of manuals, and information, education and communication activities. The veterinary workforce is weak in some competencies, such as infectious disease control and epidemiology, thus further effort is required to strengthen capacity in these key areas. As the PDSR programme is operationally managed via LDCCs at the provincial level, this programme has gone some way to strengthening capacity in key areas of disease control.

Within the Directorate General of Livestock and Animal Health Services (DGLAHS) there are an Animal Health Directorate and two Directorates dealing with animal husbandry, including ruminant nutrition and production, and non-ruminant nutrition and production. The Non-Ruminant Nutrition and Production Directorate (NRNPD) has responsibility for national poultry production improvement, but it is clear that there is limited interaction and liaison between government and the private sector in respect to either production, marketing, animal health or veterinary public health. The Animal Health Directorate (AHD) has direct supervision over a network of nine Disease Investigation Centres (DICs), and while these units have no direct supervisory responsibilities for the provinces in their region, they do provide expert advice in epidemiology as well as a laboratory diagnostic service. Over the course of the HPAI events there has been considerable investment into the laboratory system and significant advances in diagnostic capability, however, further improvement is required for laboratories to reliably contribute to outbreak diagnosis. In another part of the Ministry of Agriculture (the Agency for Agricultural Research and Development) there is a national veterinary research laboratory which is not under the direct jurisdiction of the DGLAHS, but which undertakes animal disease research and diagnostic work.

Factor 3: Commitment

There is policy-level commitment to HPAI control at the level of the ministry but this is not generally translated into either adequate budget allocations or comprehensive action at the

field level. Within the technical units there is a sufficient level of dedication to the task, but again a lack of resources makes the HPAI control effort heavily dependent on international donor support. The industry is concerned about the disease when it has production effects on large commercial operations, and especially when infection enters valuable breeding stock. Layer farms are also motivated to prevent HPAI on their farms in order to protect their investment. However, overall there is a lack of coherence in the approach due to narrow self-interests. At the level of the contract and small-scale broiler producers, generally they are not well-informed and so can often get hit by disease outbreaks which they are powerless to avoid. However, they will generally not have a close relationship with government and already appreciate that compensation is not available, so salvage by sale is a common tactic for producers when faced with an outbreak of HPAI. Generally, keepers of backyard poultry operate a low-input/high-risk production system and so taking additional biosecurity or disease prevention measures which are epidemiologically effective is not likely to be beneficial to the individual producer. They usually lack sufficient knowledge, resources and financial stability to reliably implement actions advocated by PDSR teams. For keepers of scavenging poultry and for the animal health services in Indonesia, as elsewhere, vaccination of these birds is impractical and so the coverage often achieved by early vaccination efforts was not likely to have the desired impact on the circulation of virus.

Moving forward with disease control in Indonesia

Controlling endemic HPAI in Indonesia requires comprehensive long-term surveillance, outbreak control, and a prevention strategy focused on poultry health, and involving all sectors (backyard, commercial) and marketing systems. The approach to disease control and the veterinary service needs to be more encompassing of other issues and concerns than just HPAI. A number of approaches are being developed. One is supporting healthier poultry production by identifying biosecurity practices which are both profitable to the farmer and effective in reducing the risk of HPAI incursion. Another is to strengthen veterinary services by supporting the development of a National Veterinary Service (NVS) and building the capacity of animal health services to effectively address other animal and zoonotic diseases of concern. A third important element is to facilitate the establishment of a functional and dynamic public-private partnership between the poultry industry and the government for improving the quality of poultry production in Indonesia.

In order to reduce and possibly break transmission along the market chains, considerable effort has been made in defining them, using such techniques as social network analysis and risk analysis, and then in developing with the stakeholders, measures which will have an impact on critical control points and hazards for virus dissemination. This development of risk analysis and strategies to control introduction of the virus will be taken back to farm level and efforts made through a national programme for poultry production improvement to upgrade biosecurity at the farm level. At the end of the process it is expected that a system of certification can be introduced to formalize the benefit to farmers and consumers from the upgraded system. Part of the strategy is to improve the quality of basic veterinary services to the poultry sector so that it is possible for the certification system to be adequately supported from the technical aspect. Vaccination will remain part of the control measures, and it will be necessary to continue to monitor its effectiveness, as

well as to ensure its efficacy by continued study of antigenic and genetic characteristics of field viruses. A mechanism to track the use of vaccine in time and space will be investigated and the management of vaccination put on a national basis through closer cooperation between the public and private sector.

Since the FAO programme began there has been much effort and expenditure on field surveillance of disease outbreaks. The effort will continue but will be improved through further enhancements in surveillance targeting, information management and epidemiological analysis.

Application to the broader context of the agro-ecological zone

Indonesia's separation from the mainland of Asia makes the archipelago one agro-ecological zone from the regional disease control perspective. The fact that the Indonesian viruses do not appear to have passed across the straits to Malaysia or elsewhere does suggest that there is not a high risk for this transit to take place, especially given the large Indonesian workforce present in the former country. In addition, the disease has not moved from Indonesian territory to land-border neighbours on Borneo (Malaysia and Brunei), New Guinea (Papua-New Guinea) or Timor (Timor Leste). If the country is treated as a number of separate zones then it is probable that the approach to control advocated earlier by FAO – that is progressive control of the disease in the periphery and a gradual contraction of the infected areas – could be applied. This is still some time away and in the meantime there are several places toward the centre (on Java and Sumatra) which appear to be virus factories, therefore approaches to reduce the disease here will have benefits at the periphery. In fact, the incidence of disease at the periphery is negligible and perhaps dependent on re-introduction from the centre.

VIET NAM AND THE GREATER MEKONG SUB-REGION

Overview

In the lower Mekong basin the rice and flood plain ecosystem is shared by both Viet Nam and Cambodia so that the national border does not represent a natural break in the landscape or land use. The highly productive delta is linked to the larger population centres of Ho Chi Minh City and Phnom Penh by robust trade in agricultural goods and livestock. Trade routes also cross the international border and livestock, such as pigs and poultry move in both directions. Nomadic duck flocks will utilize rice paddies on both sides of the border and people enjoy free local movements. It is said locally that a "a duck might be a Cambodian duck in the morning and a Vietnamese duck in the afternoon".

In the north of Viet Nam, the predominant agro-ecological zone is the Red River Delta, with Hanoi as the main population centre. Again there is significant production of ducks and chickens in this zone with a focus on supplying the capital. There is significant movement of poultry and other livestock species across the northern border with China and this route is likely to have been the conduit of introduction of the newer clades of H5N1 since the first epizootic in 2003-2004.

Viet Nam first reported cases of H5N1 HPAI in late-2003 but by the time the disease was reported it was already widespread and well-entrenched. A range of control and pre-

ventive measures has been implemented beginning with wide-area culling in 2004 (which was scaled back in late-2004 to modified stamping out only, involving culling of known infected and high-risk in-contact poultry), temporary bans on duck breeding, changes to marketing practices in urban centres and introduction of vaccination as one of the preventive measures in 2005.

H5N1 HPAI viruses continue to cause disease sporadically in humans and poultry, with most reported avian outbreaks centred on the two river deltas. Some cases have also occurred in isolated mountainous regions of some provinces, although investigations have not established how these cases occurred. Clade 2.3.4 viruses are the main viruses detected in the north since 2007; clade 2.3.2 viruses also occur; and clade 7 viruses have been detected in smuggled poultry and in markets in northern Vietnam. Clade 1 viruses have persisted in the lower Mekong area since 2003 and the same clade sporadically appears in Cambodia and the central plains of Thailand. It is highly likely that the duck management systems play a role in persistence and spread of viruses in this area.

Context of the model

The Mekong delta has a high human population density and land is scarce and valuable. The area is prone to inundation and also the ravages of storms from the South China Sea. Transport around the parts of the delta has to be by waterways or motorbikes as the road network cannot reach many areas readily. While the production of chickens is not so simple because of the constraints of moving feed and product, the Delta is none-the-less close to the larger population centres areas where there is intense demand for chickens. For local consumers there are many small live bird markets and the larger markets handle the significant daily flow of birds to Ho Chi Minh City. Within the Mekong Delta there is also a great concentration of ducks and these are used for both meat and egg production. With the difficulty of the terrain and sometimes the weather the management of livestock diseases can be quite challenging. In addition, the veterinary service is often stretched beyond its limits because of concurrent outbreaks of more than one serious disease in livestock besides HPAI, e.g., FMD, PRRS.

Viet Nam also adopted a national blanket vaccination as a support to the control programme in 2005 which has now been contracted to high risk areas. The routine and wide application of vaccines especially for scavenging chicken populations has been an onerous task which is difficult to carry out in strict accordance with the guidelines. After six years of vaccination there is an acknowledged 'vaccination fatigue' setting in at field level and the organizational costs of the logistics for the vaccination programme are burdensome and divert effort from other important animal health problems. These are common features of such intense vaccination efforts and so there is an effort to reduce the vaccination load and move towards an exit strategy.

In Viet Nam the administration is markedly decentralized, with significant autonomy being given to authorities at the provincial, district and lower levels. Government employees engaged at the local level are paid by local authorities and to a great extent take their direction from these authorities (although the central technical departments are mandated to provide guidelines for technical officers at all levels of government).

Viet Nam has significant wetlands which are part of the western Pacific flyway and important staging posts or endpoints for migratory water birds. As in other parts of the

Asia, the role of these wetlands as conduits for new strains of HPAI to enter domestic waterfowl and then other poultry species is not yet determined. There is vigorous cross-border trade in various livestock species, much of which is unregulated or subject to any measures to reduce risks of transfer of infectious disease agents. This trade across land borders has probably been responsible for the introduction of H5N1 into the country, as well as recent highly pathogenic PRRS and also of new strains of FMD. In this respect Viet Nam is typical of many countries in southeast Asia.

Viet Nam, like its neighbours, has a great diversity of agri-ecological systems through which poultry are scattered at different densities, and are of variable economic importance. This variation brings with it local complexity in the different socio-economic drivers for the disease and its control. While the distribution of H5N1 HPAI clades suggest that there are some in-built system barriers to the spread of the virus, until there are well-supported efforts to create disease control zones (this is a feasible approach) the whole of the country must be considered endemically infected. Across the range of agri-ecological systems the proportion of avian cases of infection and disease which go undiagnosed is unknown. However, such cases do occur, as demonstrated by the detection of the virus during market surveillance, and the outbreak of human cases before avian cases in the same location. This is a common feature of the endemic countries. The upsurge of disease observed every cool season indicates that at this time of year the incidence of disease reaches a level likely to result in outbreaks being reported. The occurrence of undiagnosed infection is not surprising given the stage of development of veterinary services, the reluctance of farmers to report disease, the presence of a large duck population in which disease may not always be seen or diagnosed, and the vaccination of poultry (which alters the course of infection, so that it may go unreported). In addition, local officials will attempt to deal with suspect outbreaks of disease by taking local control measures but not confirming the suspicion or reporting to central authorities. Such local action can partially control the level of disease, but cannot break the ongoing cycle of infection.

In relation to the three key factors for endemic countries, the following observations are made for Viet Nam:

Factor 1: Structure of the poultry sector

Intensive poultry production is generally confined to production zones which are close to large population centres. Less intensive production both as small commercial and scavenging type systems may be also present in these zones and predominate outside them. Generally, there are insufficient biosecurity barriers between different production systems and this allows virus to circulate freely. Viet Nam has the second largest duck population in the world with a standing population of approximately 60 million birds and an annual turnover of about 30 million. The management of ducks in the Mekong Delta is multifaceted and complex, and makes for some difficulties for official veterinary services to effectively manage a disease control programme. Two important features of duck production are that many ducks are moved around to follow the cycle of the rice harvest as they feed on spilled grain in the paddies, and there are significant populations of long-lived ducks (layers and breeders) which can mix with relatively young and possibly unvaccinated short-lived meat ducks.

Since H5N1 HPAI was first reported in Viet Nam some restructuring has occurred in the poultry sector as one way to combat the disease. This followed from decisions made, centrally by the Ministry of Agriculture and Rural Development (MARD) through the Department of Livestock Production (DLP), to promote industrialized livestock production. At the provincial level, changes were made to marketing and slaughtering practices, including bans on the sale of live poultry in markets in major urban centres such as Ho Chi Minh City, as well as through the development of provincial poultry development plans which incorporated designated poultry production zones. Adjustments to supply chains with improved disease control have taken place for Ho Chi Minh City and are a useful demonstration of what is possible if food safety becomes a key policy issue for the administration.

Investments have already been made into the Ha Vi wholesale poultry market in Hanoi. Construction of the new market facilities will be completed in 2010 and the changes are expected to reduce the risk of H5N1 virus circulating in the market if it is managed correctly. Future plans for this market include improving the traceability of live poultry into and beyond the market. This can only be achieved if traders and transporters are included in specific training and awareness programmes. It is imperative that if there are to be some traditional markets maintained, the management of the supply of healthy birds is given priority both at policy and operational levels.

Some of the early restructuring measures during the emergency phase of the outbreak response resulted in considerable disruption of trade for farmers and traders. For example, decisions made by urban authorities to ban the sale of live poultry in markets and to close small urban slaughterhouses had significant implications for smallholders in provinces around urban centres. These producers used to sell live birds to the urban areas where the decision was made, and were locked out of these very markets.

FAO has produced a detailed atlas of the poultry sector for a small number of provinces and this has proved a useful resource for understanding the patterns of production and marketing, and for understanding risk of disease associated with market chains.

Factor 2: Veterinary and animal production services

The animal health services in Viet Nam do not have an unbroken line of management, thus provincial and district operations are managed by local administrations. This has some impact on the overall coordination of disease control efforts. At the central level, with the Department of Animal Health, there are limitations on capacity and manpower, although FAO has provided support to strengthen key areas such as information management and epidemiological analysis. FAO has also assisted the DAH and the Agricultural University of Hanoi to establish an Applied Veterinary Epidemiology Training (AVET) programme and this will begin to have some impact on disease control programmes in the next few years. The laboratory services have been significantly strengthened as a result of the HPAI programme and much training has been carried out to improve emergency outbreak response at the local level. However, there is insufficient capability within the wider animal health system to provide technical advice and support to small holder poultry producers on such matters as general good production practices and disease control. This is in part a reflection of the need to improve generally the curriculum and training of veterinary graduates, especially in poultry health and epidemiology.

While veterinary laboratory capacity has been enhanced substantially, a recent assessment shows the need for more investment to improve laboratory infrastructure and build new laboratories. Quality management systems for national and regional laboratories are being introduced in 2010, but additional time and resources will be needed for accreditation of all laboratories, including better testing facilities. One of the significant constraints on the diagnostic process in Viet Nam is the lack of veterinary pathologists and case managers in most veterinary laboratories. Twinning arrangements with international reference laboratories are currently being explored.

Considerable effort has been expended on training community-based animal health workers (AHWs) over the past five years, and this is reflected in the increase in disease reports received from them at the district level. However, there is still a marked tendency in the training to concentrate on clinical diagnosis in the first instance and not on investigation to establish cause. As such it is possible that AHWs will classify outbreaks as diseases other than HPAI because the signs do not meet all the criteria understood to be necessary. In addition, vaccination will modify clinical signs so that classic disease pictures are not presented. In some instances local authorities might try to control a disease outbreak and if it remains confined to a single commune might not feel obliged to report it up the line.

The Department of Livestock Production is mandated to look after matters which deal with production issues, industry structure and marketing, but has a relatively small manpower resource at central level and no equivalent sub-department at provincial level (at each provincial livestock office which is a Sub-Department of Animal Health)

Factor 3: Commitment

The central government has a strong commitment to the control of HPAI and especially the prevention of infections in humans. In the period between 2006-2010, the government followed the *Green Book* and following the IMCAPI meeting in Hanoi in March 2010, has now commenced the plan for another five years of effort to contain and control HPAI. At the height of the response there were formal multi-sectoral committees at all administrative levels to coordinate the programme and manage local inputs. At the level of provincial, district and commune administrations, the commitment to provide resources and to enforce regulations to control the disease is now probably somewhat variable. Some who have been dealing with the disease for more than six years show signs of fatigue and are less enthusiastic about mounting a response to it than they were in 2004-2005. Not all of the producers of chickens and ducks can be said to be committed to HPAI control as it is often an inconvenience, and also an issue which is not seen as an individual responsibility. In this sense, the broader aspect of the social and economic drivers for disease and its control are not fully understood.

In the private sector, at present work is being undertaken to build systems which will allow well-managed farms to demonstrate freedom from H5N1 HPAI, backed up by a set of strong farm biosecurity measures which are audited to demonstrate that the risk of virus entering the premises is extremely low. If attempts are made to eliminate H5N1 viruses from a zone then support will be needed from all levels of government and also from producers, traders and the general public within the zone. All stakeholders will need to perceive some advantage stemming from being involved in such a programme.

Moving forward with disease control in Viet Nam

The government has great concern over the ‘vaccination fatigue’ and ‘HPAI fatigue’ which have become evident in recent years. The animal health services devoted energy and resources to HPAI and it is argued that this is now to the detriment of controlling some of the other important epidemic diseases, such as PRRS and FMD. However, it cannot be argued that the epidemic of HPAI with the attendant human cases which were occurring was a not major zoonotic disease emergency at the time and the effort and emphasis was indeed justified. It was not possible at the time to devise an exit strategy for the vaccination programme, but reducing the effort with the programme without releasing the disease from control is now a major objective of the government. Over the past 18 months, the GETS project (see Chapter 4) has been active in providing information to the DAH on ways to reduce the level of vaccination carried out. At this point the government has proposed to reduce the amount of public sector supported vaccination in chickens and to concentrate on reduction of infection in ducks by using age-based vaccination. It is however, clear that new vaccines are needed for ducks as a two-shot regime with an oil-based vaccine is not ideal for meat ducks and is not readily accepted by producers. An ideal candidate for ducks would be a genetically modified live duck virus enteritis virus with an influenza H5 and N1 gene fragment inserted, as this would potentially provide protection against duck virus enteritis, a disease considered important by duck farmers and H5N1, an infection which is often not associated with overt clinical disease. It is clear that HPAI control in Viet Nam will require in part a new technical approach with the vaccine and also greater effort to separate ducks and chickens in the production and marketing segments of the value chains. Trying to eliminate the large population of free ranging ducks is not regarded as feasible within the Viet Nam context and so the medium-term focus must be to manage the endemic infection in this production system.

While the government will not cease vaccination in the short-term there is a strategic approach to gradually reduce the area and the numbers involved. It is evident that in order to achieve this goal and not lose control over the disease, the capacity to monitor and manage the overall programme will need to be continuously strengthened. The approach to post-vaccination monitoring and the virus surveillance programmes which currently tend to monitor activity rather than outcome will need to have objectives which focus on the effectiveness and efficiency of the programme.

Work will continue to develop programmes which will invoke more the principles of ‘good production practices’ for small scale commercial chicken enterprises, rather than simply with a focus on ‘biosecurity’ for HPAI control. There is a gradually developing consumer consciousness about food safety in Viet Nam, and so efforts to make markets less likely sources of infection and better managed from a hygiene perspective will gain more traction with policy makers in the immediate future. FAO has taken the view that it might be possible to facilitate control by creating incentives for chicken producers to establish disease-free production zones, even down to the level of the individual commune. This concept of the ‘Healthy Commune’ can also incorporate the principles of One Health. Market access or market premiums are proposed incentives which could increase private sector stakeholder participation in an integrated disease control programme.

Restructuring will continue, involving a gradual shift towards industrialized production although land constraints are likely to limit the extent of consolidation. New industrialized

farms should have enhanced biosecurity measures in place to prevent disease. Well-implemented biosecurity measures are still regarded as key defence mechanisms against HPAI and other diseases. Setting and enforcing legally binding standards for all commercial farms would be of great benefit. The systems being developed to regulate hatcheries should ultimately be extended to farms. Although there are plans at the central and provincial levels for developing and restructuring the poultry sector, most of the investment required to achieve the plans will be made by private sector investors, provided they perceive a reasonable potential for profit and also have access to capital. Decisions have been made by the private sector to invest in improved farm facilities and slaughterhouses. Based on events since 2004, banks may view poultry production as a risky enterprise for small operators. If livestock production zones are developed, they will require strict guidelines on facilities and management, hygiene and farm practices, and on veterinary support and disease reporting obligations.

No matter how much restructuring is conducted, Viet Nam will still have a substantial population of free grazing ducks and village poultry. Scavenging chickens remain an important source of supplemental income for those on low-incomes. As long as there are significant numbers of rural poor, there will be a need for this production sector. It is axiomatic that restructuring must not put smallholders at a disadvantage. Before any changes are made, the impacts of the restructuring should be examined and additional measures devised to protect or support groups which might be adversely affected.

Marketing and slaughtering practices will also evolve with more poultry slaughtered centrally and sold as fresh or chilled carcasses. Systems are already in place to allow the sale of certified native poultry carcasses, albeit involving larger-scale production than that used by smallholders. Until there is a change in consumer demand for live poultry, the sale of live birds will continue and will need to be managed with hazard reduction a high priority.

Application to the broader context of the agro-ecological zone

The role of ducks in the maintenance of H5N1 virus circulation is well accepted but there remains limited understanding about how best to manage the situation when free grazing ducks are considered to be an important part of the rice agriculture ecosystem. The lessons learned here are important to neighbours with significant duck populations, even as far afield as Bangladesh, Myanmar and Thailand. The issues for vaccination are important in the GMS because an upsurge in H5N1 in Viet Nam might have ramifications for more regional spread. Certainly a significant upsurge of H5N1 infections in waterfowl does also raise the possibility of the virus again cycling through wild migratory birds and being spread via this mechanism. The scale of vaccination in Viet Nam is large enough to require development of some additional management tools and these will at least be of interest to countries further afield with vaccination programmes.

The propensity of H5N1 to spread along trade routes is a regional and an agro-ecological issue. The future of HPAI control does depend on closer integration of cross-border efforts to understand the value chains and the forces which drive them in order to better manage the chances of transfer. Many ethnic Vietnamese work as duck farmers in neighbouring countries also and they have system links with counterparts at home, so this is an additional form of link which needs to be considered.

FAO STRATEGY FOR NON-ENDEMIC REGIONS

Africa

The H5N1 HPAI situation on the African continent must be considered a success story especially with the elimination of the disease from the commercial poultry sector in Nigeria. While the risk factors for introduction of the disease are not entirely controlled (migratory birds and probably risky commercial practices), there is probably more awareness in the commercial sector about high risk activities which might result in incursion, and so there is a reduced chance of an adverse event. The risks associated with the introduction of the disease in wild birds still remain, but it would appear that with fewer wild bird die-offs related to H5N1 being reported, the rate of infection in these populations may be declining for the present. However, FAO will maintain the global activities to monitor the presence of H5N1 infection in migratory birds. If an increase in wild bird infections is detected then the high risk sites in west Africa will be alerted. The appearance of clade 2.3.2 may herald the possible dispersal of H5N1 again by migratory bird populations. The situation evolving in Japan and the Republic of Korea might be an early warning of another significant spread of H5N1 HPAI in 2011.

Central Asia and the Middle East

The FAO activity for the Middle East was managed through the ECTAD office in the Regional Animal Health Centre in Beirut. At the present time this office is not operational because of lack of funds but it is anticipated that it will re-open in the near future. The office operated a regional laboratory network and also provided a hub for training in animal disease surveillance. FAO plans to continue these activities as a means to maintaining HPAI awareness in the region.

For Central Asia, the original Asian Development Bank project was completed and FAO used funds available for global initiatives to undertake further regional activities. As indicated in Chapter 3, the main approach – as a result of the relatively basic level of the veterinary services – has been to build regional networks and to use these as the springboard to deliver training in the various countries through a training of trainers (TOT) approach. The use of national consultants is important here because of the number of different languages and the various language barriers which exist. The World Bank funded projects are continuing at country level and the FAO regional project supports these where possible.

High-risk countries

Countries which border the endemic countries or which form part of the agro-ecological zones in Asia in general have significant support from international sources managed through FAO, or in some cases fund substantial programmes from national budgets (eg Japan, Republic of Korea and Taiwan POC in east Asia; and Malaysia and Thailand in south-east Asia). In the case of India, West Bengal is considered to be endemically infected but the Government of India essentially meets all the control costs from national sources. In October 2010, a project commenced with India to strengthen the epidemiology capacity in the country, principally with the goal of better understanding disease dynamics and making disease control more efficient and effective. In Nepal, there are two projects operating:

the USAID-funded project and the World Bank-funded project. At present there is a small amount of WB funding in Bhutan but it does not involve FAO in implementation. While Bhutan only has a small poultry population, because of the dependence on other regional neighbours for supplies, there is a moderate likelihood of an outbreak. The situation in Myanmar is probably more volatile than the other countries in the Gangetic plain as it is now considered that some duck populations might be endemically infected. The disease however, is not endemic in the domestic chicken sectors. In the Greater Mekong sub-Region, it is not likely that the disease is endemic in Lao PDR or Cambodia but there are areas where ducks are raised in free range systems and these areas may harbour long-term circulating virus or are particularly susceptible to virus incursion. While FAO is not currently active in the Philippines, there has been an appropriate level of investment to prepare the country in the event of a disease outbreak incident.

With these three areas FAO has a consistent approach to support countries either with country projects in the case of the most at-risk countries or through more broadly focused regional projects based on supporting regional networks.

Chapter 6

Moving forward: FAO's contribution to the One Health approach

INTRODUCTION

At the International Ministerial Conferences on Avian and Pandemic Influenza (IMCAPI) in Delhi (December 2007) and Sharm el-Sheikh (November 2008), the countries present resolved to initiate longer-term action in response to infectious diseases which emerge at the interface between animals and humans within different ecosystems, and which are capable of causing economic disruption, affecting livelihoods, and resulting in animal and human illness and death. The framework to effectively manage diseases at the human-animal-ecosystem interface is known as the 'One Health' approach. The principal technical partners in One Health are FAO, OIE and WHO, and these partners are progressing, in close collaboration with United Nations System Influenza Coordination (UNSIC), the World Bank and others, to develop the mechanisms which will enable the approach to become operational. During 2010, FAO worked on a corporate strategy and an Action Plan (for the period 2011-2015), setting out the priorities and the organization's contribution to the One Health framework, in relation to the complex interplay between host, pathogen and the environment which determines the outcome of disease events at the individual to the population level.

At the same time, it is recognized that FAO's mandate and mission is broader than the global concerns about zoonosis and public health impacts of animal disease raised in the context of One Health. This recognition is reinforced by the recommendations of the Second Real-Time Evaluation of ECTAD activities for the period 2006-2009, which suggested that investments into HPAI prevention and control should be harnessed to complement efforts to control other important TADs. While non-zoonotic TADs are recognized as having an impact on human welfare, it is probably more useful for FAO member countries to initially engage with the One Health approach within the limits of zoonotic diseases. It has already been observed that animal disease control becomes more complicated as the urbanization of populations and increasing global trade in animal products leads to the intensification of production, to maximize the efficiency of use of inputs. This production environment is dynamic and constantly evolving: within systems, with the expansion of systems to new locations, and with the evolution of new systems. The role of livestock production intensification as a factor in emergence of new diseases is not fully understood, but experience and some underlying scientific theory suggests a strong causal link. Recognition and control of new diseases is clearly a key issue for the global animal health community. Broadening the FAO ECTAD programme beyond HPAI, however, presented the challenge of

maintaining the link of this core programme back to the context of One Health. The FAO corporate strategy and action plan will set out this linkage in detail.

Climate change is also hypothesized as a potentially significant factor which will drive the emergence of new diseases. To date the most likely influence of climate change on disease will be as a result of the invasion and establishment of insect vectors in new niches, although the redistribution of animals and humans as a result of issues such as water shortages, food shortages and inundation due to rising sea levels, has the potential to have an impact on disease emergence. The interaction of multiple factors in the causation of disease makes it difficult to model and predict outcomes, but it is possible to model with greater certainty the potential for insect vectors to establish in new environments. It is understood that the impact of climate-driven changes will vary in different parts of the world and in the different agro-climatic zones. FAO has begun to harness the considerable repositories of data and expertise in different disciplines related to climate change and disease emergence in order to support the One Health approach. FAO and partners will continue to monitor changes in disease patterns and climate in order to refine the tools available which will help to understand and ideally predict disease emergence or redistribution.

This chapter examines a number of examples in which FAO has responded to the challenge of emerging (and re-emerging) threats to broaden the ECTAD portfolio, and is contributing to the application of the One Health approach to practical issues related to animal and zoonotic disease problems. *The Third Report on the Global Programme on HPAI* provided an extensive outline on the background to FAO's engagement in the approach and discussed the three complementary areas of work which would be followed to operationalize this concept. These areas of work were: 1) the elaboration of One Health in normative terms; 2) the provision of One Health field programme support to member countries, and at (sub-) regional level(s) (shared environments); and 3) strengthening partnerships and structures. These three areas are further explored below, including progress achieved in 2010.

FAO NORMATIVE ACTIVITIES AND THE ONE HEALTH APPROACH

In relation to the normative activities, FAO has been working actively in a number of areas. The development of a Strategic Action Plan outlining its contribution to the One Health agenda has involved considerable iteration. The plan extends FAO's six-year response to H5N1 HPAI to other animal and animal-related human health threats. It is outlined in a prioritized and sequenced medium-term (2011-2015) plan of work; and emphasizes FAO's comparative advantage in taking a broad, multidisciplinary approach and building on investments and lessons learned during the H5N1 HPAI programme.

Significant resources are being applied during 2010 and the early part of 2011 to finalize and formalize the declaration of global eradication of rinderpest. The control of rinderpest has had a significant impact on human livelihoods and health in wide areas of the globe, due to the impact on cattle production. The achievement of eradication follows a long investment by FAO in the Global Rinderpest Eradication Programme and is an important milestone for FAO and the global animal health community. It is additionally significant as it coincides with the 250th anniversary of the establishment of the first veterinary school (in Lyon, France, in 1761), a development driven by the ravages of rinderpest in Europe.

Collaborative studies have been undertaken by FAO to develop models to investigate possible impacts of eco-climatic factors on vector and consequent vector-borne disease distribution. This work leads to better understanding of the potential for certain vectors and their associated pathogens to emerge or broaden their distribution. The relationships between water, crops, ducks and HPAI outbreaks have been published earlier and further elaborated. More recently, with academic collaborators, a model to predict changes in virulence in changing eco-epidemiological landscapes has been developed and applied. There has also been consideration of the impact of disease and expanding animal production on biodiversity and genetic conservation.

In the veterinary public health area, initiatives have looked at policy development with respect to antimicrobial resistance and in finding better prevention and control strategies to address neglected zoonoses such as brucellosis, rabies, echinococcosis, cysticercosis and anthrax. FAO works closely with the Alliance for Rabies Control (ARC) and has become a member of Partners for the Prevention of Rabies (PRP), which collaborated with ARC to create the rabies 'blueprint' enabling countries to access user-friendly and structured materials related to establishing a rabies control programme.

The socio-economics group continues to examine incentives and motivational issues such as compensation, and develops methodologies to examine risk pathways and understand stakeholder behaviours in relation to value chains associated with HPAI. This work relates to animal production economics, and the risks to humans associated with particular activities in the poultry market chain. The epidemiology programme continues to develop and in late-2010, hosted an international workshop to allow experts to examine ways to improve global animal disease surveillance. The workshop was attended by OIE and WHO, the two technical collaborators (with FAO) in the One Health approach. The laboratory group continues to develop approaches to improving the performance of animal disease diagnostic laboratories, principally within the HPAI programme. The wildlife group has also been developing tools to investigate the mechanisms for emerging disease threats, such as tracking of animal movements and collaborating in studies to look at the role of bats and environmental factors in the emergence of pathogens.

The emergence of Pandemic (H1N1) 2009 raised questions in relation to One Health, but also provided early opportunities for collaboration at the global level (and also included FAO carrying out regional projects to monitor the presence of the virus in animal populations). In this case the virus spread effectively in humans and was transmissible from humans to several species of livestock, although not necessarily with great efficiency. However, the potential for Pandemic (H1N1) 2009 to become established in livestock was a major concern which required FAO to respond with a number of Technical Cooperation Projects (TCPs) to monitor the disease situation in Asia, in particular. The experience illustrates that the tools do not exist at the scientific level to make predictions about pathogen behaviour, even when the pathogen is relatively well-studied, as in the case of the influenza virus. Nor do the tools appear to exist at the public policy level to model the risks and hence the requirements during likely scenarios when the pathogen leap is successful. It would be important at this point to undertake a retrospective analysis charting the possible public policy process if for example, Pandemic (H1N1) 2009 was recognized in pigs and the agent well-characterized four months prior to the outbreak in Mexico.

At this time it is not yet possible to predict the emergence of new diseases, but recommendations from One Health conferences indicate approaches which may be productive. These include monitoring of hot-spots for new diseases (and existing diseases). Moreover, in the context of One Health there needs to be stronger linkages between animal and public health services in respect of H5N1 monitoring and surveillance, especially in countries where the agent is endemic in poultry populations. These matters are under consideration as part of the normative activities of FAO and within the One Health alliance.

FAO FIELD PROGRAMME SUPPORT TO THE ONE HEALTH APPROACH: TURNING THEORY INTO PRACTICE

FAO has continued to provide support to field programmes and especially to the regional networks which have developed to support the global effort on HPAI control. In relation to specific One Health activities, there have been no programmes operationalized at the field level involving a One Health project or programme. However, the collaborative efforts of FAO, OIE and WHO in responding to the RVF epidemics in southern and west Africa – as well as to other zoonotic diseases such as rabies in Bali (Indonesia) and other regions – have been good examples of One Health in action. Collateral activities have been undertaken in response to anthrax outbreaks in Bangladesh, showing a good example of the One Health approach in action at the community level, where interactions and cooperation between local veterinary and public health services facilitated the control of this zoonosis. Further examples of such collaboration can be seen with human and animal brucellosis control programmes in Tajikistan and other countries in central Asia. Within the veterinary public health programme, a field project monitoring antimicrobial resistance will eventually develop a link to public health counterparts monitoring the same issues. Rabies is an important zoonosis which is increasing in incidence in many parts of the world. FAO plays an active support role in the development of national rabies programmes in a number of countries.

In order to institutionalize the One Health approach, FAO has included it in the National Medium Term Priority Plans for Animal Health developed between FAO and counterpart animal health authorities in member countries.

The One Health approach is also incorporated as a key element in the FETPV. The EMPRES Wildlife Unit, for example, has developed a short course on the wildlife-human-environment interface entitled 'Wildlife Investigation, Livestock Disease, and Public Health (WILD)'. The course brings together colleagues from the Ministries of Agriculture, Health and Forestry/Environment under the broader One Health banner and has already been conducted in Thailand and South Africa. The training sessions engaged participants from 7-10 countries in the respective regions in lectures and problem-based learning exercises. The overall learning objectives include participants: 1) being able to explain the role of wildlife in infectious diseases and the importance of including wildlife in disease surveillance, outbreak investigations, and epidemiological assessments; 2) learning about the interface between livestock, wildlife, human and environmental health, the main drivers of disease emergence and their role as field epidemiologists in monitoring, and intervening on specific disease outbreaks, especially TADs and EIDs; 3) learning about emerging infections which arise from either wildlife, livestock, or human hosts and impact on livelihoods, food security, ecosystems, and/or human health; and 4) being able to assess and investigate wildlife dis-

ease from a logistical, epidemiological and statistical perspective, taking into consideration practical and fiscal constraints.

Disease management at the operational level, involves a multidisciplinary approach. FAO will encourage the development of effective projects at the field level to build functional One Health partnerships which can act as a foundation of future responses.

An international workshop in Winnipeg Canada on 'One World One Health, Principles into Practice' identified many issues and themes required for successful development and implementation of disease control plans. In effect it recommended that the control plans must be developed with full cognizance of the multiplicity of factors which can influence the outcome of the control programme. Technical aspects of control must also be balanced with local cultural, political and socio-economic imperatives. Again it is difficult to assess all of the variables in the pressured situation of an emerging or emergency disease situation within unknown parameters, and perhaps in a population about which little is known. The One Health approach can broadly define the variables which must be considered, but it is likely that organizations will tend to err on the side of caution when outcomes are not predictable.

In the context of prediction, it was recognized that certain 'hot-spots' for disease emergence exist. Therefore one component of One Health is to put resources into monitoring these hot-spots or hot-spot species for infectious agents which might have the potential to emerge and cause widespread disease in human populations. While such surveillance and pathogen hunting is likely to return findings, at present it is not clear how to predict a species jump of a potential pathogen. More knowledge is required on pathogens which have jumped species, in order to predict those which might in the future. The theory regarding pathogen emergence in intensive livestock industries and along the value chains is embryonic and it will take more time before useful models can be developed and validated for this process. In the meantime, FAO and partners have to work with the tools at their disposal to build the working systems at country level, and collaboration in One Health zoonoses projects is likely to be the most productive mechanism to achieve this goal. Some of the zoonoses amenable to and requiring a One Health approach are discussed in the following sections.

In the context of H5N1 HPAI, the conflict between disease control measures and the subsequent impact on livelihoods was highlighted in the early part of the epizootic, and the debate on how to manage this particular interface in the face of a disease emergency is an ongoing one. When H5N1 was introduced into market chains the impact was often dramatic, however, many production systems have displayed considerable resilience and have largely been rehabilitated. Some individuals have been forced out of poultry production because they were not able to absorb the losses at the individual producer level, but in most instances the gross levels of production have recovered. Vaccination has been added to the list of tools to assist producers to adapt to the pathogen and if it were not for the human health concerns it is probable that for many countries that would be where the control effort would finish. Countries such as Thailand, with significant foreign exchange income from the poultry sector and the motivation of international trade, aimed at eliminating the disease, but others are not easily able to achieve this goal. This conclusion to some extent raises the question of the validity of applying disruptive measures which are not likely to

eliminate disease as the supporting factors required are not in place. An important mechanism to arise from H5N1 HPAI would be one which allows a rapid assessment of the best tools to use for disease control, for example, stamping out may not be appropriate for a disease in some circumstances, but could be the preferred option in a highly developed production system. These impacts are important to understand and assess in the case of the emergence of a new pathogen. Where there is a high transmissibility in animals and humans, and a significant case fatality, stringent measures are required to prevent the spread of the disease in animals.

There is a continuing need for strong leadership in global policy development to maintain the gains both in capacity and knowledge (lessons learned) which have been made through investment in the HPAI emergency, in order to avoid and avert problems in the future. It is difficult politically to maintain the commitment when the threat is inconsistent or sporadic and the mechanism and source is unknown, and to a great extent with current knowledge the risk is not measurable. This makes nascent disease threats so much more difficult to work with than for example, climate change, where there are measurable indicators that can be used to quantify or model the risk of events taking place.

Another linked issue for FAO is that of food security. It is clear that rising urbanization has a profound impact on the location of food production, and on volumes and composition of national and international trade and food distribution channels. Alongside this transformation, demand for higher food quality and safety is expected to rise, as will the potential impact of natural disasters, including animal diseases, on food supplies and human health. In addition to increased international trade, there is growing mobility of capital and labour resources both across borders and within countries, so that there are other powerful dynamics at work shaping this aspect of the eco-system. Growing trade is also coupled with greater importance of biosecurity issues, including transboundary pests and diseases. Dealing proactively with these issues requires articulated trade policies and associated support measures. A functioning One Health approach will be part of this new global policy environment, where the impact of disruptions and vulnerabilities in trade of food commodities will need to be monitored.

Current zoonotic disease control efforts

In response to the One Health deliberations at Winnipeg and a subsequent meeting at Chatham House in the UK, there are several aspects related to zoonotic disease control which require investigation, in particular the attitudes of communities to some of the key control principles and also to the cause of disease. Another aspect is the capacity of the animal health services to deliver vaccine to susceptible livestock and the willingness of farmers to participate in this control measure. At the time of an outbreak it is important that public and animal health activities are synchronous and synergistic and these have to be written into the response plan. Anthrax does provide a good platform for the One Health approach, as the disease is easy to control, provided that technical inputs are possible, and when an outbreak occurs the measures are relatively pro-poor.

Anthrax

It is not clear whether there is a general global increase in the number of outbreaks of anthrax or whether better reporting of the disease in humans is responsible for the significant number of outbreaks reported on ProMed in the past year. The occurrence of outbreaks in humans is associated with certain social and cultural issues. In particular the desire to harvest sick, dying or in some cases dead livestock leads to two key problems: the increase in environmental contamination due to dispersal of spores from the slaughtered beast, and the exposure of humans to the organism through several portals of entry (including the respiratory tract, the gastro-intestinal tract and through wounds in the skin). The reports of outbreaks in humans would suggest multiple occurrences which appear to mirror successive outbreaks in livestock.

In 2010, a major outbreak occurred in several areas of Bangladesh involving 607 human cases and more than 100 reported animal cases. The outbreak drew the media's attention and created fear throughout the country. It detrimentally affected the meat and leather sectors and meat consumption plummeted. FAO, in collaboration with OIE and WHO, conducted a CMC – AH mission to assist in the epidemiological analysis of anthrax outbreaks and to advise on the disease control strategy. Analysis of anthrax data over the period from 2008 to 2010 showed that anthrax is endemic throughout the country with a few hundred cases per year in animals reported annually. The features of the 2010 outbreak were consistent with previous reports of anthrax in animals. The unusual feature of the 2010 outbreak was the increased incidence in humans, which was considered the largest documented human anthrax outbreak in the country to date. A number of risk factors were identified with plausible association with the occurrence and spread of anthrax in Bangladesh, including an inappropriate vaccination strategy and lack of public awareness among community members about the hazards of anthrax. Farmers in Bangladesh usually dispose of any animal which dies during the rainy season in the flood water, leading to the spread of disease and the persistent contamination of the environment. The vast majority of human anthrax cases were associated with the slaughtering of sick animals and the subsequent handling of meat and animal by-products. Progress was achieved in building public awareness during the last outbreak, but further coordinated efforts are still needed at the community level to avoid the slaughter and consumption of sick animals and to promote proper handling and disposal practices. Interaction between the veterinary and medical authorities, particularly at the field level, has been activated by the emergency situation during the outbreak, but a more intensified and structured mechanism of information exchange, joint case investigations and better coordination of awareness messaging and implementation is needed for effective prevention and control of anthrax. This is an area of work where the One Health approach can be operationalized through locally adapted approaches for improved surveillance, increased community awareness and effective delivery of vaccination campaigns.

Brucellosis

Brucella melitensis infection is recognized as a significant public health challenge, with a major economic and financial burden in countries where the disease is endemic. The infection is causing concern as an emerging zoonosis in central Asia and Caucasian countries,

resulting in significant human illness, primarily from consumption of contaminated dairy products or from occupational exposure to infected livestock. This situation may have some of its origins in the dismantling of the collective farming systems and the associated publicly-supported animal health services.

There are very significant benefits to human health and poverty alleviation from controlling and eradicating *Brucella melitensis* infections in animals, and FAO has been responsible for advancing practical knowledge and experience on brucellosis in various countries, while assisting in the development of sound policies and strategies for sustainable control programmes. As part of these efforts, FAO is implementing a comprehensive brucellosis control programme in Tajikistan with the objective of reducing the prevalence of brucellosis in the country and limit its spread within and across central Asia. Since 2003, the implementation of sheep and goat bi-annual eye drop vaccinations with quality-controlled *Brucella melitensis* Rev 1 vaccine, coupled with ear notch identification of vaccinated animals in eight high-disease incidence districts, resulted in an 83 percent reduction in sheep and goat brucellosis prevalence after six years of vaccination rounds.

Authorities in central Asian and Caucasian countries recognize that brucellosis is endemic in the region and agree that regional collaboration in controlling this and other zoonotic diseases could leverage ongoing national veterinary efforts and reduce animal and human disease burdens. In response, FAO is encouraging regular and formal discussions of mutual problems, open and transparent information-sharing, harmonization of strategies related to control methods, diagnostic protocols and disease monitoring, as essential pillars to effectively control brucellosis and other pernicious animal diseases in the region.

Brucellosis can be a suitable platform for development of the One Health approach in central Asia because it is not an emergency disease and the tools for control are available but need to be modified to suit the existing situation. It is also possible to treat infected humans, which reduces the pressure on the different jurisdictions in developing integrated disease control. It may be beneficial to consider small-scale or community pasteurization plants as part of the strategy to reduce the infection in humans, while a progressive control strategy was implemented to control the disease in sheep and goats.

Rift Valley fever

From the end of 2006 to 2010, RVF has seriously affected the Horn of Africa, Sudan, southern African countries and nearby islands in the Indian Ocean. The respective emergency intervention systems of WHO (GOARN) and FAO-OIE (CMC-AH), promptly answered requests for support from countries, and through collaborative actions between central and regional/national offices of the United Nations agencies, deployed suitable intervention teams to support investigations and implement national action plans.

International organizations benefited from the expertise of collaborative centres for field activities conducted with national counterparts. This support was a key contribution for early diagnosis, virus isolation, epidemiological investigation and risk assessment. It also later facilitated the characterization of the virus and possible vectors, and the building of capacities and capabilities in the countries.

Madagascar, Sudan and Tanzania are examples of countries where joint strategies between public and livestock health authorities have been particularly efficient. FAO and

WHO jointly promoted concerted development of the national action plan, based on: 1) establishment of a coordinated inter-ministerial management taskforce; 2) communication, social mobilization and at-risk population awareness; 3) strengthening of case reporting and surveillance systems for both animal and human health; 4) human case management; and 5) livestock management, i.e. animal movement, slaughtering and vaccination. Detailed SOPs were developed and implemented. The joint taskforce was successful in assisting funds mobilization from United Nations emergency funds and other donors. Finally, these activities facilitated the management of these crises, contributed to linking authorities in charge of public health and livestock health, and strengthened capacities in these countries.

Rabies

Rabies is a serious public health issue which is beginning to receive due attention globally. The interaction between humans and dogs is important to understand and the nature of the relationship has much to do with the evolution of outbreaks of rabies in urban dog populations. In the case of the vulture die-off in India due to the use of diclofenac in cattle (fatal nephritis occurred in vultures feeding on carcasses of treated cattle), the increase in food supply for feral urban dogs led to an increase in the dog population and a resultant increase in rabies in dogs and human. This was a very complex ecological interaction which was driven by commercial interests and human behaviour in the first instance. The control of rabies is also to some extent a good proxy measure for the effectiveness of veterinary services in respect of operational effectiveness, policy development and political influence. In a number of countries rabies is not a notifiable disease either in humans and/or animals, and FAO expects that there is significant under-reporting of animal rabies, as a large number of animals die or are killed without a confirmatory test being undertaken. Many of the human cases are determined on clinical diagnosis only. Rabies remains surrounded by many myths and beliefs which further make the collection of accurate data difficult (the symptoms of disease can be attributed to witchcraft, possession by demons, etc).

Besides the animal and human health services, different sectors can have jurisdiction over important aspects of the prevention and control of rabies, such as the police and municipal officers in charge of dog population management, or as in case of sylvatic rabies, the responsibility lies with the wildlife departments which are most often located in departments of Forestry or Environment. While veterinary services are generally embedded in the Ministries of Agriculture with a mandate to deal with livestock health and economic and trade-related aspects of animal production, in some countries rabies control falls under the mandate of the Ministry of Health, and their veterinary capacities are often limited. Because of the plethora of factors which influence rabies control, it is also a good platform on which to base the One Health approach in a number of countries.

A good example of one aspect of the One Health approach associated with rabies control has been the creation of Animal Health Clubs in Sierra Leone. Initially fostered for World Rabies Day, the Animal Health Clubs were established in schools to sensitize children on the dangers of rabies and ways of preventing and controlling the disease. An additional benefit was that the interaction with the community in general by the Animal Health Clubs provided an additional avenue for technical and policy persons to understand community

concerns and ideas about the control of the disease. This community engagement is considered a key component of the One Health approach. FAO is disseminating the concept of the Animal Health Club to other countries and also within existing clubs to enhance knowledge on general aspects of animal health and production.

Impacts of diseases on ecosystems and wildlife

At FAO, it is recognized that an integrated multidisciplinary approach is necessary to address the complex issues of disease emergence, food security, socio-economic stability, livelihoods and conservation. The EMPRES Wildlife Unit serves an important role in demonstrating the fundamental linkages between human, livestock, and wildlife health, and their reliance on healthy and productive agro-ecological systems.

While there is a tendency to focus on the impact of diseases on animals or humans, there are also signs that infectious diseases are having a significant effect on ecosystems which are not immediately tied to livestock production or human health, but at the same time have the potential to have major impacts because of loss of the ecological services carried out by affected species. Important examples of diseases of domestic animals having an impact on wildlife populations were rinderpest in African wildlife, canine distemper in lions in Africa, dog rabies in wild canid populations, phocine distemper, anthrax in hippopotamus, and recently FMD in Mongolian gazelle. While it appears that fruit bats harbour some of the emerging diseases of the last 50 years, these species also play an important role as pollinators of fruit and other trees. It would seem therefore critical that a close watch is kept on the health of these species to ensure that established diseases of mammals do not find their way back into these populations. Hence, there is a strong argument for the One Health approach to include a component which monitors the health of wild populations, and compiles this information so that knowledge about their health status is part of an overall indicator of global health.

An example of a wildlife disease of wide significance is the emergence of the white-nose fungus in insectivorous bats in the United States. This is concerning wildlife experts because of its apparent potential to drive some bat populations to extinction. While the origins of this disease are not known, there is concern about the propensity of human activity to spread the causative fungus from one site to another. These bats perform important environmental services by maintaining some balance in insect populations and so with climate change and the removal of this constraining balance on insect populations, there is potential for new diseases to emerge.

In recent years, bats have been implicated in numerous EID events and are increasingly recognized as important reservoir hosts for viruses which can cross species barriers to infect humans and other domestic and wild mammals. However, despite their abundance, relatively little is known about the species from which zoonotic viruses emerge to cause human disease (Calisher et al., 2006). Much of the information gathered on the role of bats in the maintenance and spread of viruses has been from species of Microchiroptera (insectivorous bats), and there is relatively little information available for members of the suborder Megachiroptera (flying foxes and fruit bats) (Mackenzie, Field and Guyatt, 2003).

Bats possess certain characteristics which may maximize their effectiveness as reservoir hosts for viruses. Natural history features such as high species diversity, long-life span,

the capacity for long-distance dispersal, dense roosting aggregations (colony size), social behaviours and population structure, the use of torpor and hibernation, unique immunology and spatial population structure (Calisher et al., 2006; Turmelle and Olival, 2010) [2009 in refs] have been suggested for the association of bats and EIDs. Evolutionary adaptations such as conserved cellular receptors and pathways may also enhance the capacity for transmission of bat-associated viruses to other mammals (Calisher et al., 2006).

CASE STUDY 6.1

EBOLA Reston Virus, Bats, Pigs and Humans

In December 2009 Ebola Reston virus was detected in pigs in the Philippines. Five pig farm workers also tested positive for the virus, but remained healthy and showed no clinical disease. The recent detection of Ebola Reston is of concern because it is the first time the virus had been detected in pigs, an animal which is in close contact with humans and which has served as a bridge species for a variety of viruses which can become newly emerging infectious diseases in humans.

Although it has been found in wild primates, the wildlife reservoir for Ebola-Reston virus is unknown, but bats are a likely candidate. Bats have extremely hardy immune systems and have been shown to be the reservoir for many viruses such as rabies, Nipah, Hendra, and SARS which can infect and kill other species, including humans. In Africa surveillance has shown that bats are a possible wildlife reservoir for the Ebola Reston virus, with outbreaks occurring in primates (monkeys and humans) associated with exposure to an infected bat, often through hunting.

To understand the epidemiology of Ebola Reston and other bat-borne viruses we need to understand the behavioural ecology of their wildlife reservoirs to assist in identifying where the risk of disease transfer across species is most likely. A thorough study of the wildlife species' role in the spread and maintenance of an infectious agent is critical for any complete epidemiologic investigation to be completed. It will also provide a basis for countries to develop policies on livestock industry restructuring focused on promoting good livestock production practices.

In response to the Ebola Reston outbreak the FAO EMPRES Wildlife Unit initiated a programme working with the Philippine government and international partners to investigate the role bats may play in the serving as a reservoir and transmitting virus to livestock and humans. A workshop which integrated issues concerning the Ministry of Agriculture (MOA), Ministry of Health (MOH), and the Protected Areas and Wildlife Bureau (PAWB) of the Philippines on bats, diseases, and the interface between wildlife, human and livestock health was conducted in late-2009. This cooperative meeting resulted in FAO experts working alongside the government ministries with technical support from wildlife NGOs, Queensland Biosecurity, Eco-Health Alliance, and Max Planck Institute, and the Australian Animal Health Laboratory to conduct bat capture, sampling and radio-marking to better characterize habitat use and movement patterns.

Regardless of the underlying mechanisms which facilitate adaptation to new host species, there appears to be increasing interaction between man and Megachiroptera or between livestock species and Megachiroptera. This is likely due to a combination of factors including increasing human populations and establishment of new communities, forest encroachment, deforestation, expansion of farming areas, increased access to remote forests, reliance of humans on forest based food resources, and increasing marketing and trade of wildlife.

In the case of Nipah virus and Hendra virus it is suggested that environmental factors have resulted in closer contact between livestock species and bats, in the former case with pigs and the latter with horses. Humans have then proven to be the sentinels for the emergence of a new virus, as sickness and death alerts to the presence of a previously undescribed condition. A similar sequence of events was the case with the emergence of the SARS virus, where it seemed perhaps the intermediate and multiplier host was the civet. In the case of SARS part of the complexity was the dietary predilections of the human population in southern China where the disease emerged. The expansion of the epidemic was also influenced by the socio-political factors which affected initial reporting of the incident and hampered identification of a new infectious agent. In the case of the haemorrhagic fever virus Ebola Reston and Marburg, megabats can also be involved in disease transmission, and are thought to spread infection through the preparation and consumption of bushmeat. In the case of these viruses there has so far been no domestic animal link in the transmission to humans. Here there would appear to be a possible role played by pigs in the transfer of infection between bats and humans. In the case of these emerging diseases there is a pattern that domestic livestock can act as a bridge between the reservoir host and humans.

Bat-borne viruses are an example of emerging infectious disease agents which innately require a One Health approach. The engagement and cooperation of multiple sectors of governments is necessary to effectively understand the epidemiology of these viruses and to identify the risk factors to all populations human, livestock and wildlife.

OTHER PROGRAMME ACTIVITIES WITH ONE HEALTH LINKAGES

Antimicrobial Resistance associated with livestock production

In the broader context of veterinary public health there is concern about the emergence of antimicrobial resistance in livestock systems in the developing world and what might follow if such resistant organisms are transferred to humans. This transfer could lead to the direct development of disease syndromes which respond poorly to therapy or to the transfer of resistance factors to human pathogens rendering them less tractable to treatment. While the use of antimicrobials in livestock was pioneered in highly developed industrial livestock production, there are regulatory limits placed on the drugs which can be used in livestock in these systems. This is sometimes not the case in developing economies and intensive livestock producers are often able to get access to generic versions of antimicrobials which should be reserved for specific and limited use in humans. It has also been observed that in the mid-level of commercial producers in emerging economies there is a tendency to introduce part of the technical package for industrial production, and to use antimicrobial

drugs to cover for some of gaps in hygiene and biosecurity which are not fully understood and perhaps more difficult to properly introduce. A project underway in Kenya to examine this issue is a good example of the potential for collaboration between animal health and public health to deal with a different dynamic in the context of the One Health approach.

FAO PARTNERSHIPS AND THE ONE HEALTH APPROACH

In relation to partnerships and structures, FAO has been continuously engaged in dialogue with its technical partners, OIE and WHO, to develop the framework for institutionalizing and implementing the One Health approach. The framework is outlined in the key Tripartite Concept Note *The FAO-OIE-WHO Collaboration. Sharing responsibilities and coordinating global activities to address health risks at the animal-human-ecosystems interfaces* which was published in 2010. In addition, within the framework of GLEWS and OFFLU, these partnerships are further reinforced and developed. FAO and OIE are the principal partners in the

BOX 6.1

Global spread of animal pathogens during 2010

As noted above, in response to the 2nd RTE, FAO has increased the resources devoted to major animal diseases. During 2010, major animal disease events continued to disrupt livestock production, rural economies, people's livelihoods and food security and so timely interventions were necessary.

The disease events of concern are the rapid expansion of ASF in Eastern Europe, from Georgia and Armenia, to the Russian Federation and imminent incursion into Ukraine; the recurrence of FMD in the Korean peninsula, Japan and Mongolia; the rapid spread of PPR in eastern African countries, Kenya and Tanzania, with potential risks to the entire Southern African Development Community (SADC) region; and the emergence of a new highly virulent strain of PRRS virus in Asia, and potentially in Europe, which is having a major social and economic impact on the swine industry and pig smallholders in the People's Republic of China and the Mekong region. The HPAI issues of concern in endemic countries have been dealt with in the previous chapter. The spread of these four diseases has elements of concern within the One Health agenda, such as intensification of animal production, increased trade of animal and animal products and intensified contact between animal, human and wildlife populations, as well as the limited capacity of veterinary services to contain animal diseases in endemic settings. Efforts to control these diseases will fit well with the One Health principles because of the complex nature of the relationship between animals, man and the environments in which both live. FAO will increase efforts to gain international support for the control of these diseases which now stands in the way of development in many farming communities.

ASF continued to spread during 2010 in Eastern Europe and the Russian Federation. Where ASF infection occurs, pig production is usually sustainable only by adoption of high biosecurity levels on individual holdings. Outbreaks have now been reported

within a few kilometres of the Ukrainian border and the concern is how far ASF will spread to non-infected countries in Eastern Europe, particularly Ukraine, but also to Asia through pig trade routes and swill feeding with contaminated products. Introduction of ASF to Asia would be a major disaster and have a very serious impact on the food security and livelihoods of many poor people.

Asia and east Asia in particular has been a hot-spot for FMD during 2010. In Mongolia, FAO animal health support was required to confront FMD spread in domestic ruminants and Mongolian gazelle populations in trans-frontier areas of Mongolia and China. In Mongolia, extensive pastoral livestock production presents a main source of food security. However, the system is inherently vulnerable: the severe winter of 2009-2010 decreased national livestock population from 40 to 20 million heads of sheep, cattle and other stock. The FMD epidemics of autumn 2010 concern China, Mongolia and the Russian Federation. FAO assists in bringing these countries together to discuss a cohesive approach to FMD control and prevention. During 2010, FMD in eastern Asia brought severe losses also to livestock industries in the People's Republic of China, Japan and the Republic of Korea.

During 2010, the spread of a new highly virulent strain of PRRS virus in Asia continued to have a major social and economic impact on the swine industry and pig smallholders in the People's Republic of China and the Mekong region. PRRS is an infectious viral disease of swine, characterized by high morbidity and mortality, which is easily transmitted through direct contact between susceptible pigs and vertically to foetuses. It is considered the most economically devastating viral disease of intensive swine farms and the Mekong region is one of the densest areas for pig production in the world. It is highly likely that the new virulent strain of PRRS will continue to circulate in the Mekong area due to poor biosecurity and intensive pig/pig product movement between borders. It is very difficult to eradicate but can be controlled using vaccination in the commercial sector, and enhanced biosecurity.

In Haiti during 2010, FAO – in parallel to the earthquake-related emergency support – assisted the veterinary services in confronting a new, lethal pig disease in smallholder pig holdings, progressively spreading into a wider area and currently posing a threat to the commercial pig production plants in the Dominican Republic and the rest of the region. National veterinary staff and experts provided by the USA, FAO and other partners, have worked together to establish the identity of the pathogenic agent causing paralysis and mortality in pigs. The results revealed porcine Teschovirus (PTV1) to be responsible.

GF-TADs within which collaboration takes place on a range of important issues related to the broader mandate of TAD control which is discussed below. The GF-TADs has been used as the basis for the implementation of the EU-funded project on Highly Pathogenic and Emerging Diseases (HPED) in ASEAN and SARC. To this end FAO has a strong working partnership with ASEAN and SARC in the implementation of this project and also in establishing regional

networks dealing with H5N1 HPAI. These regional organizations in Asia will play an important role in the development of One Health projects. The EMPRES Wildlife Unit participates in the OIE Working Group on Wildlife Diseases as an observer and FAO also serves as a member of the Scientific Committee for the OIE Global Conference on Wildlife, Animal Health and Biodiversity (in Feb 2011). OIE and WHO are both observers of the FAO - United Nations Environment Programme - Conservation of Migratory Species of Wild Animals (UNEP-CMS) co-convened Scientific Task Force on Avian Influenza and Wild Birds (see below).

The multidisciplinary nature of FAO also allows the organization to have a broad connectivity with international partners, to contribute to multilateral environmental agreements, and to work on efforts aligned with many international treaties. FAO closely collaborates with the Convention on Biological Diversity (CBD) and is part of the CBD Liaison Group on Bushmeat. This group aims to find solutions to address over-harvesting of forest-based bushmeat which is reaching critical levels and threatening the food security and livelihoods of indigenous and local communities, as well as the ecological stability and resilience of forest ecosystems. The group developed international and national level recommendations to improve the sustainability of wildlife management in tropical forests. FAO also cooperates with the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), contributes to issues on endangered species monitoring and protection, and habitat requirements for foraging, migration and reproduction, as well as the illegal trade of wildlife and wildlife based products

The FAO/UNEP-CMS aims to disseminate the best scientific advice on the conservation impact of the spread of H5N1 HPAI, including assessing the potential role of migratory birds as vectors of the virus. It has issued advice on the root causes of the spread of this disease and has promoted the development of international early-warning systems. FAO also works closely with The Convention on Wetlands of International Importance (RAMSAR) and has contributed to the guidance on wildlife diseases in wetlands. FAO has also undertaken waterfowl migration ecology work which contributes to identifying important wetlands to be considered for conservation status, as well as affirming the importance of designated RAMSAR sites based on use by important migratory avian species. FAO is further engaged in the efforts of two migratory bird treaties, the Agreement on the Conservation of African-Eurasian Migratory Waterbirds and is a member of the Partnership for the East Asian - Australasian Flyway, and co-convenor of the working group on avian influenza and wild birds.

CONCLUSION

FAO is committed to pursuing the One Health approach and to supporting its partners in their endeavours to develop a constructive operational framework to deliver the outcomes required to make progress. Efforts will be made at a number of levels. Control of serious livestock diseases is seen as necessary to ensure the health and well-being of human populations which are the most underprivileged and to continue pathways to development. Zoonotic diseases in many instances have their roots in controllable disease of livestock or domesticated species and well-understood interventions can be applied in the context of the full scope of the One Health approach. Equally, FAO has the expertise, partnerships and data to begin to explore how to predict emergence of diseases as a result of livestock intensification, climate change or ecological issues.

Conclusion

There are a number of concerns for the FAO HPAI Global Programme which must be considered during 2011. The endemic foci of disease will continue to pose a threat to countries at risk in Asia and Africa. The finding of a new clade of H5N1 in wild birds would suggest that another round of outbreaks may occur in Europe, possibly Africa and certainly neighbouring countries in Asia. Thus a long-term approach is required to eliminate H5N1 HPAI from poultry in these endemic foci. The complete epidemiology of H5N1 in wild birds is far from understood, and the role of the evolution of viruses in domestic poultry as a source of new viruses for wild birds needs to be defined.

The emergence and spread of additional non zoonotic diseases, such as ASF, FMD and PPR, highlights major areas of concern, such as intensification of animal production, increased trade of animal and animal products and intensified contact between animal, human and wildlife populations, as well as the limited capacity of veterinary services to contain animal diseases in endemic settings. FAO will increase efforts to gain international support for the control of these diseases which now stands in the way of development in many farming communities.

H5N1 HPAI is endemic in five countries (and areas of India) and the main factors identified which inhibit progress toward elimination of H5N1 viruses from such countries are: (1) the structure of the poultry sector, which generally have highly complex and fragmented production and market chains, concentrated close to areas of high human population density, and where poultry are reared and sold under conditions which afford little protection from influenza viruses (or other pathogens); (2) the quality of public and private veterinary and animal production services, which have limited capacity to identify and respond to all cases of infection, fully understand the drivers of value chains and implement needed changes to production and marketing systems; and (3) the level of commitment on the part of the poultry sector and governments to the elimination of viruses (or the availability of resources to implement an effective programme).

Although measures have been introduced in all endemically infected countries to address these factors, all require further long-term commitments and investment if the virus is to be eliminated. It is now generally accepted that this is unlikely to happen for the next ten years at least, as it will take many years for all constraining factors to be overcome and the necessary preventive measures to be introduced universally. One of the key outcomes of the One Health approach and also the lessons learned from the HPAI epidemic is that veterinary services have a definite public good role to play. Investment into these services must take place within a structured approach which has clear goals to provide defined

public good outcomes. They must also be provided with the necessary skills, technical and management competencies and funding to function adequately during an emergency response .

The economic drivers of disease and disease control are also pivotal to the future of the H5N1 HPAI control effort. An important consideration for HPAI control is how quickly economic growth in endemic countries can act as a stimulus to safer and sustainable production, marketing and processing practices. As part of this process there is also the requirement for the private and public sectors to understand more of each other's roles and rights in terms of food production and disease control; and improve the quality of their services to the poultry sector.

Overcoming the constraints to HPAI control will be a lengthy process and governments and donors must be clear that there are no 'quick fixes' to the institutional and structural problems which led to the disease becoming endemic in the first place. The approach to meeting goals will be based around progressive control, which has been the foundation of the FAO response until now. FAO is developing five-year frameworks or pathways for consolidation of the disease situation and the progressive shift to containment and reduction of the virus in the production environments.

The virus remains a low threat to human health generally. However, the unpredictability of the evolution of the agent means that there is the potential for a variant to emerge with greater infectivity and transmissibility in humans. This concept has limited recognition among poultry producers and the general public in the endemic countries. The ongoing developments in strategy and policy therefore must be generated by an amalgam of interests from producers to human health officials, to the wider range of individuals with a stake in the outcome. For the longer-term process, the milestones must be clear and achievable and support from global sources necessary until such time as the threat of a pandemic driven by H5N1 is eliminated or reduced to a level where it is no longer a major concern. Given this requirement the global community remains a stakeholder in the efforts to control the disease.

Annexes

Detailed country analysis

Annex 1

Bangladesh

INTRODUCTION

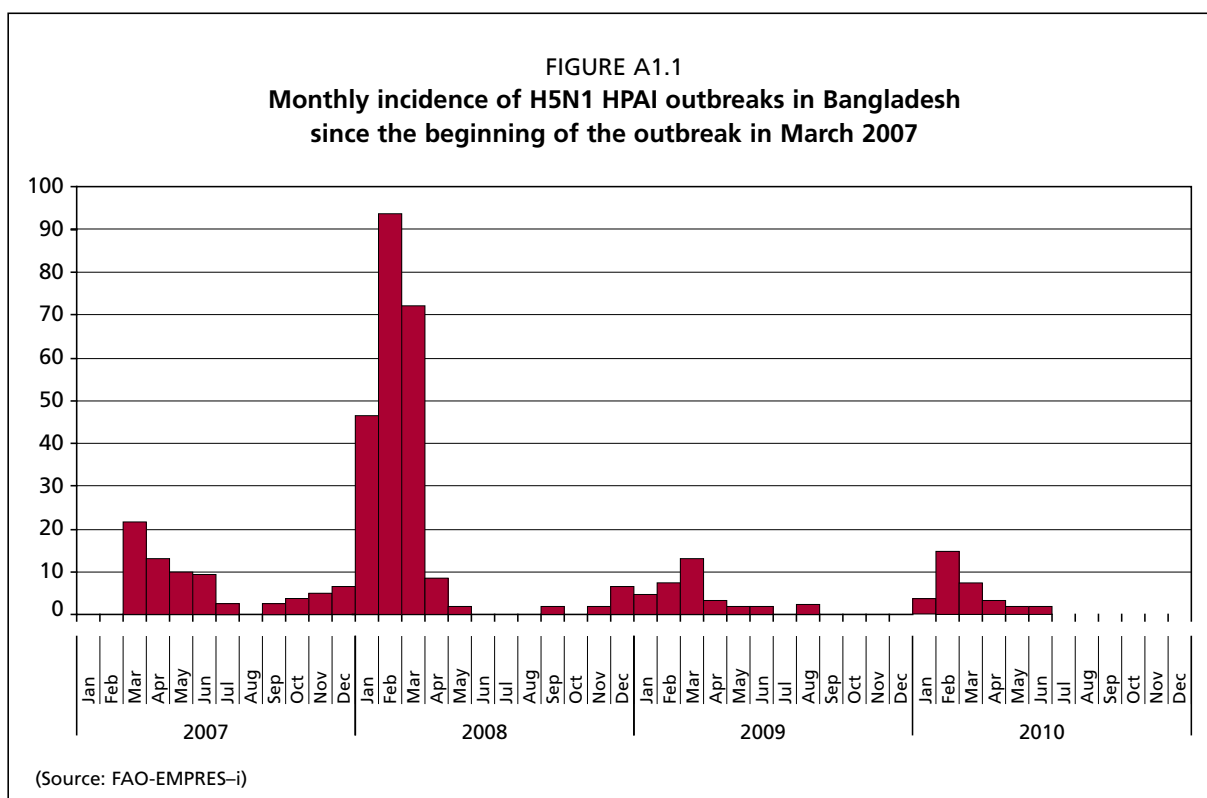
The following Annexes provide a further detailed analysis of the (i) disease situation overview (containing more detail than the summary in Chapter 1); and (ii) the overall FAO contribution to the national HPAI response, since the beginning of activities, in Bangladesh, the People's Republic of China, Egypt, Indonesia and Viet Nam.

DISEASE SITUATION OVERVIEW

Bangladesh is the case study for the Indo-Gangetic Plain HPAI agro-ecological zone (see Chapter 4). The disease is now considered endemic in this zone, although in Bangladesh the prevalence is relatively low and no outbreaks were detected during the months between July-December in 2010. A seasonal peak has, however, been consistently detected during the last four years, occurring during the cooler and drier period between December and April. Most of the 358 outbreaks reported as at December 2010 were in small commercial operations and only 54 in 'backyard' scavenging poultry. During 2010, there were 31 outbreaks reported of which 23 (74 percent) were reported through the short message service (SMS) gateway as a result of active surveillance by CAHWs with support from project-hired veterinarians (referred to as Additional Veterinary Surgeons [AVSs]) and *Upazila* Livestock Officers (ULO). Of the eight cases which were not reported through active surveillance, two were from *Upazilas* (sub-districts) not covered by the active surveillance, indicating that the active surveillance programme is correctly targeted at the higher risk areas.

A recent programme publication¹ reported on the temporal/spatial distribution of outbreaks reported between 2007 and 2009 and showed that there were three spatial risk factors that distinguished sub-districts with HPAI from near neighbours without outbreaks: the human population density; the poultry population density; and the number of roads in the sub-district. It concluded that the distinct clusters of HPAI outbreaks and risk factors identified could assist the Government of Bangladesh to target surveillance and to concentrate response efforts in areas where disease is more likely to occur.

¹ *Risk factors and clusters of Highly Pathogenic Avian Influenza H5N1 outbreaks in Bangladesh*, Loth, L. Gilbert, M. Osmani, M.G. Kalam, A. Xiangming Xiao. (2010). *Prev Vet Med.* ; 96(1-2):104-13.



The virological studies that continue to be carried out indicate that the virus remains the same clade 2.2 that was probably introduced through infected migratory birds in 2007. With no new clade detected since then, this suggests there have not been continuous introductions of HPAI into the agro-ecological zone from wild bird sources, although the number of virus sequences available for comparison is relatively small. During 2010, new sequences of three H5N1 virus isolates from Bangladesh were posted on Genbank. It is of concern that H5N1 clade 2.3.2 has appeared in Nepal, probably as a result of contact between domestic poultry and migratory birds. If this virus is present in migratory birds during the northern winter of 2010-2011, then it might appear in poultry in Bangladesh. Outbreak viruses will be constantly monitored to detect such an incursion. The principle concern would be whether this strain will show more virulence for poultry and particularly for humans.

FAO'S OVERALL CONTRIBUTION TO THE NATIONAL HPAI RESPONSE

With financial support from USAID, FAO is continuing to implement major USAID funded projects. - Immediate technical assistance to strengthen emergency preparedness for Highly Pathogenic Avian Influenza (HPAI) in Bangladesh, including active surveillance (OSRO/BGD/902/USA and OSRA/RAS/605/USA);

- Improved bio-security and hygiene at production, collection points and live bird markets, including decontamination (OSRO/GLO/802/USA); and
- Developing and Maintaining Public-Private Partnerships for the Prevention and Control of Highly Pathogenic Avian Influenza H5N1 and other Emerging Infectious Animal Diseases (OSRO/INT/805/USA).

TABLE A1.1
FAO project portfolio in Bangladesh to December 2010

Project	Start date	End date	Project Status	Total Budget (US\$)	Donor
National Projects					
OSRO/BGD/902/USA	Sep 2009	Sep 2011	Active	5 332 800	USA
UTF/BGD/036/BGD	Apr 2010	Dec 2012	Active	1 082 167	Bangladesh
Regional/Global Projects					
OSRO/RAS/605/USA Baby 01	Jul 2006	Sep 2011	Active	2 590 000	USA
OSRO/INT/805/USA BABY02	Jan 2009	Sep 2011	Active	533 333	USA
OSRO/RAS/701/USA	Mar 2008	Sep 2011	Active	2 000 000*	USA
OSRO/GLO/802/USA BABY02	Jan 2009	Sep 2011	Active	833 333	USA
OSRO/RAS/601/ASB	Apr 2006	Aug 2010	Closed	1 495 000	ADB
OSRO/RAS/704/SWE BABY 02	May 2006	Dec 2009	Closed	4 452 560*	Sweden

(Source: FPMIS)

* For regional and global projects indicated, activities were implemented under the mentioned projects, however the budget figures provided are for the whole project.

Since 2006 FAO has supported the efforts of the Government of Bangladesh to prepare for and control HPAI. In particular, FAO has contributed to the development of national plans, and to operational aspects of control through nine projects directed at prevention, detection and control activities. Capacity building has also been an important target for the programme. Activities have included training for field veterinarians in disease control and inputs into the laboratory network.

Annex 2

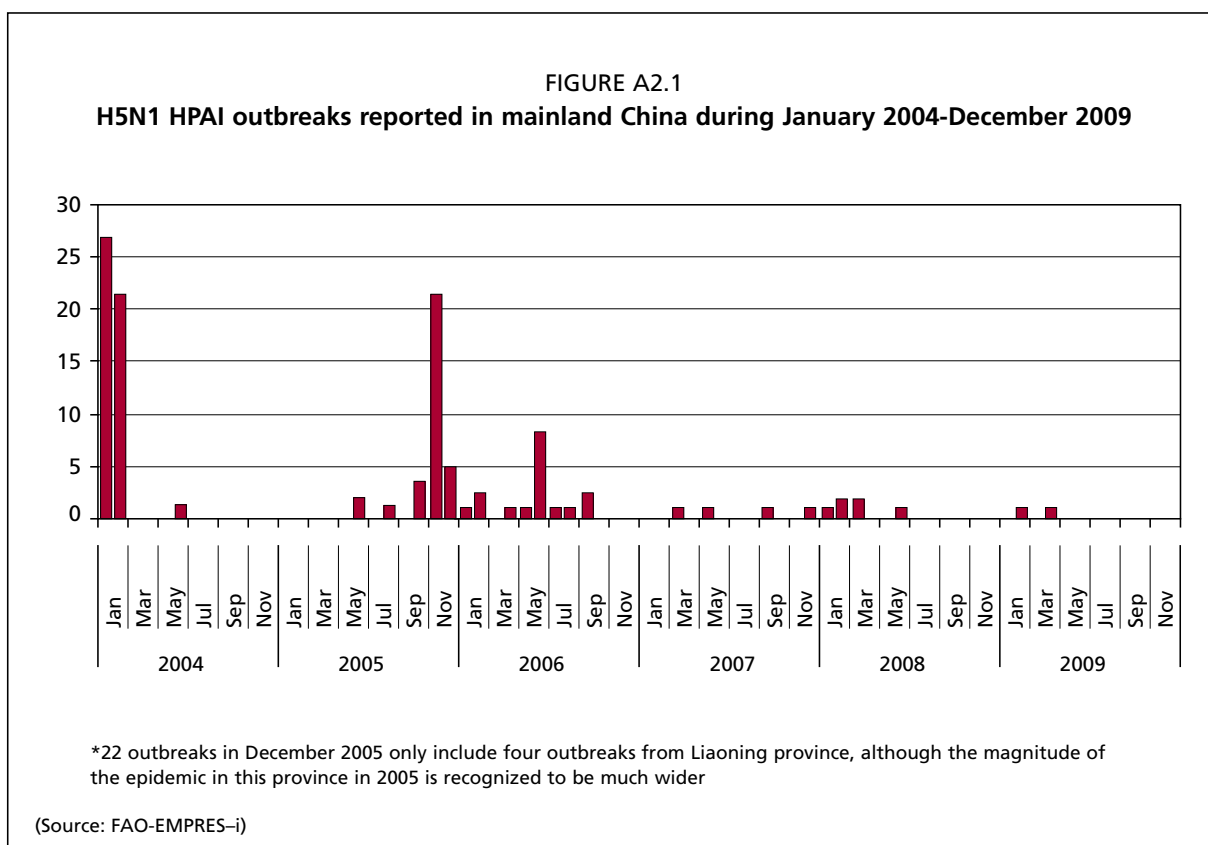
The People's Republic of China

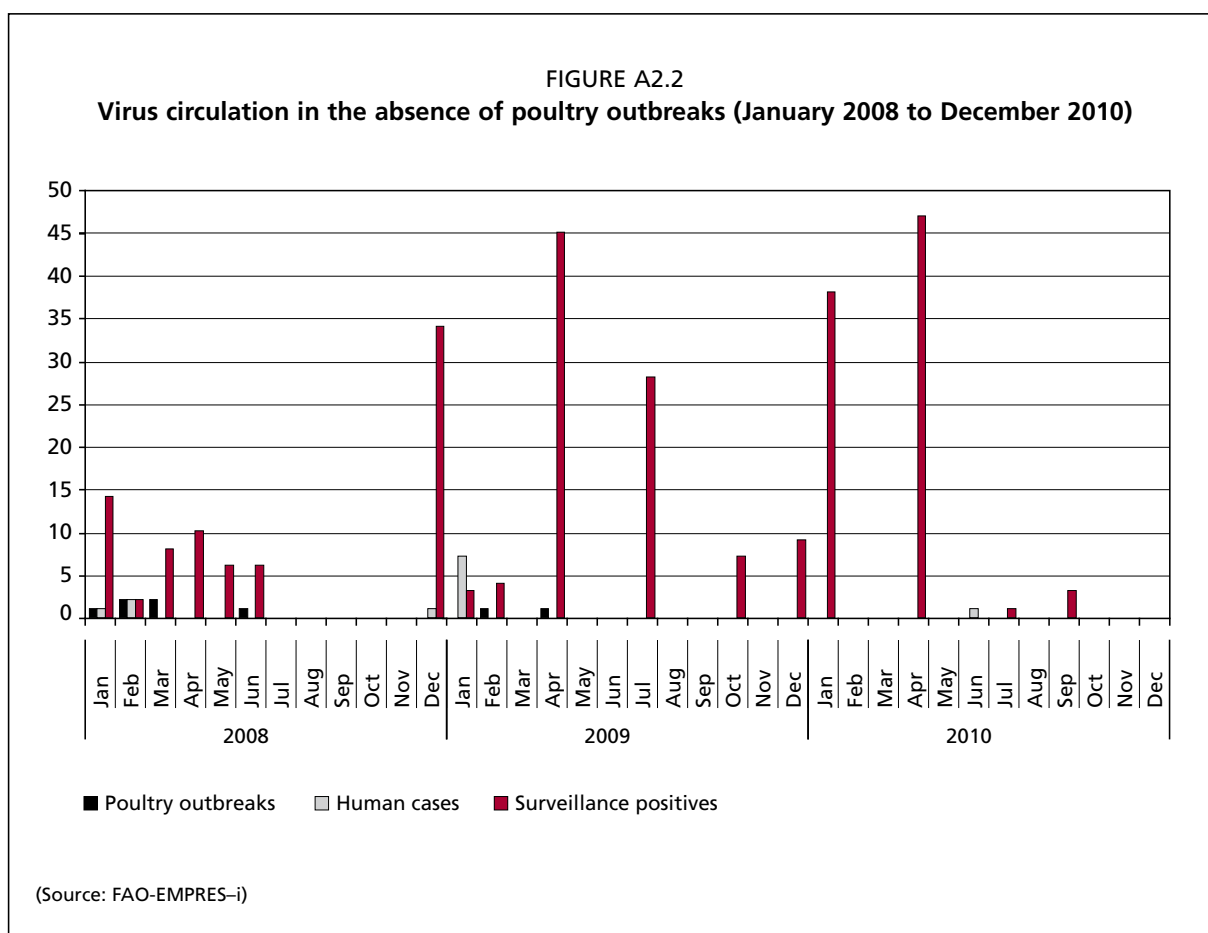
INTRODUCTION

The following Annex provides a further detailed analysis of the (i) disease situation overview (containing more detail than the summary in Chapter 1); and (ii) the overall FAO contribution to the national HPAI response, since the beginning of activities, in the People's Republic of China.

DISEASE SITUATION OVERVIEW

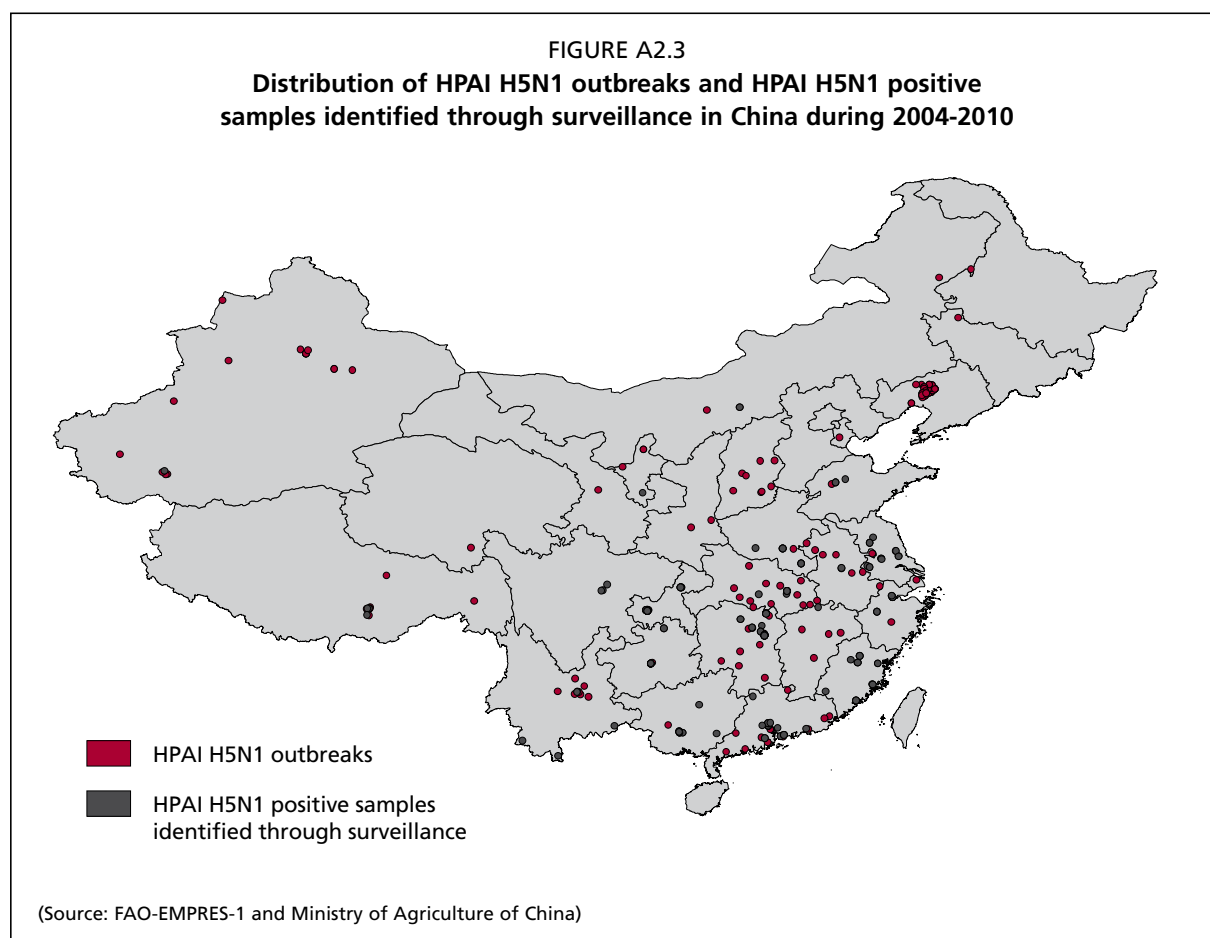
The official reporting of outbreaks of H5N1 HPAI in the People's Republic of China (hereafter China) over the last six years is shown in [FIGURE A2.1](#). In the last year there were no officially reported outbreaks of H5N1 HPAI in poultry species and there was one outbreak reported in May from wild birds in Tibet. The last outbreak reported in poultry was in April 2009. However, virus surveillance in live bird markets in early-2010 has detected viruses circulating in poultry offered for sale. [FIGURE A2.2](#) below shows viral circulation in the absence of poultry outbreaks from January 2008 to February 2010.





In June 2010, China confirmed its 39th human case in a patient from Hubei province, but there was no associated clinical disease in poultry. A more recent indication of covert circulation of virus was a case of H5N1 infection in a resident of Hong Kong SAR who had returned from southern China. It would appear that there is still a pool of H5N1 in China that is kept from causing overt disease in poultry by the widespread use of vaccines. H5N1 has been reported three times in avian species in Hong Kong SAR during 2010: in an oriental robin (actually discovered dead on 29 Dec 2009); in a barn swallow in March; and in a decomposed chicken carcass from an unknown source washed up on Lantau Island in December.

Several clades of virus still circulate in China with both clade 2.3.2 and clade 2.3.4 being the most frequently detected. The monitoring of viruses by the veterinary services allows for a watch on the efficacy of vaccine and a new vaccine has been introduced to deal with the shift in the predominant virus strain in the field. The spatial distribution of outbreaks indicates that the incidence is higher in the south-eastern part of the country (see [FIGURE A2.3](#))



FAO'S OVERALL CONTRIBUTION TO THE NATIONAL HPAI RESPONSE

FAO does not have an estimate of the total investment by the Government of China in the HPAI programme, although it is thought to be considerable given the large numbers of vaccine doses (estimated to approximately 13.65 billion doses in 2010) that are produced and delivered free of charge. In comparison to this national input, the FAO contribution is small. However, it is targeted to technical areas where there is a need for specialized support, such as strengthening epidemiology capacity and mapping and analysis of market chains.

The FAO programme engages with the Veterinary Bureau of the Central Ministry of Agriculture (MoA) and with the provincial Centres for Animal Disease Prevention and Control, as well as with other national level institutions, such as the China Animal Health Epidemiology Center (CAHEC) in Qingdao and the National Harbin Reference Laboratory (NHRL). The activities are mainly associated with the country programme although some of the wildlife work carried out is connected to the global project. The activities coordinated by FAO assist with building cohesion in the national programme, and strengthening the links between FAO and the government to facilitate communication and programme delivery.

The field activities of the programme in China took place in three provinces in southern China (Guangxi autonomous region, Hunan and Yunnan), together with Chongqing Municipality. The latter was included in this phase in order to support the development of additional activities on risk assessment and more specifically address the concept of disease free zones and compartments.

TABLE A2.1
FAO project portfolio in China in 2010

Project	Start Date	End Date	Project Status	Total Budget (US\$)	Donor
Regional/Global Projects					
OSRO/RAS/604/USA Baby 02	Jul 2006	Sep 2011	Active	4 050 000*	USA
OSRO/GLO/804/USA	Oct 2008	Sep 2011	Active	3 150 000*	USA
TCP/CPR/3004	Feb 2004	Dec 2005	Closed	363 783	FAO

(Source: FPMIS/FCC-EMU Operational Brief)

* For regional and global projects indicated, activities were implemented under the mentioned projects, however the budget figures provided are for the whole project.

Annex 3

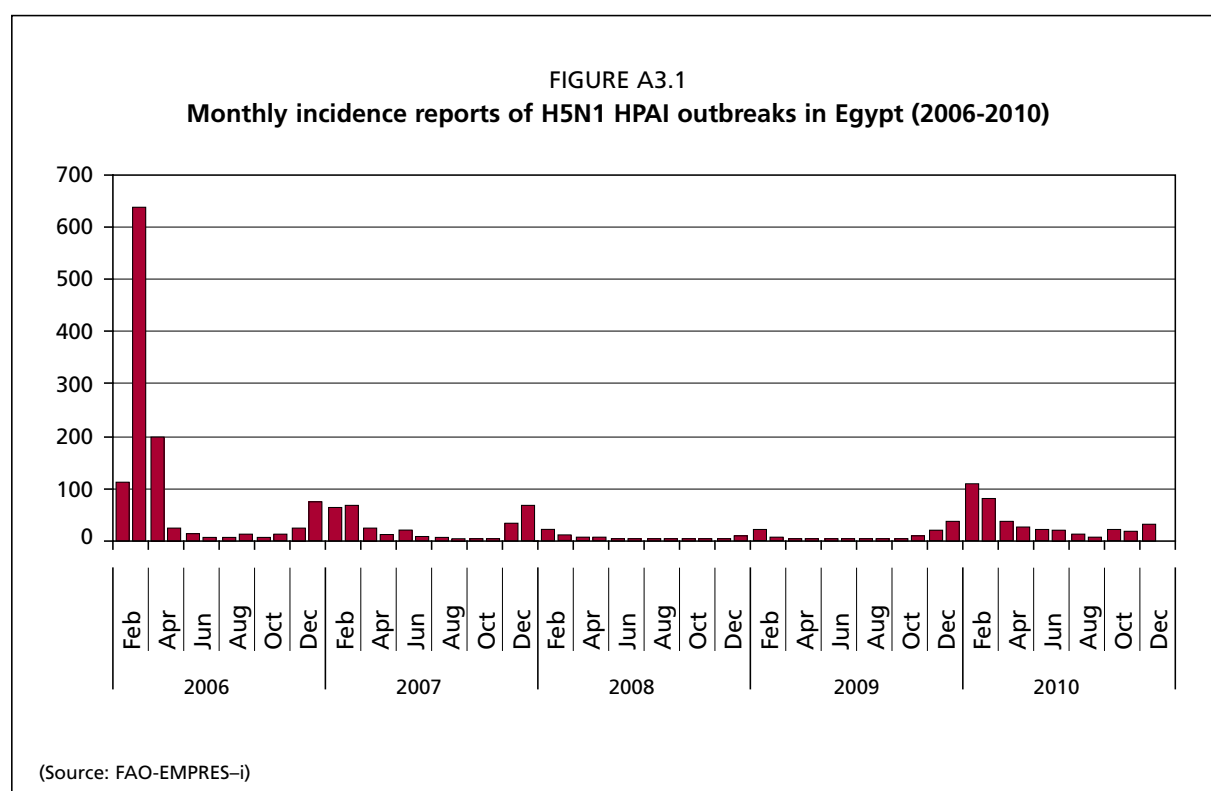
Egypt

INTRODUCTION

The following Annex provides a further detailed analysis of the (i) disease situation overview (containing more detail than the summary in Chapter 1); and (ii) the overall FAO contribution to the national HPAI response, since the beginning of activities, in Egypt.

DISEASE SITUATION OVERVIEW

During 2010, there were 457 confirmed outbreaks of H5N1 HPAI in Egypt. The temporal distribution of the outbreaks in poultry for 2006-10 is shown in [FIGURE A3.1](#). Outbreaks were reported throughout the year, but, as in previous years and in other countries, there is a greater incidence of clinical disease during the cooler months. The distribution of outbreaks generally increases with the density of poultry. The incidence curve would suggest an upsurge of disease activity in January and February 2010 compared to 2009 but this probably reflects the more intense surveillance carried out by CAHO teams. During the year, 92 percent of outbreaks were reported from the household and smallholder poultry sector. This may reflect the reluctance of commercial producers to report disease to the veterinary

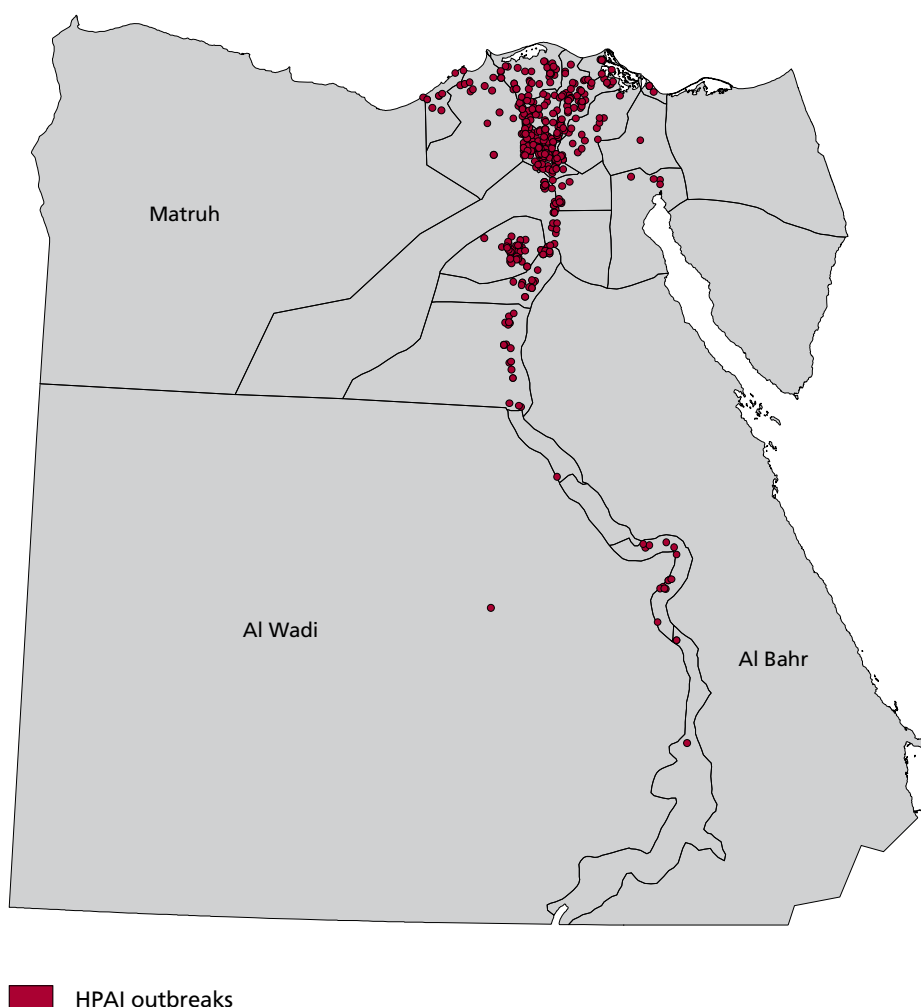


authorities, due partly to fear of closures of their farms and/or other unfavourable measures taken by the authorities. In addition, there is no compensation system in operation in Egypt.

The H5N1 viruses in Egypt continue to be clade 2.2.1, indicating that it is unlikely there have been no fresh introductions of H5N1 viruses from migratory birds since the first introduction in 2006. The work on gene sequencing indicates that currently there are two main groups of viruses: the classical group, which is closely related to the initially introduced virus and circulating mainly in household poultry flocks, and spread to the commercial poultry sector; and the variant group, which emerged in late-2007 and is circulating mainly in commercial poultry farms. In 2010, the latter was divided into two subgroups.

During 2010, there were 28 human cases of H5N1 infections reported and of these 12 (43 percent) were fatal. This brings the total number of H5N1 cases to 118 with 39 fatalities (a fatality rate of 33 percent) over the period 2006-2010.

FIGURE A3.2
Spatial distribution of H5N1 HPAI outbreaks in Egypt 2010



(Source: FAO-EMPRES-i)

TABLE A3.1
FAO project portfolio in Egypt to December 2010

Project	Start Date	End Date	Project Status	Total Budget (US\$)	Donor
National Projects					
OSRO/EGY/701/USA	Oct 2007	Sep 2011	Active	9 300 000	USA
OSRO/EGY/801/USA	Jun 2008	Feb 2011	Active	2 416 500	USA
Regional/Interregional Projects					
OSRO/GLO/802/USA BABY01	Jan 2009	Sep 2011	Active	575 000	USA
OSRO/INT/805/USA BABY03	Jan 2009	Sep 2011	Active	533 333	USA
OSRO/GLO/702/CAN	Feb 2007	Mar 2011	Active	68 000	Canada
OSRO/RAB/701/SWE	Jan 2008	Jun 2010	Closed	257 506	Sweden
OSRO/GLO/604/UK child	Mar 2007	Mar 2010	Closed	10 700	UK
OSRO/GLO/601/SWE BABY01 &02	Apr 2006	Dec 2009	Closed	3 415 302*	Sweden
GCP /INT/010/GER	Jul 2006	Nov 2009	Closed	143 778	Germany
OSRO/INT/603/USA Baby04	Jul 2006	Mar 2009	Closed	22 375	USA
TCP/RAB/3006	Nov 2005	Oct 2007	Closed	32 594	FAO
TCP/RAB/3005	Nov 2005	Oct 2007	Closed	310 230*	FAO
OSRO/GLO/504/MUL BABY04	Jan 2006	Apr 2007	Closed	49 264	France
OSRO/GLO/504/MUL BABY06	Jan 2006	Jan 2007	Closed	31 661	S. Arabia

(Source: FPMIS/FCC-EMU Operational Brief)

* For regional and global projects indicated, activities were implemented under the mentioned projects, however the budget figures provided are for the whole project.

FAO'S OVERALL CONTRIBUTION TO THE NATIONAL HPAI RESPONSE

There are two national projects funded by USAID: OSRO/EGY/701/USA which is concerned with the field situation and control issues; and OSRO/EGY/801/USA, focused on molecular characterization of H5N1 viruses and the selection of candidate vaccine strains. The OSRO/GLO/802/USA BABY01 project focuses on biosecurity and decontamination, for which there was considerable activity during 2010 in Egypt. Public-private partnerships (PPPs) were developed under OSRO/INT/805/USA BABY03 and again there was significant activity during 2010 in Egypt. The main activities for these global projects were described in Chapter 3. However, they are regarded as integral to the national projects and fulfilled an important function in the overall country programme.

Annex 4

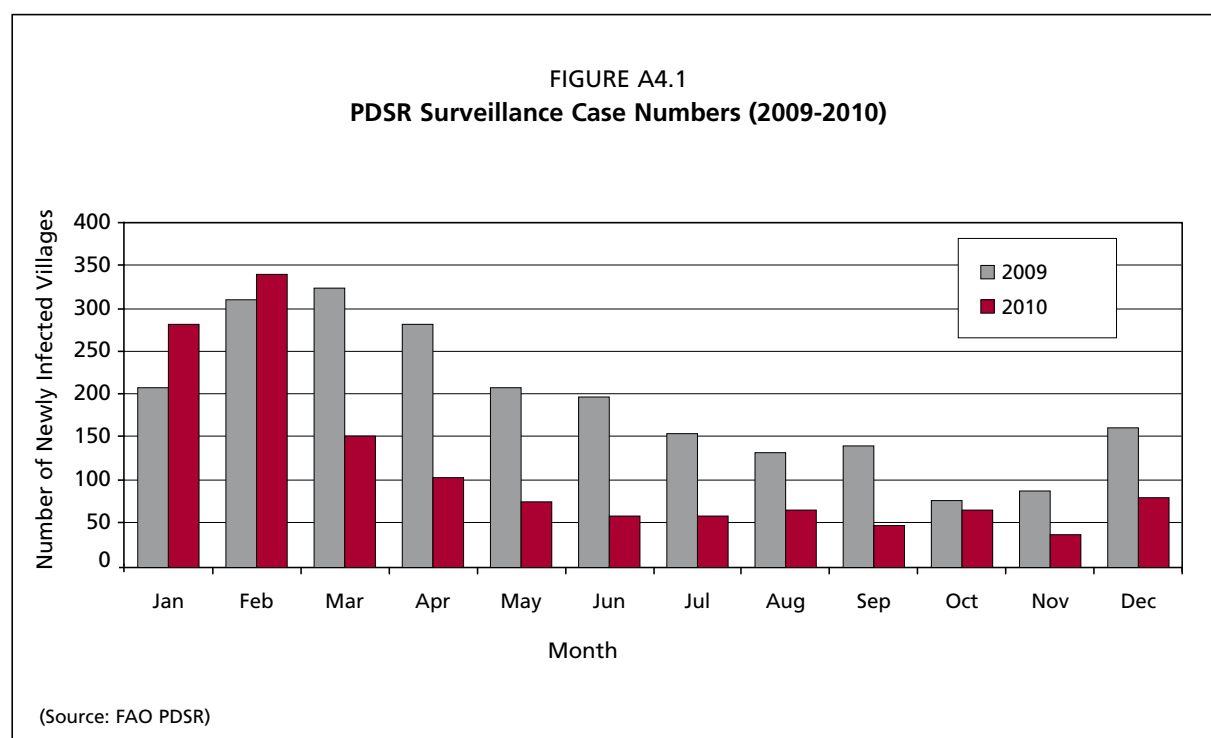
Indonesia

INTRODUCTION

The following Annex provides a further detailed analysis of the (i) disease situation overview (containing more detail than the summary in Chapter 1); and (ii) the overall FAO contribution to the national HPAI response, since the beginning of activities, in Indonesia.

DISEASE SITUATION OVERVIEW

H5N1 HPAI is considered to be endemic in Indonesia, although the area where outbreaks of disease are frequently reported has been reduced to the western part of the island of Java and the southern parts of the island of Sumatra. Elsewhere the disease is reported sporadically and in some provinces it has been a long time since the disease has been observed. PDSR teams are widespread, vigilance in detecting disease in sporadic areas appears high, and there is no obvious reason why the effectiveness of passive surveillance detection should be so biased to higher risk areas, thus it is likely that the observed contraction is accurate. The number of outbreaks reported over the last year is shown in [FIGURE A4.1](#) below. An outbreak represents the occurrence of the disease in a village (rather than in a household as was the case with PDSR reporting in the early part of the programme).



FAO'S OVERALL CONTRIBUTION TO THE NATIONAL HPAI RESPONSE

The FAO country portfolio is set out below. Currently the projects, OSRO/INS/604/USA and OSRO/INS/701/AUL are the national projects which will carry over to 2011. The project OSRO/INS/703/USA completed its funding cycle in December 2010.

TABLE 4.1
FAO project portfolio in Indonesia to December 2010

Project	Start Date	End Date	Project Status	Total Budget (US\$)	Donor
National Projects					
OSRO/INS/604/USA	Jun 2006	Sep 2011	Active	44 200 000	USA
OSRO/INS/701/AUL	Jun 2007	Mar 2011	Active	8 365 333	Australia
OSRO/INS/703/USA	Oct 2007	Dec 2010	Closed	1 630 500	USA
OSRO/INS/803/WBK	Dec 2008	Dec 2009	Closed	467 874	World Bank
OSRO/INS/804/WBK	Dec 2008	Dec 2009	Closed	1 156 052	World Bank
GCP /INS/077/AUL	Mar 2006	Dec 2007	Closed	1 666 910	Australia
TCP/INS/3001	Feb 2004	Dec 2005	Closed	353 485	FAO
OSRO/INS/402/GER	Mar 2004	Sep 2004	Closed	60 962	Germany
Regional/Global Projects					
OSRO/INT/901/NET	Dec 2009	Dec 2011	Active	700 001*	Netherlands
OSRO/GLO/802/USA	Dec 2008	Sep 2011	Active	833 333	USA
GCP /RAS/221/JPN	Sep 2006	Aug 2011	Active	631 219*	Japan
OSRO/RAS/601/ASB	Apr 2006	Aug 2010	Closed	11 140 000*	ADB
OSRO/GLO/601/SWE BABY01	Mar 2006	Jun 2010	Closed	6 600 494*	Sweden
OSRO/RAS/602/JPN	Apr 2006	Dec 2009	Closed	11 400 052*	Japan
OSRO/GLO/504/MUL BABY02	Jan 2006	Dec 2007	Closed	3 696 573*	Switzerland
OSRO/INT/501/NET	Apr 2005	Dec 2007	Closed	629 238*	Netherlands
OSRO/GLO/504/MUL BABY01	Dec 2005	Apr 2007	Closed	3 352 715*	Norway
OSRO/RAS/505/USA	Sep 2005	Mar 2007	Closed	783 532	USA
TCP/INT/3010	Nov 2004	Jul 2006	Closed	351 790*	FAO
TCP/RAS/3006	Mar 2004	Feb 2006	Closed	320 156*	FAO
TCP/RAS/3004	Feb 2004	Jan 2006	Closed	362 331*	FAO
OSRO/RAS/401/JPN	Mar 2004	Nov 2005	Closed	1 621 026*	Japan
TCP/RAS/3010	Apr 2004	Sep 2005	Closed	362 013*	FAO

(Source: FPMIS)

* For regional and global projects indicated, activities were implemented under the mentioned projects, however the budget figures provided are for the whole project.

Annex 5

Viet Nam

INTRODUCTION

The following Annex provides a further detailed analysis of the (i) disease situation overview (containing more detail than the summary in Chapter 1); and (ii) the overall FAO contribution to the national HPAI response, since the beginning of activities, in Viet Nam.

DISEASE SITUATION OVERVIEW

Initially the epizootic of H5N1 was severe with the disease widespread across the country at the time of its first reporting in January 2004. Since the introduction of vaccination in late-2005, the incidence of disease was reduced markedly from that seen in 2004 and 2005. Most importantly the incidence of human cases of H5N1 was simultaneously reduced and there was a long period from 2006 to May 2007 when no human cases were reported. In late-2009 and early-2010 there was a small increase in the incidence of human cases (the number grew from 111 human cases with 56 fatalities to 119 with 59 fatalities), but the last human case was reported was in April 2010. Over this year the pattern of outbreaks in poultry has been similar to other years with a small rise in the cooler months and outbreaks reducing through the hotter, middle months of the year (see [FIGURE A5.1](#)).

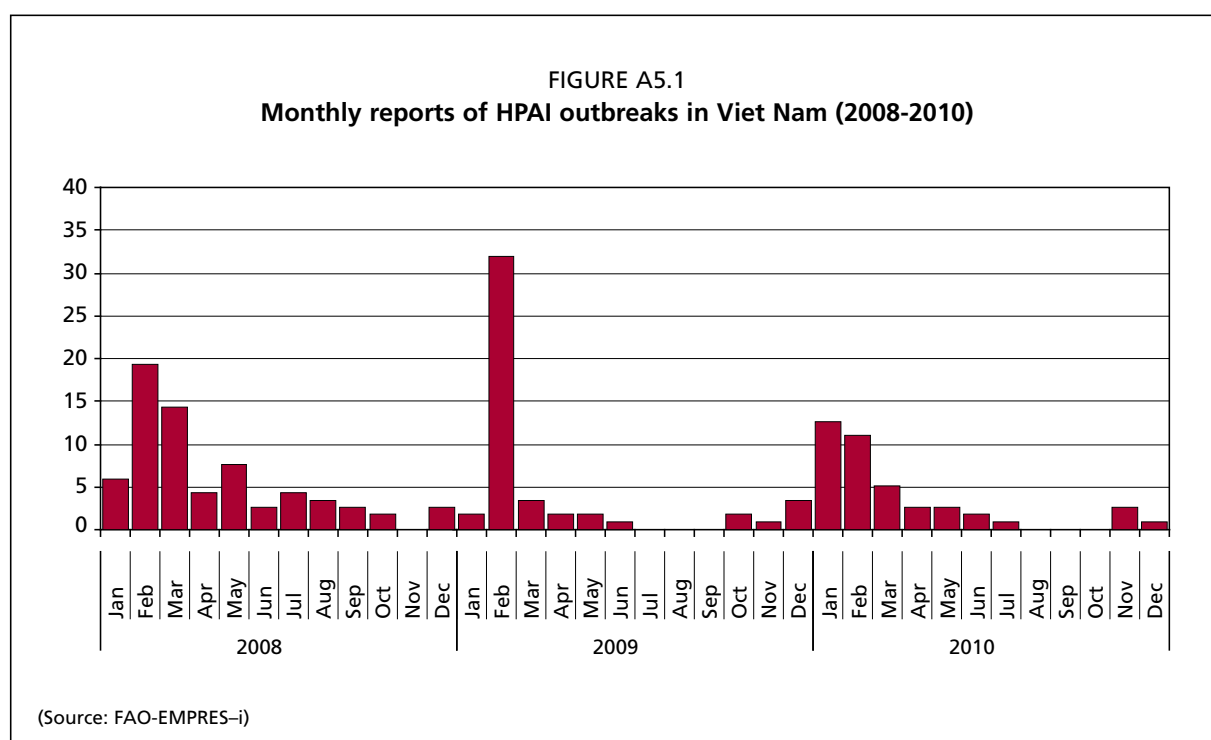


TABLE A5.1
FAO project portfolio in Viet Nam to December 2010

Project	Start Date	End Date	Project Status	Total Budget (US\$)	Donor
National Projects					
OSRO/VIE/701/UNJ	Jan 2007	Jun 2011	Active	2 326 974	UNDP Admst JTF
OSRO/VIE/801/USA	Oct 2008	Jun 2011	Active	4 000 000	USA
UTF /VIE/034/VIE	Dec 2007	Dec 2010	Active	1 045 000	Vietnam
OSRO/VIE/601/IRE	Aug 2006	May 2007	Closed	321 043	Ireland
OSRO/VIE/501/UNJ	Nov 2005	Jul 2006	Closed	2 017 062	UNDP Admst JTF
TCP/VIE/3003	Feb 2004	Jan 2006	Closed	359 039	FAO
Regional/Global Projects					
OSRO/RAS/604/USA – Baby 06	Aug 2006	Sep 2011	Active	11 675 000	USA
TCP/RAS/3004 – Baby 01	Feb 2004	Jan 2006	Closed	362 331*	FAO
OSRO/RAS/401/JPN – Baby 04	Mar 2004	Nov 2005	Closed	1 621 026*	Japan

(Source: FPMIS)

* For regional and global projects indicated, activities were implemented under the mentioned projects, however the budget figures provided are for the whole project.

Viet Nam Avian and Human Influenza Preparedness Project (VAHIP) (UTF/VIE/034/VIE). The overall objective of the project is to reduce the threat of HPAI by controlling the disease at its source in poultry, and also to strengthen the health services' ability to respond to pandemic infections, such as influenza. FAO has provided a Chief Technical Advisor (CTA) and short-term consultants for this project.

H5N1 highly pathogenic avian influenza (HPAI) continues to be a major concern, including the risk of human infection. In six countries, the disease is entrenched in poultry populations (Bangladesh, the People's Republic of China, Egypt, Indonesia, Viet Nam and parts of India) and elimination remains a long-term goal. During 2010, other major animal diseases also continued to spread in different regions of the world, disrupting livestock production, rural economies and people's livelihoods and food security. This has been largely due to the limited capacity of veterinary services to prevent incursion of diseases of high impact or contain them, and to disease drivers such as poor production hygiene, high intensification of animal production, increased trade of animal and animal products and intensified contact between animal, human and wildlife populations.

FAO's HPAI Global Programme addresses the continuing threats from HPAI, and other high-impact animal diseases, through an approach which is moving away from disease specific interventions to a more integrated, multidisciplinary focus on developing sustainable animal health systems at country, regional and global levels. The approach builds upon lessons learned from the responses to H5N1 HPAI and applies them to other transboundary animal and emerging infectious diseases. FAO has been working towards this approach, including with its new Animal Health Strategic Action Plan (2011-2015) in line with the 'One Health' agenda.

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