RCP GREASE

Gestion des Risques Epidémiologiques émergents en Asie du Sud-est

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Regional prospect for research needs on Swine Emerging Diseases in SEA

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Mission report from:

Professor Guy-Pierre Martineau, DVM, Diplomate ECPHM
National Veterinary School

ECOLE NATIONALE VETERINAIRE TOULOUSE

With support from
François Roger (CIRAD), Carlène Trevennec (ENVT-CIRAD) and Flavie Goutard (CIRAD)

cirad PRISE

List of Acronyms

ASF: African Swine Fever

ASVELIS: Asian Veterinary and Livestock Services

CIRAD: *Centre de coopération internationale en recherche agronomique pour le développement*

CSF: Classical Swine Fever

EID: Emerging Infectious Disease

ENVT: *Ecole Nationale Vétérinaire de Toulouse*, France

FAO: Food and Agriculture Organisation

FMD: Foot-and-Mouth Disease

GREASE: *Gestion des Risques Epidémiologiques Emergents en Asie du Sud-est* - Management of Emerging Risks in Southeast Asia

HP-PRRS: High Pathogenic Porcine Reproductive and Respiratory Syndrome

INR**A**: *Institut National de la Recherche Agronomique, France*

IPC: *Institut Pasteur du Cambodge*

JE: Japanese Encepahlitis

NTD: Neglected tropical disease

OIE: *Office International des Epizooties*

PCV2: Porcine Circovirus type 2

PED: Porcine Epidemic Diarrhea

PRISE: *Pôle de recherche sur les Risques liés à l'Intensification des Systèmes d'Elevage* – Research consortium on risks associated with livestock intensification

PRRS: Porcine Reproductive and Respiratory Syndrome

SEA: Southeast Asia

SIV: Swine Influenza Virus

TAD: Transboundary Animal Disease

WHO: World Health Organisation

Introduction

This mission has been undertaken in the framework of a new regional platform launched by CIRAD in Southeast Asia. This new platform is called GREASE for '*Gestion des Risques Epidémiologiques émergents en Asie du Sud-est meaning* 'Management of Epidemiological Emerging risks in Southeast Asia'. Actually, CIRAD and its partners intend to develop this platform in order to address scientific challenges raised by the transboundary and emerging diseases in Southeast Asia, including swine emerging diseases. GREASE events should pave the way of future regional exchanges, the building up of a network among universities and scientific centres and the submission of joint research projects to international donors.

1. COUNTRIES VISITED: VIETNAM, CAMBODIA AND THAILAND

Workshop in Vietnam

PRISE National Consortium - GREASE Regional Network.

In introduction, the well-established consortium in Vietnam, PRISE, and the new regional network, GREASE, have been presented. PRISE (http://www.prise-pcp.org/) is a Vietnamese-French research consortium. It was created in 2003 to assess the risks associated with the intensification of livestock production and to propose technical solutions for sustainable intensification. Emerging animal diseases is one of the PRISE topics.

GREASE (*Gestion des Risques Epidémiologiques Emergentes en Asie du Sud-est/*Management of Emerging Epidemiological Risks in Southeast Asia) is a new regional network launched recently by CIRAD. GREASE is focusing on emerging diseases in south-east Asia (SEA) and aim to structure research on animal and zoonotic diseases in SEA. Following a preliminary meeting organised in Bangkok in June 2009, the workshop organised in Hanoi on "Swine Emerging Diseases" is the first regional workshop. The first official meeting is planned mid-December 2009. Two other workshops are planned in December 2009 (Social Network Analysis) and January 2010 (Health Ecology).

Moreover, the general concept of regional networks supported by CIRAD has been presented by the CIRAD regional director.

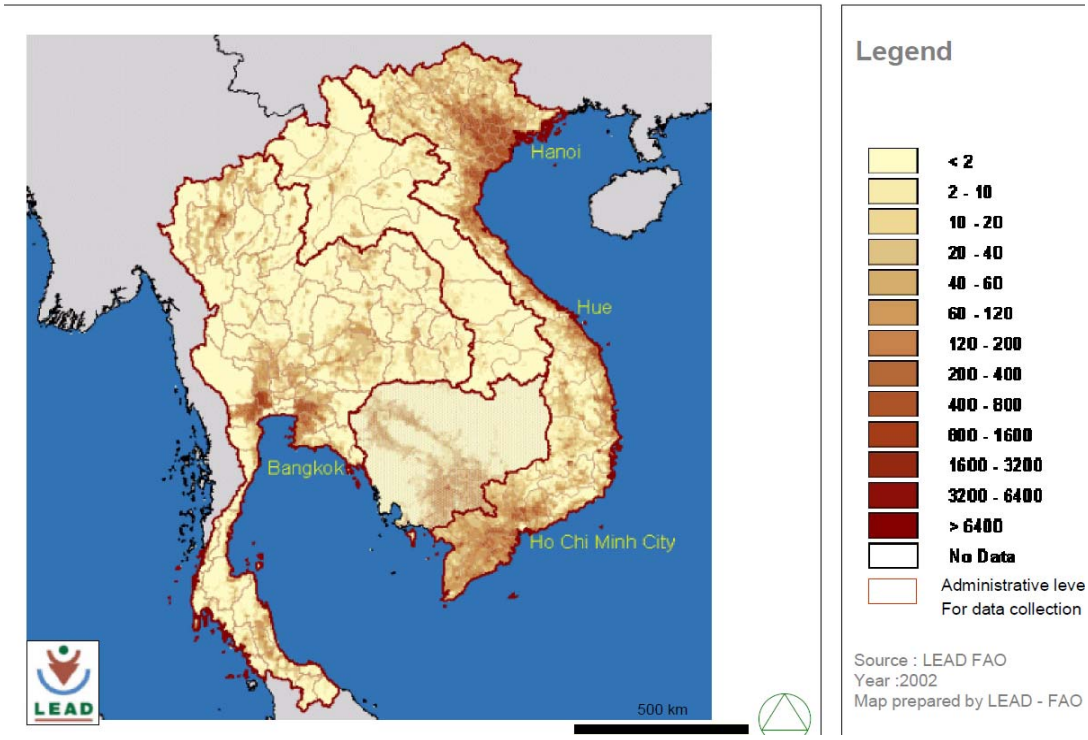
Regional and integrated project on zoonoses at the regional level: an intention.

CIRAD with its partners is intending to develop a zoonotic or OWOH component or sub-project, linking medical and veterinary sectors. The objectives should be (i) to build up and reinforce surveillance systems at the national level; support the countries by making their animal health situation transparent and setting up mechanisms for the early detection of disease outbreaks; (ii) to propose recommendations to be made on ways of improving cooperation between the Veterinary Services and the Public Health Services; (iii) to develop a regional platform/network to improve early warning on infectious zoonoses in Southeast Asia. The strategy should be 1. To develop activities and tools at the national level in Cambodia and Lao PDR, 2. To assess the risk of zoonotic diseases in SEA and 3. To build up OWOH network at the regional level.

Pig Farming Systems in SEA.

SAE is one of the largest pig producing regions in the world (see map below).

ESTIMATED PIG DENSITY IN Thailand, Cambodia, Laos and Vietnam (animals per km²)



Vietnam: Pork and poultry play a key role in contribution of protein for people in Vietnam, accounting for approximately 90% of meat consumed by Vietnamese and the pig and poultry sectors are two of the fastest growing sub-sectors in Vietnamese agriculture. Pig production is unequally distributed geographically. The Red River Delta and the Mekong River Delta account for about 40% of the country's pig population and about half of the pork output. Pig production is based mainly on small-scale farms, the majority of farms on average having 1 or 2 pigs. The size of pig farms has increased slowly. In 2002, this proportion increased to 8% and there were less than 600 herds commercial pig farms in whole country (commercial pig farms defined as farms which keep at least 100 pigs). Annual pork production is 1,850,000 tons (6th largest world producers), ahead of Thailand (8th largest world producer, with an annual production of 1,790,000 tons).

As the majority of pig farmers in Viet Nam raise few pigs, the marketing systems must assemble pigs from a large number of small-scale farms, which, combined with poor infrastructure, leads to high transactions costs. Pig farmers use two marketing channels: sale to assemblers and sale to slaughterhouses, of which the first is the most common. Assemblers are individuals specialized in the collection of fattened pigs from farmers and their onward sale to larger assemblers or slaughterhouses.

Based on output channels, pig slaughterhouses in Vietnam belong to one of three categories: slaughterhouses selling both wholesale and retail (70%), slaughterhouses selling only wholesale (24%), and slaughterhouses only selling to end consumers (6%). Most slaughterhouses are privately owned and use small scale and simple equipment. Only around 30 slaughterhouses in Viet Nam are in a position to participate in the export of pork

products, of which Vissan Company in Ho Chi Minh city, with a capacity of 20,000 tons, and Vinh Niem-Hai Phong, with a capacity of 10,000 tons are the largest.

Cambodia: according to Dr. Holl Davun, pig production is classified into semi-commercial and traditional or family production system. Pig production is around 2,2 million pigs per year (from 1,9 in 2000 to 2,7 millions in 2006). Major identified and underlined constraints are illegal animal movement from neighbouring countries, lack of livestock production data and veterinary data, late reporting from an outbreak area and human resources are limited.

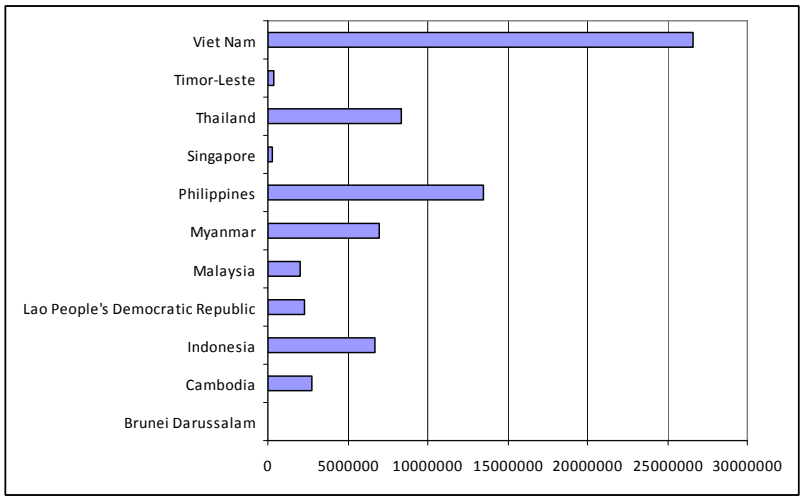
Thailand: chicken (and duck) production is the biggest livestock production (250 millions in inventory). Pig and beef are similar (around 11-12 millions inventory heads) with a clear regional specialisation (in central Thailand). There are 800,000 sows and 25% of these sows are in one integrated group (CP). The second larger integration is Betagro (64,000 to 80,000 sows). Another characteristic is the presence of big swine farms (up to 20,000 sows, with an average from 3,000 to 8,000 sows). Since 2000, exportation increase each year but with a huge increase in 2008 (180,000 pigs were exported in 2008 compared to less than 10,000 pigs in 1999.

Precise data of the repartition of backyard and commercial production is not available probably in part related to the definition of these two words (ASVELIS, 2009) and the perception of the importance according to the contact person. It is why I give a general view using qualitative term (with correspondence according to EFSA, 2005).

	Backyard	Commercial	Major health constraints*
Cambodia	Moderate to High	Low	CSF, PRRS
Thailand	Low to moderate	High	PRRS, PCV, PED
Vietnam	High	Low	CSF, PPRS, PED,

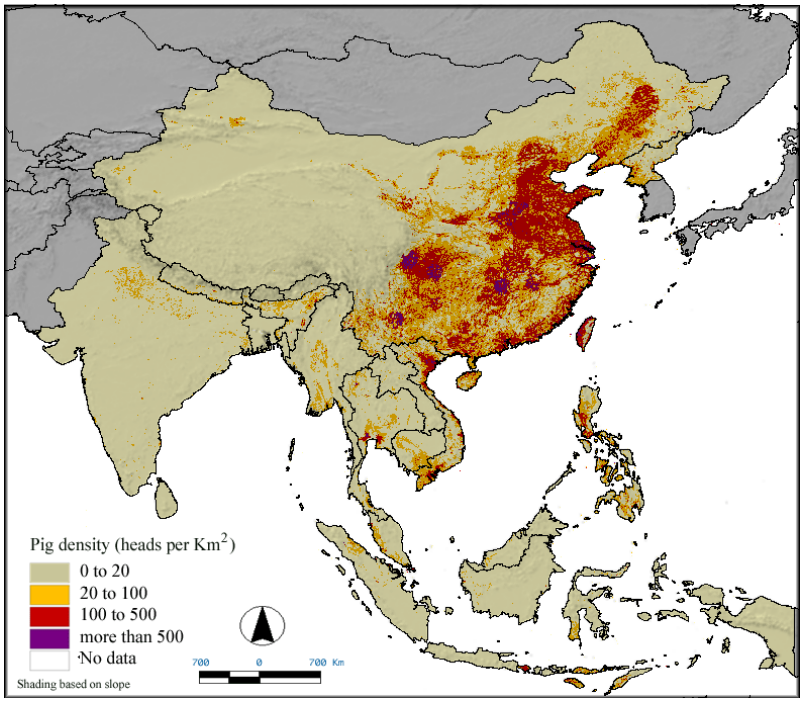
Table 1 – Qualitative relative importance of backyard and commercial pig production in Cambodia, Thailand and Vietnam (*the identified constraints are not official constraints but those perceived by discussion with different people meet during this mission)

The three major pig producing countries of SEA are Vietnam, Philippines and Thailand:



FAO STAT 2007: Pigs' stocks (heads) per country in South-east Asia

Beside SEA, we have to consider the close geographical relationship with China, the first pig producing country in the world. As we can see, SAE countries (Vietnam, Lao PR, Cambodia and Thailand) are near high pig density Chinese production area.



"Swine emerging disease in SEA: the clinician point of view" (GPM).

Many of the new human pathogens that have emerged or re-emerged worldwide originated from animals (especially wildlife including wild boar and scavenging pigs) or from products of animal origin (including also wild boar and scavenging pigs). Therefore, wild boar, scavenging pigs and backyard pigs, of major economically importance in SEA, were implicated in the transmission of diseases to humans (*Streptococcus suis*, *Trichinella spiralis*). Because it is difficult or in most instances even impossible to predict when or where the next important new zoonotic pathogen will emerge, collaborations of veterinary and public health specialists are important. The discovery of Reston ebolavirus in pigs in the Philippines and the present episode of a novel swine-like H1N1 influenza virus spreading through human populations in Mexico, the US and elsewhere in the world are current reminders that cross-talk between these disciplines is critical.

Ranking of major swine diseases is greatly depending on which country is affected.In one hand, the fact that PRRS and PCV2 are major diseases in North America lead to a huge quantity of information on these diseases, with many communications in International Symposium (such as IPVS). On the other hand, there is a lack of information regarding situation in some regions such as SEA. Some diseases, such as CSF or ASF, although occurring in many countries, are not the subject of a lot of discussion in international swine veterinary meetings (such as IPVS) because of the lack of interest by the audience (except those of affected countries).

Beside "classical" swine disease (PRRS, CSF), new emerging swine disease have occurred the last 2 years. Emerging of a Chinese-like strain of Porcine Epidemic Diarrhea Virus (PEDV) has been recently reported in Thailand (Puranaveja et al., 2009). Emerging of a Highly pathogenic Porcine Reproductive and Respiratory Syndrome virus has been reported in China in 2006-2007 ((Tian K et al. (2007) and, in 2007, in Vietnam (Ken Inui, 2009).

To report disease, we have to take into account local specificity such as type of production (different backyard production systems), type of social behaviour (such as eating raw pork meat, slaughtering,), type of information (clinical observations or laboratory results).

Private Sector

Merial continues their activities related to PRRSV in order tobetter understand emerging diseases including HP-PRRSV but also CSF. Areas of potential collaboration in the framework og GREASE include participation in the design and analysis of clinical research studies from active infections/outbreaks situations, exchange and/or reception of personnel in Lyon (France) to develop competencies in PRRS related to lab testing. Merial may help to investigate isolates from active PRRSV disease outbreaks.

Merial also aims to develop further strategic partnerships/activities in Asian Region related to understanding emerging diseases: this includes a specific focus on PRRSV/HFSD.

ASVELIS in Hanoi, Vietnam has been created in 2007. ASVELIS is the acronym for Asian (AS) Veterinary (VE) & Livestock (LI) Services (S). The company's range of activities relates to both veterinary work and to most of the elements of livestock supply chains (genetic, farm management, processing, marketing etc.). ASVELIS has a primary focus across South East Asia. The number of ASVELIS full-time collaborators has climbed every year from 6 in 2007 to 12 in 2008 and 24 in 2009 and includes Vietnamese, Thai, Burmese and European nationalities. In addition, a number of experts (from South East Asia, Europe, Australia, USA, Canada and other countries) are supporting them with their skills and experiences giving them access to a higher level of specialization.

Summarise of presentations (CD available with all the presentations)

For each specific disease, many aspects have been reported and discussed.

We summarized information in the following table:

Type	Disease	Covered and discussed aspects	Comments
Viral	CSF	Epidemiology (with specific situation in SEA) Vaccination	A major disease Many available information Protocols of vaccination probably much more important than vaccine per se
	ASF	Risk analysis (discussed with CSF)	No doubt: according to discussions, a disease to be considered
	PRRS	Overview and specifically High Pathogen PRRS outbreaks in Vietnam	A very complex epidemiological situation in SEA according to specificities of the PRRSV and pig production characteristics
	SIV	Zoonotic as well as inter-species transmission	A very complex epidemiological situation in SEA according to specificities of the SIV and pig production characteristics
Bacterial	*S. suis*	Zoonotic disease	Epidemiological and bacteriological information from human cases in Vietnam
Parasites	*Trypanosoma evansi*	Synthesis	A need for information in SEA
	Trichinella spiralis	Zoonotic outbreak	Restricted (declared) outbreaks in human in Vietnam

Differences of diseases perception, for a swine European practitioner, in Western Europe compared to SEA:

		Ranking in western Europe*	**Ranking in SEA**
Viral	CSF	No	Major
	ASF	No	Not recognized
	PRRS	Major	Major
	SIV	Major	Major
	PCV2	Medium	Minor to Major
Bacterial	*S. suis*	Medium	Major
Parasitologic	*Trypanosoma*	Not reported but?	Not reported but?
	Trichinella	Low	Emerging?

Conclusions:

- always dangerous to extrapolate from Western countries
- specific SEA situation
- many unknown situations

An other classification could be displayed and should be discussed in order to prepare future activities.

		Ranking in western Europe*	Ranking in SEA
Specific Swine diseases/Transboundary Diseases	CSF, PRRS, ASF, FMD, etc.	To be clarified	
Zoonotic diseases	SIV, *S. suis*, Nipah, etc.		
Neglected disease	Surra, Cysticercosis, Trichinellosis, etc.		

Annexes: list of participants and programme

Mission (meetings, discussions) in Cambodia

Institut Pasteur du Cambodge: Director (Dr V. Deubel), Head of Epidemiology team (Dr S. Vong) and Head of virology team (Dr P. Buchy).

Swine flu: all the samples (1000) collected at the abattoir were PCR negative. Some samples were serologically positives for AI . The laboratory intends to use other antigen including the S-OI A/H1N1/2009 strain to investigate further. Contacts should be developed with Professor R. Thanawongnuwech, from Chulalongkorn University in Thailand. He is a swine pathologist internationally well recognized in swine diseases. He is a coordinator of Vet lab in swine necropsy for technician and/or vets. He is also an international leader in PRRS and PED.

Japanese Encephalitis Virus Disease (JEVD) remains a major human disease in SEA. Indeed, reported by Dr. P. Buchy over 3,000 cases of clinical encephalitis in human occurred in 2008, 1/3 are related to JEV in a sentinel hospital located in Siem Reap for health network in Cambodia. Nowadays none JE field investigations are carried out on pigs. The Director (virologist) intends to develop an ELISA test using NS1 antigen and could collaborate with the veterinary sector. In that framework, there is a need for animal reference samples (via AFSSA Ploufragan and/or via INRA-Tours: contacts could be established).

National Veterinary Research Institute: Director (Dr S. San), Deputy director (Dr D. Holl)

There is a global lack of human resources and budget. Need for PRRS reagents for estimating the occurrence of this disease in Cambodia

AVSF (M. Saoleng Chheng)

Past projects: A regional project “Vietnam-Cambodia” funded by the SEA-FMD project, on the cost related to FMD-CSF diseases has been done in 2007. It was a case-control study in two districts from two provinces. This project includes cattle (FMD) and swine (CSF) and was based on reporting of clinical symptoms.

AVSF has been involved in the training of “Village Animal Health Workers” (VAHW), officially recognized by Official Cambodia authorities. These VAHW are in charge of reporting the disease outbreaks to the official district veterinarian. Instruction of these VAHW is based on 7 modules (one week each) on 7 consecutive months.

Coming project: A strategic mass vaccination against CSF (but with other antigens such PRV …) is plan. Actually, in a given herd, only 50% of the pigs are vaccinated.

FAO Cambodia (L. Allal – Officer in charge of AI Control in Cambodia). Dr Allal confirms the importance of the VAHWs (10,000 in which 8,000 have been trained by FAO; there is approximatively 1 VAHW/village). For Dr Allal, CSF is problem number 1 in pig. Although not discussed, it may be interesting to perform a case-control study on mass vaccination against CSF using the village as a unit.

Thailand: meetings/discussions and seminar

OIE/SEAFMD: Coordinator (R. Abila) and Technical assistant (A. Bouchot)

In terms of priorisation, CSF appears to be the first one for international agencies. Moreover, surveillance systems should be developed in order to detect emergences of new diseases in pigs.

Chulalongkorn University: Professor Doctor Roongroje Thanawongnuwech (RT), veterinary pathologist at the Faculty of veterinary science.

Following the question of the three major swine diseases in Thailand, the answer was CSF, PRRS and FMD. For RT, the major reason to explain the CSF situation is the vaccination failure, consequences of bad quality of some vaccines, bad conservation of vaccines (freezing chain), bad timing of vaccination (too early according to interference of maternal immunity and too late according to immunosuppressive undercurrent disease such as PRRS after weaning) and immunosuppressive effect of some mycotoxins.

KU: seminar and discussions (P. Tulayakul and coll.)

I gave a seminar on Swine zoonosis

The objective was to underline the facts that we need information to rank hazards in a given country / region and in a given model of production such as backyard versus intensive or mono-specie (only swine) vs. multi-species farms.

Zoonoses are highly variable, depending on the region with generally a low incidence of reported cases in modern production systems but with scarce information from "backyard production system"

2. COMMENTS

80% of emerging diseases in the world are zoonotic diseases. Pig is one of the major reservoirs. Because of local and regional characteristics, many of them are identified in SEA. There are always two questions: "Why a disease appears" and "How to control this disease". The strategy is different according to each disease. For the purpose of this report, we have to differentiate major specific swine diseases (limited to swine), swine zoonotic diseases and "neglected" disease (specific ecology in some countries such as backyard production).

Major Swine Diseases in SEA

CSF: the situation is probably well known but some of the risk factors are not easy to control such as "backyard production" (with consequences on the perception of the disease) and, in large herds, bio-security (with a link with backyard production) and human vector.
ASF: although not reported in SEA, there is a high risk of introduction in the region (including China) according to what happens recently in Georgia.

FMD: it does not seem to be a priority from the pig health situation in continental SEA.

PRRS: In June 2006, a previously unknown severe disease designated "high fever syndrome" occurred in several pig farms and subsequently overwhelmed almost half of China and infected over 2,000,000 pigs, resulting in about 400,000 fatal cases. This epidemic persisted for nearly 3 months and caused considerable economic losses among local pig farmers. More than 10 provinces were affected by the pandemic. Initially, the "high fever" was suspected to be Classical Swine Fever (CSF) or African swine fever (ASF). Other cases occurred in 2007 in Vietnam. This new syndrome is caused by a highly pathogenic PRRSV virus (HP-PRRSv). Particularly, in these atypical PRRS outbreaks, many adult pigs and some pregnant sows, died as a result of the infection. This PRRSv has a unique molecular feature in NSP2, namely a discontinuous deletion of 30 amino acids, implying its potential role as a virulence marker.

Zoonotic diseases

SIV: well recognized by all as a major (potential?) zoonotic disease. On-going studies (CIRAD-ENVT studies, KU studies …) will gave a lot of new information needed for further works. Actual studies are a first and "mandatory" step.

Streptococcus suis and trichinellosis: once first human diagnosed, a quick retrospective epidemiological investigations is the preliminary step of zoonotic control. Therefore, the speed of reactivity includes a link between human and veterinary services, between central and local veterinary services with transfer of information and, further, training. It should be included in a typical network organization of zoonotic diseases surveillance.

We did not take into account cysticercosis. The fact that many national publications are in local languages (such as Vietnamese) does not facilitate the information available to the

international community. Hospital surveys indicate that cysticercosis is emerging as a serious health problem in Vietnam mainly from the Hanoi area. Many more men than women are being treated for cysticercosis with most patients being young to middle-aged adults though several juvenile cases have been seen in the south. As written by Willingham et al. (2003), further researches on the epidemiology and impact of cysticercosis in both human and pig hosts in order to determine whether a prevention and control program in Vietnam would be merited and cost effective.

JE is a zoonosis where pigs are the main contributors in the transmission cycle with respect to human infection, because these animals often stay close to human dwellings. Humans become infected when bitten by an infected mosquito and are a dead-end host because of low viremia, preventing the virus from being transmitted further. Although JE virus (JEV) ecology has been widely studied, and that a zoonotic transmission cycle among mosquitoes, pigs, bats, and some water birds is well accepted, we don't know if changes in ecology of pig production (herd size, specialization) will lead to changes in disease epidemiology amongst pigs and consequently on human disease.

Neglected diseases

There is a recent paper of FAO on "Global plan to combat neglected tropical diseases 2008-2015*":*

> *The need to fight neglected diseases is incontestable –from a moral perspective, a human rights perspective and an economic perspective, as well as a global goods perspective (WHO/CDS/CPE/CEE/2004.45). Although one or more of these diseases can be found in almost every livestock keeping community in the developing world, they are often simply forgotten.*

In the field of development, livestock have been treated as the 'poor cousins' of crop agriculture, receiving far less financial support from donors and national governments. The name per se illustrated the problem: we have only little information, often none generated in the country (SEA) but for which all participants recognized the importance to be included in a surveillance programme. Participants are also convinced of the difficulties to "sell" such work in comparison with other zoonotic diseases (such as SIV).

WHO considers that cysticercosis, trichinellosis are neglected diseases, as well as Japanese encephalitis. Neglected tropical diseases (NTDs) and zoonoses are a devastating obstacle to human settlement and socioeconomic development of already impoverished communities.

As mentioned, to report disease, we have to take into account local specificity such as type of production (different backyard production systems), type of social behaviour (such as eating raw pork meat, slaughtering,), type of information (clinical observations or laboratory results).

The first step in dealing with a disease is trying to understand the magnitude of the problem. For a variety of reasons, in the case of many zoonoses, their incidence is completely unknown, and usually greatly underestimated – far more so than is the case for other disease categories.

The reasons for under-diagnosis fall into two broad categories. Firstly, many zoonotic diseases are inherently difficult to diagnose (**unevenly spread geographically**, being known in one locality and unknown in another, their **symptoms are shared** with a number of other common diseases, definitive **diagnosis is complex** and/or reliable, cheap diagnostic tests are

not available). The second category concerns the chain of events from the human case to the animal reservoir.

The veterinarians are often at the front line of dealing with zoonotic diseases. There is a real need for integration of veterinary and medical sectors for disease prevention. Veterinary staff also lacks the facilities for efficient diagnosis. In many countries, mechanisms by which human cases of zoonotic diseases are automatically reported to veterinarians are not available.

Although not discussed during the workshop, as we have to start by what happens on the level of the pig unit, it seems that there is a lack of expertise of field veterinary swine practitioners. This has many consequences including the late recognition of a disease. As reported by Peter Davies (2009):

> *"Although practicing veterinarians are the frontline of response to emerging health problems in food animals, they remain an underutilized resource for epidemiologic intelligence"*[1].

Some Questions and Research Questions rising during the mission:

- What are the impact of CSF and cost-effectiveness of CSF control?
- How to improve CSF control in backyard systems?
- How to carry out efficient surveillance of swine influenza?
- Do we need to develop epidemiological tools for controlling PRRS?
- How to address the neglected diseases?
- What are the real impacts of trichinellosis and cysticercosis?
- Is JE an important disease for pig production?
- Is changing of pig husbandry in SEA responsible for emergences (JE[2]?)?
- How to improve surveillance of emerging and unknown diseases?

[1] From: **Detecting Emerging Diseases in Farm Animals through Clinical Observations by Gwenaël Vourc'h et al. They wrote: "**Emerging diseases in animals, especially farm animals, involve economic losses through direct (deaths, culls, movement restriction, laboratory tests) and indirect (decreased consumption of animal products, tourism decline) costs. Because diseases will continue to emerge, the potential unexpected or atypical features of future health problems makes surveillance particularly challenging. No single data source captures all the information required for surveillance. Early clinical detection is one of the cornerstones regarding unexpected diseases insofar as the surveillance activities of the veterinarians can be focused and systematized.

[2] Swine acts as amplifying host and has very important role in epidemiology of the disease

3. RECOMMANDATIONS

Networking and data collection

There is a need:

1. for a review paper like "Swine Emerging Diseases in SEA: knowledge and gaps", bringing together workshop participants and other potential contributors;

2. for a coordination on some practical aspects (exchange of informations, serobank, …) ;

3. for a manager in order to initiate a regional network. Within the GREASE network, we could set up a first specific network on swine diseases.

Training and education

Training and education should be developed through the networking activities and the regional research projects.

Trainees from Master courses in Vietnam and Thailand could be enrolled for field and lab works.

A residency programme in clinical epidemiology at regional level to complete a PhD programme at regional level could be planned in the future: an educational international network (two options: residency I, II, and III, as well as MSc and PhD) program with CIRAD, ENVT, Murdoch University, Kasetsart University. For instance, one could **adapt** and **complete** the University of London Postgraduate study programmes and short courses in Livestock Health and Production and Veterinary Epidemiology and Public Health by distance learning (**www.londonexternal.ac.uk/rvc**) to local needs.

Research projects – proposals

Transboundary swine diseases: two diseases are of major importance: CSF and PRRS (including HP-PRRS). There is a need for going along control measures e.g. economic impact of surveillance and vaccination; modelling (dynamic models, risk mapping, etc.) in order to target surveillance and control, etc.

Risk analysis for ASF should be proposed and carried out at the regional level including China.

Swine influenza: strains' surveillance (monitoring) and study of interspecies transmissions (and role in the complex respiratory syndrome).

Zoonotic neglected diseases. Two or three main groups of diseases could be differentiated:

1. Japanese encephalitis and West Nile: ecological and epidemiological roles of pigs
2. Parasitic diseases: impact in human, risk assessment, management and communication; control measures, surveillance at the abattoirs.

Non disease-specific activities and transversal projects:

1. Priorisation of pig diseases based on risk analysis

2. Surveillance systems for emerging diseases including field and clinical training of veterinarian and paravets.

Two steps must be completed: the first is to identify a coordinator GREASE able to understand the issues in each country and the second is to build consensus on priority diseases which should be considered.

Annexes

1. Contact list

2. Abstract - conference Bangkok Oct. 2008: Roger et al. Risk-based Management of Zoonotic and Animal Emerging Diseases in Southeast Asia.

3. Extract from ASF paper: "ASF risk for Australasia". African swine fever: how can global spread be prevented? Costard et al. Phil. Trans. R. Soc. B 2009 364, 2683-2696. doi: 10.1098/rstb.2009.0098

Participants - Workshop: "Swine Emerging diseases in Southeast Asia"
8-9 Oct 2009 - Hotel Moevenpick Hanoi

No	Name	Contact	Institution, Country	Field	Day 1		Day 2	
					Session1	Session2	Session1	Session2
1	Dam Tuan Tu	damtuantuvcn@gmail.com	NIAH, Vietnam	Pig Research Center			x	x
2	Davun Holl	vun.navri@gmail.com	NAVRI, Cambodia	Vet Services	x	x	x	
3	Desquesnes Marc	marc.desquesnes@cirad.fr	CIRAD, France	Research Center/Parasitology	x	x	x	x
4	Dinh Van Tuyen	vantuyen1973@gmail.com	Prise, Vietnam	Prise Coordinator	x			
5	Goutard Flavie	flavie.goutard@cirad.fr	CIRAD, France	Research Center/Epidemiology	x	x	x	x
6	Ho Thu Huong	hothuhuong2002@gmail.com	NIVR, Vietnam	Research Institute/Lab/Serology	x	x	x	x
7	Huynh Thi My Le	huynhtmle@yahoo.com	HUA, Vietnam	University/Bacteriology	x	x	x	x
8	Inui Ken	Ken.Inui@fao.org	FAO, Vietnam	FAO Vietnam/Lab expert	x	x	x	x
9	Kiers Alexis	alexis@asvelis.com	Asvelis, Vietnam	Private Sector	x	x	x	x
10	Martineau Guy Pierre	g.martineau@envt.fr	ENVT, France	Vet School/Pig diseases	x	x	x	x
11	Nguyen Cong Khanh	khanhnguyen@nihe.org.vn	NIHE, Vietnam	Research Institute/Epidemiology	x	x	x	x
12	Nguyen Cong Oanh	ncoanh@hua.edu.vn	HUA, Vietnam	University/Animal Husbandry	x	x	x	x
13	Nguyen Tien Dung	dzungntd@gmail.com	NIVR, Vietnam	Research Institute/Lab/Virology	x	x	x	x
14	Nguyen Viet Khong	nguyenvietkhong@yahoo.com	NIVR, Vietnam	Research Institute/Immuniology	x		x	?
15	Patrice Gautier	patrice@asvelis.com	Asvelis, Vietnam	Private Sector	x	x	x	
16	Phan Le Thanh Huong	thanhhuong@nihe.org.vn	NIHE, Vietnam	Research Institute/Bacteriology	x	x	x	x
17	Porntippa Lekcharoensuk	fvetptn@ku.ac.th	KU, Thailand	University/Virology	x	x	x	x
18	Roger François	francois.roger@cirad.fr	CIRAD, France	Research Center/Epidemiology	x	x	x	x
19	Seneque Sacha	Sacha.Seneque@merial.com	MERIAL	Private Sector	x	x	x	
20	Suwicha Kasemsuwan	fvetswk@ku.ac.th	KU, Thailand	University/Epidemiology	x	x	x	x
21	To Long Thanh	thanhto@fpt.vn	LCVD, Vietnam		x	x		
22	Trevennec Carlène	carlene.trevennec@cirad.fr	CIRAD, Vietnam	Research Center/Epidemiology	x	x	x	x
23	Vu Thi Nga	ngattcd@yahoo.com	LCVD, Vietnam	Lab/Parasitology	x	x	x	x
24	Waraphon Phimpraphai	fvetwrp@ku.ac.th	KU, Thailand	University/Epidemiology	x	x	x	x
25	Nguyen Thi Giang Thanh	giang_thanh67@yahoo.com	NIVR, Vietnam	Lab	x	x	x	x

Risk-based Management of Zoonotic and Animal Emerging Diseases in Southeast Asia

Roger F., Abila R., Tavornpanich S., Desquesnes M., Desvaux, S., Paul M., Goutard F., Peyre M., Trevennec C., Edwards J.

CIRAD, INRA France; OIE-SEAFMD, Thailand; DLD, Thailand; Murdoch University, Australia

Several major animal and zoonotic diseases are occurring in Southeast Asia. Actually, Foot-and-Mouth disease (FMD), Classical Swine fever (CSF), Avian Influenza (AI) are highly prevalent. The Porcine reproductive and respiratory syndrome (PRRS) and *Streptococcus suis* infection have emerged recently. Endemic diseases like Surra, *T. evansi* infection (TE), and Japanese Encephalitis (JE) can spread at a more large scale and could jeopardize the public health (Joshi *et al.*, 2005, Chevalier *et al.*, 2004). All of these diseases are transboundary animal diseases (TADs), some are emerging (EIDs). Several of them are under surveillance and/or more or less controlled (e.g. FMD, CSF and AI) by the veterinary services and national or regional projects (Edwards, 2004, Peyre *et al.*, 2008). However, the acute weaknesses in the veterinary services from Asian developing countries make vulnerable the surveillance network (Forman *et al.*, 2008) and contain the efficacy of the control measures.

Management of TADs and EIDs should be based on robust risk analysis in order to target more effective surveillance and control measures. Besides epidemiological risk assessment, socio-economic features should be considered. Indeed, limited financial support and human resources in many countries restrict the implementation of extensive programmes. Risk assessment should take into account the potential pathways of diseases introduction and diffusion (Zepeda *et al.*, 2001) and should notably consider (i) legal and illegal trade of animals (Wongsathapornchai *et al.*, 2008) and animal products including the disposal of waste food (Wooldridge *et al.*, 2006); (iii) density of susceptible animals and organization of livestock production system; (iv) effectiveness of surveillance system that should be assessed by quantitative decision tools (Tavornpanich *et al.*, *In Prep*.). All these data combined with experts' opinions and official disease information can assist risk assessment (Sumption *et al.*, 2008).

AI surveillance and control at the animal level is managed by national veterinary services and coordinated by several regional and international projects and programmes. Thus, international agencies (FAO, OIE) and bilateral cooperation (Australia, Canada, France, Japan, USA, etc.) are funding and supervising research activities on AI ecology and epidemiology including risk modelling and applied issues, i.e. surveillance and control strategies. The OIE-SEAFMD programme is supporting the regional networking for strengthening FMD and AI surveillance and control based on risk analysis, vaccination and zoning. Concerning FMD, the aim is to have the whole region free with vaccination by the year 2020.

Japanese Encephalitis (JE) is a zoonosis transmitted essentially by rural *Culex* spp. and pigs are the amplifying host. Urbanization can lead to changing the JE epidemiological patterns (Chevalier *et al.*, 2004). TE is a neglected but important disease: often underreported because of sub-clinical outcomes, it has an immunosuppressive effect that can reduce the effectiveness of vaccination against infectious diseases like FMD (Dávila and Silva, 2000). Exotic diseases like African swine fever (ASF), Rift Valley fever (RVF) and bluetongue, for some parts of the south-eastern Asia, should be considered as a potential threat. In point of fact, ASF virus (Rousset *et al.*, 2001) and RVF virus (Chevalier *et al.*, 2008) are currently expanding out of mainland Africa and can be introduced in susceptible population e.g. pigs in Southeast Asia and small ruminants in some Chinese areas. Bluetongue is nowadays emerging in many

countries in all probability because of global warming (Guis *et al.*, 2008) and new serotypes and/or new vectors can spread further south towards Australasia.

Several projects are in progress in Southeast Asia, mainly on AI and FMD. To address the numerous research questions on epidemiology and risk-based management of TADs and EIDs, and to strengthen training (Goutard *et al.*, 2007), education and transfer of knowledge, partnerships linking universities, research institutions, veterinary services and regional programme should be promoted.

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PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

African swine fever: how can global spread be prevented?

Solenne Costard, Barbara Wieland, William de Glanville, Ferran Jori, Rebecca Rowlands, Wilna Vosloo, Francois Roger, Dirk U. Pfeiffer and Linda K. Dixon

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predominant, the disease spread quickly with devastating consequences for the whole production sector. However, in this part of the country control measures have proven to be more successful and with the introduction of a comprehensive national eradication programme in 1985, 96 per cent of the country was considered free of ASF within 2 years (Anon. 1990) and disease persisted only in the southwest of the country. Besides extensive monitoring activities, the eradication programme focused on improving biosecurity on farms, strict animal movement controls and increased disease awareness of pig farmers. In Sardinia, where the disease first occurred in 1978, endemicity is the result of extensive pig farming that has been practised for centuries (Firinu *et al.* 1988) and of the presence of endemically infected wild boar. Following an increase in reported outbreaks in 2004, the European Commission approved an eradication plan for Sardinia that includes targeted surveillance and control in high-risk areas for wild boar and domestic pigs, stricter enforcement of biosecurity and increased control of export of pig meat products (European Union 2005).

The importance of wildlife reservoirs for disease maintenance has been clearly demonstrated in the past and therefore the recent outbreaks in Georgia and the subsequent spread of the disease to Armenia, Azerbaijan and Russia (OIE WAHID 2009) are of great concern to the growing pig industry in many eastern European countries. The situation has been further complicated and control options made more difficult by the spread of the disease into the local wild boar populations (OIE WAHID 2009). Further west- or eastward spread could adversely affect the pig sector in many countries. For instance, the pig industry in the Ukraine is an important growing agricultural sector with massive foreign investments into large-scale pig farming. Backyard farms and free-ranging pigs seem to be limited; however, the presence of wild boar could lead to spread of ASF to Moldova, Romania, Hungary, Slovakia, Poland or Belarus.

(c) *East, Southeast Asia and Australasia*

Countries of eastern and austral Asia have never been affected by ASF. Because of the dependence of the national economies on livestock production-related export industries, New Zealand, Australia, Japan and South Korea have very effective sanitary regulations for pork and live animal imports and waste food disposal. Recent animal health emergencies (e.g. bovine spongiform encephalopathy—BSE, classical swine fever—CSF and avian influenza) convinced the Japanese and Korean governments of the need to further strengthen their veterinary services' capacity to deal with such outbreaks (Ozawa *et al.* 2006). As in other parts of the world, feeding of pigs with illegally imported animal products is a highly important pathway for entry of diseases such as FMD, CSF and ASF. This was acknowledged in an external evaluation of surveillance plans in New Zealand (Pearson 2002).

Although ASF has never occurred in Southeast Asia, introduction could result in massive losses, considering the importance of pig production and pork consumption in this part of the world. China holds nearly 50 per cent of the world pig population (den Hartog 2004), and its pork production is likely to keep increasing. Other Southeast Asian countries also keep significant pig populations, mainly for household consumption and local marketing. The risk of introduction of ASF into this region has increased recently through China's intensified trade and development aid links with African countries (Beuret *et al.* 2008), since some of these countries are endemic for ASF or have recently declared outbreaks (e.g. Nigeria, Zambia and Tanzania). Increases in demand for pork during Asian cultural events and festivals are likely to be accompanied by an increased risk of introduction and spread of infectious diseases such as ASF. Illegal import of animal products through Taipei International airport was also considered to be more likely during the period between Christmas and Chinese Lunar New Year (Shih *et al.* 2005).

In China, the high pig density and large proportion of small-scale pig producers create suitable conditions for the spread of infectious diseases. Large numbers of live animal movements and related products at the regional level have been reported to occur specifically along the southern Chinese borders (Rweyemamu *et al.* 2008), and these could lead to the spread of ASF within the region. The extensive free-ranging pig husbandry systems in large parts of Asia would complicate the implementation of control measures.

In addition, potential wild pig reservoirs of ASF exist in these regions. Southeast Asia is considered the origin of the *Sus* genus, with seven of the eight species being present and six considered to be endemic (Mona *et al.* 2007). This region, particularly the insular part, has the highest wild pig species diversity in the world (Lucchini *et al.* 2005). If susceptible to ASFV, these wild suid populations could become a reservoir of infection and, for the rare species, even accelerate their extinction. *S. scrofa*, with many subspecies in South and Southeast Asian ecosystems (Nowak 1991), could also become a reservoir. In Australia, large feral pig populations (*S. scrofa*) that are principally derived from introduced domestic pigs (Gibbs 1997) could potentially be involved in the spread and maintenance of ASF. Knowledge of Asian ticks, including soft ticks from *Ornithodoros* (*Alectorobius*) spp. (Brown *et al.* 2005) is scarce and studies are needed on their distribution, ecology and potential for disease transmission (Ahmed *et al.* 2007).

(d) *America*

In the USA and Canada, pork production has increased during the last decade (den Hartog 2004). USA is one of the top world pork import and export countries (FAS USDA 2006). The main threat to pig herds in these countries is the introduction of ASFV-infected pork products in waste food from planes and ships arriving from endemic countries. Similar to Europe, strict rules governing waste disposal (USDA 2009) reduce the risk of ASF introduction. In addition, efficient surveillance, tracing along supply and commodity chains, and strict control and prevention policies should allow early detection of