Mission to Indonesia to participate to the 1st Indonesia-France Seminar in Medicine & Public Health and investigate potential collaborations on animal health

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Summary

Emerging and zoonotic infectious diseases are a major issue in Indonesia. The objective of this mission, funded by the Institut Français d'Indonésie (IFI), was to **identify potential subjects of collaboration between CIRAD, Pasteur Institute, and Indonesian universities, research centers, and organizations**. Meetings were held in Jakarta, Bogor and Yogyakarta with representatives of FKUI, the Ministry of Health, the Ministry of Agriculture, the DICs of Denpasar and Kupang, CIVAS, ICASEPS, LIPI, IPB, UGM, UNUD, and FAO. The mission went very well and had very positive outcomes: we were warmly welcomed by our colleagues, had fruitful discussions and identified promising grounds for future collaborations on zoonoses and emerging diseases.

The first field of collaboration could be **training**. Training modules and exchange of staff and students could be organized quite easily and rapidly, especially through the GREASE regional network for the management of emerging epidemiological risks in Southeast Asia or the Institut Pasteur International Network. Some funds should be available at IFI to initiate such training and exchanges.

Two fields of research were identified for a second stage of collaboration: rabies and wildlife health.

Regarding **rabies**, comparative and integrated approaches could be used to address research gaps on dog ecology, inter-islands movements of dogs, knowledge attitude and perception regarding dog ownership and rabies, spatial and temporal dynamics of rabies, and exploration of potential wildlife reservoirs. Ideally, these studies would be conducted in islands with different epidemiological contexts. Flores would be a good candidate to start with as this island has benefited from limited rabies research despite the fact that it has experienced more than 200 human rabies cases since the disease first occurred in 1997.

Regarding **wildlife health**, most of the work conducted thus far pertained to conservation medicine for endangered species. There is a strong will to develop studies on the potential pathogen transmission at the interface between wildlife and human/livestock. A more specific research topic identified was a health risk analysis on pioneering fronts in naturally forested areas, especially where palm oil plantation is associated to livestock farming.

The collaboration between CIRAD, Pasteur Institute and Indonesian research teams could therefore be initiated as soon as 2013 by training modules, exchange of students and staff, and participation to GREASE meetings and workshops. Proposals for research projects on rabies and wildlife health could be drafted the same year. Special attention would have to be paid for a **good communication with the Ministries of Agriculture, Health and Forestry**, as well as FAO and other international research teams working in Indonesia, in order to make sure that there is no duplication of activities.

Abbreviations

ACIAR	Australian Centre for International Agricultural Research
AI	Avian influenza
AUSAID	Australian Agency for International Development
CIRAD	Centre de Coopération Internationale en Recherche Agricole pour le Développement (French Research Center on Agricultural Research for Development)
CIVAS	Center for Indonesian Veterinary Analytical Studies
CRID TROPHID	Center for Research and Integrated Development of Tropical Health and Infectious Disease
DGLAHS	Directorate General of Livestock and Animal Health Services of the Ministry of Agriculture
DIC	Disease Investigation Center
EPT	Emerging Pandemic Threats
FAO	Food and Animal Organisation of the United Nations
FKUI	Fakultas Kedokteran Universitas Indonesia (Faculty of Medicine Universitas Indonesia)
GARC	Global Alliance for Rabies Control
GREASE	Gestion des Risques Emergents en Asie du Sud-Est (Management of Emerging Risks in South-east Asia)
HPAI	Highly pathogenic avian influenza
ICASEPS	Indonesian Center for Agricultural Socio Economic and Policy Studies
IDRC	International Development Research Centre (Canadian cooperation)
IFI	Institut français d'Indonésie (Indonesia French Institute)
IFPRI	International Food Policy Research Institute
IFSMPH	Indonesia-France Seminar in Medicine and Public Health
ILRI	International Livestock Research Institute
IPB	Institut Pertanian Bogor (Bogor Agricultural University)
IPP	Institut Pasteur de Paris (Pasteur Institute in Paris)
KKN	Kuliah Kerja Nyata (Student-Study Service Activities)
KOMNAS FPBI	Komite Nasional Pengendalian Flu Burung dan Kesiap-siagaan Menghadapi Pandemi Influenza (National Committee for Avian Influenza Control and Pandemic Influenza Preparedness)
LIPI	Lembaga Ilmu Pengetahuan Indonesia (Indonesian Institute of Sciences)
NAMRU	Naval Medical Research Unit, Jakarta
SEAOHUN	Southeast Asia One-Health University Network
UGM	Universitas Gadjah Mada
UNUD	Universitas Udayana
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
WCS	Wildlife Conservation Society
WSPA	World Society for the Protection of Animals
WWF	World Wide Fund for Nature

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1. Context and objectives of the mission

Indonesia is at the forefront of countries tackling complex emerging and re-emerging infectious diseases issues. Just to name a few examples, Indonesia is the country who has paid the highest toll worldwide in terms of human cases (188/597 human cases) and deaths (166/351 deaths as of April 2012) due to H5N1 highly pathogenic avian influenza (HPAI), and the introduction of rabies on the island of Bali in 2008 has led to 145 deaths and more than ten million dollars spent to control the disease. Ensuring the health of people, animals and ecosystem is a major challenge in a country with the fourth largest population in the world (over 238 million persons) and a territory of over 1 900 000 km² comprising more than 17 000 islands.

The Institut français d'Indonésie (IFI) has been promoting scientific and technical collaborations between France and Indonesia to help addressing health issues in Indonesia. Among the cooperation initiatives, it was decided to organize a seminar in medicine and public health that would be attended by scientists from hospitals, universities and research centers of the two countries. The 1st edition was to be held in November 2012 in Jakarta, with IFI and the Faculty of Medicine of the University of Indonesia (FKUI) as joint organizers.

Scientists from CIRAD (French agricultural research center for development) and Pasteur Institute were invited to the seminar because both institutions are involved in a regional network dealing with the management of emerging epidemiological risks in Southeast Asia. Called GREASE, this network covers the fields of animal health and veterinary public health, and is intended to improve, through synergy and sharing of skills on a regional level in Southeast Asia, the management of risks associated with transboundary animal diseases and emerging diseases.

Six partners from Cambodia, France, Laos, the Philippines, Thailand and Vietnam originally founded the GREASE network (see list on www.grease-network.com) and collaborations are now being further developed to include more countries in Southeast Asia. Indonesia is naturally a key candidate for the extension of GREASE collaborations. For that reason, Dr François Roger, head of the research unit AGIRS (Animal and Integrated Risk Management) at CIRAD, came to Indonesia in January 2012 to meet with Deans and Directors of various Universities and Research centers that would potentially be interested in collaborations on animal health and zoonotic issues.

Building on this first visit, it was decided that a team of scientists from CIRAD and Pasteur Institute would use the occasion of the 1st Indonesia-France Seminar in Medicine and Public Health to meet scientists of Indonesian universities, research centers and organizations to discuss more in details the potential subjects of collaboration that could be developed within the larger frame of animal and zoonotic diseases.

Funded by IFI and facilitated by the Regional Director of CIRAD for peninsular Southeast Asia, Dr Gilles Saint-Martin, this mission had the following objectives:

- Participate to the 1st Indonesia-France Seminar in Medicine and Public Health
- Participate to a meeting about rabies in Indonesia
- Meet representatives of Indonesian universities, research centers, and organizations as well as international organizations to:
    - Review the work conducted in Indonesia on animal and zoonotic diseases by these institutions
    - Present the approaches and activities developed by CIRAD and Pasteur Institute for research on animal and zoonotic diseases
    - Identify subjects of common interest for which the complementary skills of all partners would be most beneficial
    - Discuss the modalities of potential collaborations between French and Indonesian partners.

This report summarizes the discussions held during the seminar and meetings and presents the conclusions and perspectives for future collaborations.

2. Summary report of seminars and meetings

The agenda of the mission is presented in Annex 1 and contact information for all persons met is provided in Annex 2.

2.1 IFSMPH

The 1st Indonesia-France Seminar in Medicine and Public Health (IFSMPH) was organized jointly by the French Institute of Indonesia (IFI) and the Faculty of Medicine of the University of Indonesia (FKUI). It was held on November 3 and 4 at the Harris Tebet hotel in Jakarta.
Speakers and attendees consisted mainly of researchers and physicians working on human health and originating from hospitals, universities and research centers in France and Indonesia. Plenary sessions alternated with subject-specific symposiums and group discussions (see detailed program in Annex 3). Two presentations were given by Pasteur Institute ("Rabies and one health") and CIRAD ("Integrating socio-eco-epidemiological approaches into health research") (see abstracts in Annex 4). According to the data presented by our Indonesian colleagues, the most important communicable diseases with regards to public health in Indonesia include malaria, HIV, tuberculosis, highly pathogenic avian influenza (HPAI) due to H5N1 virus, gastrointestinal infections, upper respiratory infections, dengue, rabies, filaria and schistosomiasis.

2.2 Rabies meeting

Following the 1st IFSMPH, a meeting was organized at FKUI in Jakarta (see detailed program in Annex 5) to present the situation of rabies in Indonesia, review research work that has already been conducted and identify needs, especially in terms of research, for the future control of rabies. A regional objective has indeed been set that aims at eliminating human rabies in Southeast Asia by 2020.

Rabies has existed in Indonesia since at least the 19th century. Currently, only nine of the 33 provinces of Indonesia are free of rabies: these include Bangka Belitung, West Kalimantan, DKI Jakarta, Central Java, Yogyakarta, East Java, West Nusa Tenggara, Papua, and West Papua. The provinces with the highest incidence of rabies are Bali (where the disease was introduced in 2008), East Nusa Tenggara, North Sumatra and North Sulawesi.

Some of the major issues identified so far in the fight against rabies are:

- the **lack of good surveillance data** for both human and animal cases: information collection is not standardized across the whole country and a lot of information is missing (severity and location of bite wounds, preliminary treatment -if any- of bite wounds, time elapsed between bite and seeking hospital care, clinical symptoms of human rabies cases, type of rabies treatment applied, confirmatory diagnostic of rabies in biting dogs etc);
- the **lack of harmonization for the control strategy**. This is true among islands and also among professional sectors (human health and animal health): dog elimination has sometimes been promoted although scientific evidence shows that all attempts at eradicating rabies through dog elimination have failed. Different types of vaccines have also been used at different points in time and space;
- the **lack of integrated approach to rabies control**. Significant efforts have been accomplished in Bali in terms of adopting a one health approach to the rabies issue but a lot remains to be done in other areas of Indonesia;
- the lack of **regular availability of good quality vaccines and immunoglobulines** and their unreasonable price. There seems to have been problems in vaccine effectiveness when a locally-produced vaccine was used (for example in Flores where booster vaccination was needed after 3 to 6 months) and deficiencies in the marketing system for international standard vaccines have led to some rupture of supply during vaccination campaigns in Bali.

The following research needs have been identified to better design the rabies control strategy:

- **Dog ecology**: population dynamics and its drivers (reproduction, causes of death, etc), as well as information on dogs movements (dispersal behavior, home range, etc). Data have already been produced in Bali (where an estimated 325 000 dogs reside of which only 5% are stray dogs without owners) but not in Flores or other islands. As one of the main problems of the dog vaccination campaign is the rapid turnover of the dog population, cost-effective means of controlling the dog population (such as using immunocontraception) should also be investigated;
- **Inter-islands movements of dogs**: dogs are being transported among islands (for example between Java and Sumatra, or between Sulawesi and Flores) but no scientific investigation has thus far been performed to characterize and quantify those movements. The role of fishermen in the dispersal of dogs around the archipelago should more particularly be investigated;
- **Sociological and anthropological data** are also needed to see how they are associated with dog ownership practices and disease awareness/perception which in turn may influence dog demography and movements. It is hypothesized that religious beliefs, educational level, and professional occupation may have such an influence;
- **Evaluation of the vaccination**: the quality of the vaccine and the effectiveness of the vaccination strategy should be monitored. Some work is currently on-going in Bali but much remains to be done in other areas. There seems to be a non-uniform response of dogs following vaccination;
- **Phylogeographic studies**: molecular epidemiology on samples collected from humans and dogs could help unravel the dynamics and determinants of the spread of rabies within one island but also among islands. Molecular analyses conducted thus far suggest that rabies in Bali probably results from introduction from Sulawesi. These data are however not sufficient to be conclusive and more samples are needed to push the analyses further. Efforts will be needed to ensure that rabies strains are made available since currently only 50% of the cases are confirmed by the laboratory and biting dogs are often killed without sending the head to the laboratory to test for rabies. Help and advice should also be given on the methodology to be followed (target gene(s) to be used, size of the nucleotide sequence to be analyzed, type of phylogenetic approach, etc.);
- **Wildlife reservoir**: although it is clear that the very large majority of human cases in Indonesia are due to an exposure to rabid dogs, the role of potential wildlife reservoirs for canine rabies should be investigated. Wildlife could indeed play a role in the persistence or the reintroduction of rabies in areas where the disease has been eradicated in dogs.

Some more general needs have also been identified:

- Having top governmental decision-makers on board who are fully convinced of the importance of the rabies problem;
- Having a better coordination at the national level and among all different stakeholders;
- Improving national databases on rabies surveillance
- Having trained professionals available in infected areas as well as in rabies-free areas. The experience gained in Bali should be widely distributed;
- Widening public awareness of the rabies problem;
- Having more funds available for rabies prevention and control.

2.3 CIVAS

CIVAS (www.civas.net) is a non-governmental organization committed to the improvement of animal health and welfare and food safety in Indonesia. It was founded in 2005, is based in Bogor and includes 21 permanent members and 26 non-permanent members (individuals with interest for CIVAS activities and coming from various backgrounds, i.e professionals, researchers, academicians, governments). Its missions include:

- To provide an alternate data and information on livestock, animal health, welfare and food safety
- To enhance community awareness and participation on safety/inspection of food of animal origin
- To develop better understanding in animal welfare issues in Indonesia
- To support and assist in the development and implementation of the national animal health system

- To improve the role and capacity of the community to support early warning system
- To empower the livestock community to explore and develop local resources
- To advocate government on pro-poor policy

CIVAS supports one health and ecohealth approaches and has experience working with international collaborators. Its recent work includes the following studies:

- Reviewing free-range duck farming system in northern Java (with FAO)
- Mapping poultry farms and marketing structures in Sukabumi district (with Wageningen University as part of Indonesian-Dutch Partnership for HPAI)
- Field trial AI vaccination study in Sukabumi (as part of Indonesian-Dutch Partnership for HPAI)
- Surveillance in poultry collecting facilities in DKI Jakarta (as part of Indonesian-Dutch Partnership for HPAI)

CIVAS has also taken part to the organization of national workshops on developing strategy and guidelines for AI and workshops in live bird markets to introduce guidelines for markets (in collaboration with Komnas and with funding from USDA). Finally CIVAS is involved in training (risk analysis, veterinary epidemiology, AI vaccination and sample collection, poultry health management, GIS, risk communication) with different partners including FVM IPB, the Departments of Animal Health and Veterinary Public Health of the Ministry of Agriculture, Wageningen University, Colorado State University, USDA, Komnas FBPI, and FAO.

Two main subjects of common interest have been identified between CIVAS, CIRAD and Pasteur Institute: **rabies and wildlife health**.

With regards to **rabies**, CIVAS has worked in Bali as part of a project which was funded by the International Development Research Centre (IDRC), was facilitated by the International Livestock Research institute (ILRI), started in December 2010 and is due to finish in March 2013. CIVAS' role included implementing dog population ecology studies in collaboration with researchers from Glasgow University and social studies in two pilot villages in collaboration with ICASEPS. CIVAS was also involved in rabies vaccination campaign in Sukabumi district and Bogor, and rabies education programs for school children.

With regards to **wildlife health**, CIVAS has no experience thus far but a MoU has been signed in July 2012 with the Ministry of Forestry and potential projects of interest include emerging diseases of wild birds and primates, and the study of possible transmission of trypanosomiasis between water buffalo and Java rhinoceros.
CIVAS informed us that an indispensable partner for any work on wildlife In Indonesia would be LIPI as its scientists have very good expertise on the capture and identification of a large number of taxa. LIPI would also facilitate obtaining permits for capturing and collecting samples from wildlife.

Our colleagues from CIVAS were also interested in **training collaborations**, whether to train CIVAS staff on field skills such as wild bird capture and sample collection, or data analysis techniques such as capture-recapture.

2.4 FVM IPB

The Faculty of Veterinary Medicine of Bogor Agricultural University (FVM IPB) is the oldest faculty of veterinary medicine in Indonesia. It comprises about 200 staff (including supporting staff) and about 800 students.
The three duties of FVM IPB are education, research and service to people. The veterinary curriculum lasts five years and postgraduate education is also available. Research includes both laboratory and field research. Service to people is provided in close collaboration with government projects and activities, especially the department of agriculture of local governments.

FVM IPB has experience working with international collaborators. Since 2006, it has for example taken part to a lot of work on AI with the Ministry of Agriculture, FAO, the Indonesian-Dutch Partnership for HPAI, USAID, and Colorado State University. It also has collaboration on viral diseases of fruit bats with a Japanese University.
It has a lot of experience on zoonotic diseases such as rabies, anthrax, cysticercosis and is in the process of establishing a National Zoonosis Center for which invitations have been sent to other faculties of IPB. It also plans on developing collaborations with an Indonesian malaria research center, especially regarding the risk for vector-borne diseases in mining sites where large reservoirs of water exist.
FVM IPB is a member of the Southeast Asia One-Health University Network (SEAOHUN) which was launched within the RESPOND component of the Emerging Pandemic Threats Program of USAID.

FVM IPB would be interested in different types of collaboration with CIRAD and Pasteur Institute:

- **Exchange of staff**: FVM IPB would be interested in welcoming researchers from CIRAD and Pasteur Institute to give courses to students on subjects such as risk analysis or one health. They would also welcome the opportunity to send staff to France for internships on laboratory diagnostic or research techniques;
- **Studies on wildlife diseases**: the experience of FVM IPB is limited thus far but this is a field that they would like to work on. Three potential research projects of interest could be:
    - Assessing health risks for livestock and humans in palm oil plantations located near forests: the government is currently promoting the association of cattle rearing and palm oil production (2 to 3 cattle per hectare of palm oil) in areas close to forests and where wildlife is therefore present
    - Assessing the risk of tuberculosis posed to people by monkeys, especially in touristy areas (West Sumatra, Bali)
    - Assessing health risks for farms located near bat colonies.

2.5 LIPI

Established in 1967, Lembaga Ilmu Pengetahuan Indonesia (LIPI, Indonesian Institute of Sciences) is a non-departmental research institution belonging to the government and coordinated by the State Ministry of Research and Technology (Kementrian Negara Riset dan Teknologi-KNRT). It is the equivalent of the Centre National de la Recherche Scientifique (CNRS) in France.
We visited the Zoology Division located in Bogor. Dr Ibnu Maryanto showed us the mammal museum which hosts an impressively large and well maintained collection.

Scientists at the Zoology Division of LIPI have key expertise on the capture and taxonomic identification of wild birds, rodents and bats. Their research work is mainly aimed at biology and ecology and they are only occasionally associated to projects addressing wildlife health issues. No collaboration exists with national partners on the theme of ecology of wildlife diseases but LIPI has been associated to work conducted by international partners such as WCS within the PREDICT component of the Emerging Pandemic Threats Program of USAID. They were also involved in the H5N1 surveillance in migratory birds in Java with the Naval Medical Research Unit (Stoops et al., 2009, see Annex 6).

They would be willing to provide their expertise on Indonesian mammals and birds taxonomy and on wildlife capture and handling within a project on the ecology of wildlife health. An MoU would be indispensable for any such collaboration and it is reminded that specific permits must be asked by LIPI to the Ministry of Foreign Affairs to work on wild animals.

2.6 UGM

Universitas Gadjah Mada (UGM) is the oldest and the largest state university in Indonesia. It was founded in 1949 and currently has 18 faculties, 69 undergraduate programs, 24 diploma programs and a Graduate School. It comprises 33 000 students and over 5000 staff without including supporting staff.

We met with representatives of the Faculty of Medicine (FM), the Faculty of Veterinary Medicine (FVM) and the Faculty of Biology who work in close collaboration. UGM has indeed a longstanding tradition of using an integrative health approach (ecohealth/ one health) for its three missions: teaching, research and community services. This is more particularly implemented through an Ecohealth Resource Center (EHRC) and a Zoonotic Disease Center. Both FVM and FM UGM are members of the Southeast Asia One-Health University Network (SEAOHUN) which was launched within the RESPOND component of the Emerging Pandemic Threats Program of USAID. Ecohealth activities also associate colleagues from the faculties of Animal Science, Anthropology, Communication and Geography.

Teaching activities use problem-based learning at FM, FVM, and the faculties of law and geography.
Research activities are related to infectious diseases detection, disease surveillance and risk management for zoonotic infections and newly emerging zoonotic diseases such as avian influenza, anthrax, rabies, toxoplasmosis, leptospirosis, trypanosomiasis, bovine tuberculosis, or brucellosis. International collaborations are numerous and include teams from Australia (such as Murdoch University), Thailand (such as Mahidol University), the USA (such as Tuft University) or Japan (such as Hokkaido University).
Service to community is provided among others through Kuliah Kerja Nyata (KKN, Student-Study Service Activities), a mandatory activity which has been running since 1974 and consists of sending students from different disciplines to live in and help communities for a period of two months during their curriculum.

UGM would be interested in different types of collaboration with CIRAD and Pasteur Institute:

- **Exchange of students and participation to training programs:**
    - Students from UGM could be candidate for the MSc Inter-Risk that will be launched in September 2013 at Kasetsart University in Thailand in collaboration with CIRAD
    - Students from the MSc SAEPS and SEMHA in France could do their compulsory 5 to 6 month field training in Indonesia
    - Scientists from CIRAD and Pasteur Institute could intervene in some of the courses taught at UGM or give one-week to two-week courses on topics such as epidemiology, capture-recapture, GIS, etc
    - Scientists from UGM could present their experience on KKN during participatory epidemiology workshops or training organized by the GREASE network within the sub-network Participatory Research on Emerging and Infectious Disease in SouthEast Asia (SEA-PREID)

- **Work on rabies and encephalitis:**
    - UGM is working towards improved rabies diagnostic, surveillance and care of patients. Collaborations could therefore be set up on rabies depending on available/feasible projects
    - UGM students or young Indonesian professionals could participate to the rabies training program that is being organized by Pasteur Institute in collaboration with Lausanne University. Following a trainee selection process based on CV and letter of motivation, this training program is composed of about 50 hours of e-learning classes followed by ten days of field work where different aspects are covered (sample collection, laboratory diagnostic, epidemiologic investigation, bite management, mass vaccination, knowledge attitude and practice studies, etc). All expenses are covered by Pasteur Institute. A first session of this program will be organized in Senegal in 2013 and discussions are underway to organize another session for Asian participants, most likely in Cambodia in 2014 or 2015
    - UGM is associated to the SEAe project (SouthEast Asia encephalitis) which aims at improving the diagnostic of infectious encephalitis in South East Asia and for which both

CIRAD and Pasteur Institute are partners. Further work on Nipah, Japanese encephalitis or West Nile fever could be developed around the theme of encephalitis

- **Studies on wildlife diseases**: UGM has been doing work on wildlife but mainly in relation to ecological or conservational aspects. Studies underway pertain to monkey populations, rodent populations in western Java, the conservation of Balinese birds, raptor migration and parasites of orang-utans. Collaborators on wildlife or ecosystems studies include USGS (United States Geological Survey), WWF and a Czech university. Work conducted by CIRAD on the ecology of health and diseases at the wildlife/human/domestic animal interface is of interest to UGM and could therefore constitute a topic of collaboration.

2.7 ICASEPS

Created in 1976, ICASEPS is one of the echelon II level research institutions within the Indonesia Agency for Agricultural Research and Development (IAARD). It is responsible for conducting analysis and assessments of socio-economic and agricultural policy. More particularly, ICASEPS functions are to: (a) formulate programs on economic and social analysis and agricultural policies, (b) carry out economic analysis and social assessment and policies in agriculture, (c) implement review programs and policies in agriculture, (d) provide technical services in the field of socio-economic analysis and agricultural policy, (e) implement collaboration and utilize the results of the analysis and assessment and carry out public consultation in the field of socio-economic and agricultural policies, (f) evaluate and report the results of the analysis and assessment of socio-economic and agricultural policies, and (g) manage the center's administrative affairs and internal affairs.

ICASEPS would be interested in collaborations with CIRAD and Pasteur Institute on the socio-economic aspects of zoonoses and emerging diseases and already has experience on avian influenza and rabies. Previous work has been conducted in collaboration with IDRC and CIVAS. There are strong links with the latter institution as they are both based in Bogor and Dr Edi Basuno, researcher at ICASEPS, is also a member of CIVAS. ICASEPS is furthermore used to working with international collaborators such as IDRC, ACIAR, and IFPRI.

More specific topics of potential collaboration could be identified by associating researchers from ICASEPS to meetings and trainings organized within the GREASE network on socio-economic and participatory aspects of health management.

2.8 FAO

The team of FAO-ECTAD in Indonesia comprises about 34 persons including 16 national technical staff and 4 international technical staff. It is related to the FAO regional office for Asia and Pacific in Bangkok. It works in close collaboration with the DGLAHS and the national HPAI campaign management unit.

One of the main tasks attributed to FAO-ECTAD Indonesia by the DGLAHS is to improve the coordination between the various projects and initiatives pertaining to animal health in Indonesia. Some funds have been allocated by the Australian Department of Agriculture, Fisheries and Forestry to support this donor coordination. Indeed, many different stakeholders (funding agencies, technical agencies, and research institutes) from different countries work on zoonotic diseases in Indonesia and more efforts are needed to make sure that there is no duplication of activities. A report with maps is in preparation to document animal health activities in Indonesia. It should be published in 2013.

FAO ECTAD Indonesia has been running numerous projects on AI and rabies in the last years. Currently, three projects on rabies are under way with funds from FAO, AUSVET and USAID respectively. They all aim at supporting rabies control in Bali and one of them has a larger scope including the whole country. It was mentioned that for rabies, the amount of research and money invested differs greatly among islands: a lot of work has been done in Bali whereas Flores has for example received much lesser attention.
Large training programs have taken place in the last years, especially for participatory disease surveillance officers which represent an estimated 2300 persons in the country including 72 in Bali. Training modules on One Health have for example been organized and this has helped implementing rapid response forces including animal health and human health for rabies control in Bali.

Given that CIRAD and Pasteur Institutes are research institutes and given that rabies was identified through this mission as a potential topic of collaboration with Indonesian colleagues, we were encouraged to get in contact with other research teams working on rabies such as the University of Glasgow (Katie Hampson) or the University of Sydney. This is to make sure that our future work would articulate well with the work those institutes are currently implementing or plan on implementing.
We were for example told that a project funded by ACIAR and the Australian Department of Agriculture, Fisheries & Forestry is planning to do a rabies risk assessment in Eastern Indonesia, East Timor, Papua New Guinea and northern Australia. This project would associate the University of Sydney (contact Michael Ward), James Cook University, Charles Sturt University, the Australian Bureau of Agricultural and Resource Economies and Sciences, FAO, WHO, OIE, and the governments of the concerned countries.
In a similar fashion, for work on wildlife, we were advised to contact the PREDICT team of EPT who has worked in collaboration with the Primate Research Center at IPB in Bogor (contact persons: William Karesh and Joko Pamungkas). We were also advised to contact Boripat Sirianoonrat (representative of FAO for wildlife in SEA, Bangkok) to verify whether training on wild birds capture and sampling has previously been done in Indonesia.

3. Conclusions and perspective for future activities

3.1 Conclusions

Globally this prospection mission was highly positive: the Indonesian teams we met have a strong experience in the field of zoonoses and emerging diseases and there are promising grounds for future collaborations that could be initiated very soon.

Among the very positive factors we have noted that these teams:

- Have a high level of skills
- Are used to international collaborations and to apply to calls for proposals from international agencies
- Showed a high interest to collaborate with CIRAD and Pasteur Institute
- Have already integrated the eco-health and one-health concepts into their agenda
- Have spontaneously proposed to develop research activities on the ecology of wildlife diseases and wildlife/domestic interface studies
- Have a long tradition of involving communities into research projects, including the involvement of social workers for collecting data and communicating on disease awareness

Some of the constraints we perceived during our short stay include:

- The decentralization of national authority since 2001 seems to have constrained the standardization of animal health preventive and control measures between the various islands of Indonesia

- A large number of initiatives have been implemented in recent years by various national teams, international teams and funding agencies (ACIAR, AUSAID, CSU, USAID, etc) for diseases of major concern in Indonesia (avian influenza, rabies) with limited national or local coordination. It is therefore difficult to get a global vision of all activities implemented so far and to identify the current technical and knowledge gaps and the future research needs.

3.2 Perspectives for future activities

Based on our discussions with the various teams encountered, three major themes of potential collaboration have been identified: training and research projects on rabies and wildlife.

Training

The collaboration between CIVAS, LIPI, ICASEPS, FVM IPB, UGM, and CIRAD and Pasteur Institute could be initiated through training and exchange of students and staff. These collaborations could be implemented quite easily and rapidly for several reasons:

- Both CIRAD and Pasteur Institute already offer one-week to two-week training modules on subjects of interest for Indonesian teams such as epidemiology, statistics with R, risk analysis, geographic information systems, wildlife capture, capture-recapture, social network analysis and rabies diagnostic . Young Indonesian students and professionals could participate to the rabies training program that is being organized by Pasteur Institute in collaboration with Lausanne University. Following a trainee selection process based on CV and letter of motivation, this training program is composed of about 50 hours of e-learning classes followed by ten days of field work where different aspects are covered (sample collection, laboratory diagnostic, epidemiologic investigation, bite management, knowledge attitude and practice studies, mass vaccination, etc). All expenses are covered by Pasteur Institute. A first session of this program will be organized in Senegal in 2013 and discussions are underway to organize another session for Asian participants, most likely in Cambodia in 2014 or 2015
- These training sessions could be organized either by inviting French trainers in Indonesia or by inviting Indonesian trainees to training sessions organized through the GREASE regional network in South-East Asia
- Indonesian students could participate to the Master Inter-Risk that will be opened in September 2013 by Kasetsart University and CIRAD in Bangkok
- Some funds are readily available at IFI to organize training sessions in Indonesia with French trainers and to pay for travelling costs of Indonesians scientists and students who attend training sessions organized by French teams

Rabies

Discussions held during the rabies meeting at FKUI concluded that it would be beneficial to implement a large-scale research project on rabies that would include several islands and that would adopt comparative and integrated approaches.
Such a project could be conducted in three different islands with different epidemiological contexts: i) a rabies-infected island where lots of information has already been produced (e.g. Bali), ii) a rabies-infected island where relatively fewer studies have been conducted (e.g. Flores), iii) a rabies-free island.
The comparative and integrated approaches would include dog ecology, inter-islands movements of dogs, sociological and anthropological data, evaluation of the vaccination, phylogeographic studies, and exploration of potential wildlife reservoirs.
Such an ambitious project would have to start with a pilot phase and ideally this pilot phase should take place in Flores where few studies have been conducted in spite of the big toll paid by the island to rabies.
The potential priority topics of research could be: investigating dog ecology (demography, dog movements within the island and among islands), socioeconomical characteristics of dog owners (professional activity,

religion, education), environmental factors (topography, habitat), and knowledge and attitudes towards rabies (Flores has some interesting characteristics such as dog meat consumption by local people) and then testing the associations between those data. Coupling these data together with phylodynamics studies could help us to understand the spatial and temporal dynamics of rabies in dogs and more specifically the processes responsible for its maintenance in specific geographic localities and for its spread to adjacent and distant territories. Furthermore, the role of the different densities and structures of dogs population in the maintenance of rabies could be investigated by comparing the dynamics of rabies in diverse geographical and socio-economical settings exhibiting different characteristics (from clusters of isolated populations to large dog populations of high density).

Wildlife

It appears that in Indonesia, wildlife health has mainly been addressed as a supportive component in wildlife conservation programs, involving organizations such as the Wildlife Conservation Society (WCS), the World Wide Fund for Nature (WWF), or Conservation International. A relatively limited number of studies have been conducted so far on wildlife diseases, mostly on primates, and a lot remains to be done on disease surveillance in wild animals in Indonesia (see in Annex 6 Arief et al. (2010) Wildlife health in Indonesia, Asia-Pacific Conference on Wildlife Borne Diseases 19-23 July 2010 Beijing, China). A limited number of articles on the ecology or epidemiology of wildlife diseases have been published in international journals (see non-exhaustive list in Annex 7).

The potential for pathogen transmission at the interface between wildlife, domestic animals and humans and the importance of the associated disease risk has been acknowledged by most of the Indonesian teams that we met. Few studies have been initiated so far on the ecology of wildlife diseases in Indonesia but it has been spontaneously mentioned as a priority topic by most of the teams that we met. These teams have already included this research field in their agenda and want to initiate studies. This could be facilitated by a strengthening of the links between veterinarian and medical research groups and wildlife study groups.
Potential research topics on the ecology of wildlife disease include:
- Potential for pathogen transmission at the emerging interfaces between wildlife and human/livestock on pioneering front in naturally forested areas or in palm oil plantations where livestock farming is planned to be developed
- Conservation medicine: improve the surveillance of pathogens in endangered wildlife populations as a support to wildlife conservation programs

Acknowledgments

We thank IFI and FKUI for providing the funds for this mission and for the superb organization of the 1st IFSMPH and the rabies meeting in Jakarta. We also thank the staff of the Regional Direction of CIRAD for South-East Insular Asia for greatly facilitating the organization and good implementation of the mission. We thank Dr Gilles Saint Martin and Dr François Roger for their scientific contributions. Last but not least, we thank all our Indonesian colleagues for welcoming us so warmly, for sharing their work and experience with us and for being so enthusiastic about our potential collaboration.

Annexes

Annex 1: Agenda of the mission

Friday November 2
- Vol vers Jakarta
- Nuit à l'hôtel Harris Tebet à Jakarta

Saturday November 3 and Sunday November 4
- Séminaire IFSMPH (Indonesia-France's Seminar in Medicine & Public Health)
- Nuit à l'hôtel Harris Tebet à Jakarta

Monday November 5
- Matin: Réunion rage à FKUI
- Après-midi : Visite aux Ministères de l'Agriculture (Dr Pudjiatmoko, Director of Animal Health at DGLAHS) et Ministère de la Santé. Cette visite uniquement si les représentants DGLAHS et Ministère de la Santé ne sont pas disponibles pour la réunion rage du matin
- Nuit à l'hôtel Grand Kemang à Jakarta

Tuesday November 6
- Tôt : départ pour Bogor
- 9h : réunion au CIVAS avec Dr Winda Widyastuti (travaille sur la rage à Bali), Dr Andri Jatikusumah (Executive director) et Tata Naipospos (chair of the Directive board, a travaillé au Laos et connaît le réseau GREASE)
- 13h : réunion à l'IPB avec le Dr Etih Sudarnika et autres collègues travaillant sur rage
- Fin d'après-midi : départ de Bogor pour Jakarta
- Nuit à l'hôtel Grand Kemang à Jakarta

Wednesday November 7
- Tôt : départ pour aéroport
- 7h55 décollage pour Yogyakarta, arrivée 9h05
- Matin et/ou après-midi : réunion à l'UGM avec le Dr Wayan Artama (travaille sur one health)
- Nuit à l'hôtel Phoenix à Yogyakarta à Jakarta

Thursday November 8
- 9h50 décollage pour Jakarta, arrivée 11h
- Soirée : vol retour Hervé Bourhy vers Paris
- Nuit à l'hôtel Grand Kemang à Jakarta

Friday November 9
- 7h15 ; départ de l'hotel grand kemang
- 8h30 : réunion avec le Dr Edi Basuno (chercheur en sciences sociales, a travaillé sur la rage à Bali) et le Dr Handewi Purwati (Director) à l'ICASEPS.
- 11 h a confirmer : Réunion au LIPI avec Prof. Dr. Rosichon Ubaidillah (Kepala Bidang Zoologi)
- 14h15 : depart de Bogor
- 16h : réunion à la FAO avec Dr James McGrane et collègues travaillant sur rage et influenza
- Nuit à l'hôtel Grand Kemang à Jakarta

Saturday November 10
- Vol retour vers Paris

Annex 2: Contact information

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Annex 3: Agenda of the 1st IFSMPH

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UNIVERSITAS INDONESIA
FKUI

The 1st Indonesia-France Seminar in Medicine & Public Health[1]

The Burden of Communicable and Non-Communicable Diseases in Indonesia: Epidemiology and Translational Research toward Better Hospital & Public Health Services

Harris Hotel, Tebet, Jakarta – 3-4 November 2012

DAY 1st: Saturday, 3rd November 2012

07:00 – 08:00	**Registration**		
08:00 – 08:30	• Report from Chairperson *Pramita G Dwipoerwantoro* • Welcome speech from the Director of Institut Français d'Indonésie (IFI) France Embassy in Indonesia *Bertrand de Hartingh* • Opening Speech from Dean of Faculty of Medicine – Universitas Indonesia (FKUI) *Ratna Sitompul* • Photo session		
08:30 – 08:50 08:50 – 09:10 09:10 – 09:30	**Plenary Session** **Moderator: Muchtaruddin Mansyur (FKUI)** • The burden of communicable and non-communicable diseases in Indonesia: The impact on priority program of hospital services *HM Subuh, Director of Communicable Diseases – The Ministry of Health RI* • The Articulation Between The Mission of Care and The Mission of Research in a University Hospital in France *Jean-Pierre Dewitte – Director, The University Hospital of Poitiers* **Discussion**		
09:30 – 09:45	**Coffee Break / Exhibition**		
09:45 – 10:05 10:05 – 10:25 10:25 – 10:45 10:45 – 11:00	**Symposium 1A – DIABETES MELLITUS** **Moderator: Dante Saksono (FKUI)** Oxidative stress in DM *Isabelle Hininger (Université Joseph Fourier)* Metabolic Syndromes: To Fit or Fat? *Pradana Soewondo (FKUI)* Increasing Incidence of DM Type 1 in Indonesia *Aman B Pulungan (FKUI)* **Discussion**	**Symposium 2A – RESPIRATORY PROBLEMS** **Moderator: Menaldi Rasmin (FKUI)** Biomolecular aspects in respiratory failure *Prasenohadi (FKUI)* Acute onset on chronic respiratory failure: the effect on metabolism *Wahjuani Widyaningsih (FKUI)* Metabolism & nutritional support in chronic respiratory failure *Christophe Pison (Université Joseph Fourier)* **Discussion**	**30 min PRESS CONFERENCE (Friendly Room 1st Floor Harris Hotel)** **45 min RTD in Infectious Diseases** **V Deubel** *IPC* **D Widodo** *CRIDTROPHID UI*
11:00 – 11:15	**Coffee Break / Exhibition**		
11:15 – 11:35	**Symposium 1B Nutrition & Preventive Medicine** **Moderator: Minarma Siagian (FKUI)** Early Life Nutrition: From Pregnancy to Childhood and from Concept to Practice	**Symposium 2B – RABIES** **Moderator: Djoko Widodo (FKUI)** Molecular Epidemiology Of Rabies Virus And Human Immune Response Following Intradermal And Intramuscular Rabies Vaccine Administration	

[1] Secretariat : International Relations Office (IRO) FKUI – 6, Salemba-Jakarta 10430. Phone/Fax :(021) 3160493, http://www.fk.ui.ac.id
Email : ifs.fkui@gmail.com

	Widjaja Lukito (FKUI)	*Ngurah Mahardika (UNUD)*
11:35 – 11:55	The double burden of nutrition in developing countries in transition: Integrated preventive strategies *Jacques Berger (IRD)*	Update management on Rabies infection *Tuti Parwati Merati (UNUD)*
11:55 – 12:15	Sugarsweeteners and chronic diseases: Are they better than chemical sweeteners? *Gerard Mauco*	Rabies and one health *Hervé Boury (Institute Pasteur)*
12:15 – 12:30	**Discussion**	**Discussion**
12:30 – 13:00	**Lunch / Pray – Exhibition**	
13:00 – 14:00	**LUNCH SYMPOSIUM — HYDRATION IN HEALTH** **Moderator: Ermita Ilyas (FKUI)** Physiology of water in human body *Parlindungan Siregar (FKUI)* Effect of mild dehydration on cognitive performance, mood states and health *Saptawati Bardosono (FKUI)* **Discussion**	
	Symposium 1C – GASTROENTEROLOGY **Moderator: Murdani Abdullah (FKUI)**	**Symposium 2C – MALARIA** **Moderator: Rita Kusriastuti (P2PL Kemenkes)**
14:15 – 14:35	The impact of food on human health: What happens in the GIT during digestion? *Ermita Ilyas*	Malaria Vivax and beyond *Stéphane Picot (Université de Lyon-1)*
14:35 – 14:55	Indonesian Consensus on Constipation: Role of Probiotics *Ari Fahrial Syam (FKUI)*	Dihydro artemisinin-piperaquine and primaquine for malaria elimination *Inge Sutanto (FKUI)*
14:55 – 15:15	Gut microbiota and growth of Indonesian children: Pattern of gut comfort and morbidity *Pramita G Dwipoerwantoro (FKUI)*	Treatment & management update in malaria infections *Erni J. Nelwan (FKUI)*
15:15 – 15:25	**Discussion**	**Discussion**
15:30 – 18:30	**Alun-alun "Indonesian souvenirs shop" at Grand Indonesia Mall – invited guest speakers only** *Transportation by IRO-FKUI*	
19:00 – 21:00	**FACULTY DINNER at SERIBU RASA RESTAURANT (by invitation only)** *By IFI-France Embassy in Indonesia*	

DAY 2nd: Sunday, 4th November 2012

07:00 – 08:00	**Registration**	
	Plenary Session **Moderator: Bambang Budi Siswanto (FKUI)**	
08:00 – 08:20	Integrating socio-eco-epidemiological approaches into health research *Sophia Molia (CIRAD)*	
08:20 – 08:40	Implementation of research on public hospital services and public insurance policy: RSCM experiences *Akmal Taher (Director, CiptoMangunkusumo Hospital)*	
08:40 – 09:00	Research and promotion of public health: example in South-East Asia in partnership with IRD *Hervé Tissot-Dupont (IRD)*	
09:10 – 09:20	**Discussion**	
09:20 – 09:35	**Coffee Break / Exhibition**	
	Symposium 3A – CARDIOVASCULAR DISEASE **Moderator: Ganesja M Harimurti (FKUI)**	**Symposium 4A – CANCER** **Moderator: Marlinda Adham (FKUI)**
09:35 – 09:55	Reducing cardiovascular risk in patient with DM *Harmani Kalim (FKUI)*	Indonesian biodiversity for new therapeutic molecules against cancer *Jean-Edouard Gairin (IRD)*
09:55 – 10:15	The role of Omega-3 fatty acids to prevent the cardiovascular risk *Michel Lagarde (INSA Lyon)*	Update on nasopharyngeal carcinoma : Indonesia biodiversity *Sofia Mubarika (UGM)*
10:15 – 10:35	Current status of statin in acute coronary syndrome and intervention *Sunarya Surianata (FKUI)*	Microsatelite Instability among Native Indonesians with Colorectal Cancer and the Pattern of Human Migration *Aru Wisaksono Sudoyo (FKUI)*
10:35 – 10:45	**Discussion**	**Discussion**
10:45 – 11:00	**Coffee Break**	
	Symposium 3B – HYPERTENSION	**Symposium 4B – REPRODUCTION**

	Moderator: Budhi Setianto (FKUI)	**Moderator: Kanadi Sumapradja (FKUI)**
11:00 – 11:20	Epidemiology hypertension in Indonesia: changing lifestyles or else? *Arieska Ann Soenarta (FKUI)*	The role of EDC (endocrine disrupting chemicals) on reproductive function *Mohammad Sadikin (FKUI)*
11:20 – 11:40	Hypertension in metabolic disease: deadly challenge *Andang H Yoesoef (FKUI)*	The role of EDC on certain gynecological disorders *Budi Wiweko (FKUI)*
11:40 – 12:00	Metabolism and nutrition in hypertension *Noel Cano (Université d'Auvergne)*	Current knowledge on phytoestrogen *R. Muharram Natadisastra (FKUI)*
12:00 – 12:10	**Discussion**	**Discussion**
12:10 – 12:45	**Lunch / Pray / Exhibition**	
12:45 – 13:45	**Lunch Symposium** **Moderator: Djoko Widodo (FKUI)** Multidrugs – resistance bacteria to antibiotics: Indonesian experience *Pratiwi P Sudarmono (FKUI)* The role of antibiotics in management of severe infections *Kie Chen (FKUI)*	
	Symposium 3C – OBESITY **Moderator: Titis Prawitasari (FKUI)**	**Symposium 4C – HERBAL MEDICINE** **Moderator: Purwantyastuti (FKUI)**
13:45 – 14:05	Metabolic consequences in Obesity: the Role of Insulin resistance *Eric Fontaine (Université Joseph Fourier)*	Role of phaleria macrocarpa in cellular imun system for apoptosis of breast cancer cell treated by combination with chemoteraphy *Selamat Budijitno (UNDIP)*
14:05 – 14:25	Childhood obesity: Emerging situation in Indonesia *Aryono Hendarto (FKUI)*	From herbal medicine to drug development: the role of superacid chemistry with the example of the anticancer agent Javlor®, a Vinca modified alkaloid *Sebastien Thibaudeau (Université de Poiters)*
14:25 – 14: 45	Beyond adulthood obesity: The risk of degenerative diseases *Fiastuti Witjaksono (FKUI)*	Combination of Centela Asiatica (Pegagan) & AcalyphaIndica (AkarKucing) as antioxidant therapy (neuroprotection&neurotherapy) *Erni H. Purwaningsih (FKUI)*
14:45 – 14:55	**Discussion**	**Discussion**
14:55 – 15:10	**CLOSING OF THE SEMINAR**	
15:15 – 18:00	**FACULTY-WORKING GROUPS** **Group discussion [3 working groups of research, education, and hospital management]** **Leaders of the groups:** • **RESEARCH** **INFECTION: Stéphane Picot and Leonard Nainggolan-Fera Ibrahim-Ponco Birowo-Andri Lubis** **NON-INFECTION: Michel Largarde and Saptawati Bardosono-Sri Widia-Ponco Birowo** • **HOSPITAL MANAGEMENT: Jean-Pierre Dewitte and Ayi Djembarsari-CH Soejono, Surahman Hakim** • **EDUCATION (Master-PhD-Exchange Staff): Mauco and Pradana Soewondo-Pramita GD**	
18:00 – 19:00	**Dinner/Pray**	
19:00 – 21:00	**PLENO & CLOSING CEREMONY**	

Annex 4. Abstracts of Pasteur Institute and CIRAD presentations during the 1st IFSMPH

Control of rabies and the one health concept

Hervé Bourhy, DVM, PhD
Institut Pasteur, Unit Lyssavirus Dynamics and Host Adaptation, National Reference Centre for Rabies, WHO Collaborating Centre for reference and research on rabies, 25 rue du Docteur Roux, 75724, Paris Cedex 15 France.

Every year approximately 55,000 people die from rabies. Over 99% of these deaths occur in developing countries where rabies virus (RABV; genus Lyssavirus) is endemic in the domestic dog. Rabies has been neglected across much of Asia and Africa, despite becoming an increasing problem in the recent decades. It is now considered one of the most neglected diseases in the world's developing countries with the greatest burden in poor rural communities, and disproportionately in children.

There are several general and specific explanations for the continued burden of dog rabies. In general, there is a lack of awareness amongst policy-makers of the rabies burden and impacts and the need for prioritizing resources towards its control. Further, despite the widely advocated need for inter-sectoral collaboration between ministries, the recognition of roles and responsibilities amongst agencies as well as integration of budgets across ministries still poses considerable challenges. To reduce duplication of effort, and to lead to a more effective use of resources in the situation of limited funds, there is a need to ensure this integrated and coordinated control program of rabies to build a comprehensive strategy. The multi-disciplinary approach required for the design of effective rabies elimination strategies should follow the 'One Medicine One Health' concept defined as collaborative efforts of multiple disciplines working locally, nationally and globally to attain maximum health for people and animals. Therefore, in the case of rabies, this should not only linked together veterinarians and public health workers but also ecologists, sociologists, educational specialists and vaccine producers. When properly implemented, this synergism can target several fundamental problems of the control of rabies, some of them being listed below.

The reported number of laboratory-confirmed human and animal rabies cases remains limited and underestimates the real impact of this neglected zoonotic disease. There is clearly a need to improve the surveillance of rabies, including the collection of samples, the shipment of samples to the diagnostic laboratory, laboratory methods for rabies diagnosis and molecular epidemiology in order to obtain more reliable and informative data concerning the incidence and the epidemiological hot spots of rabies. Further, the information and education of the populations on the risks of rabies should be improved as well as training of health personnel. The accessibility of the target human populations to non expensive and effective post exposure prophylaxis should be favoured. Last but not least, there is a need to improve the control of dog rabies. Effective tools for elimination of terrestrial rabies are available. While the sustained deployment of these tools has led to some remarkably successful interventions, canine rabies continues to be present in rabies endemic countries and areas of re-emergence. Little is known about the spatial and temporal dynamics of rabies in this major reservoir species, or the processes responsible for its maintenance in specific geographic localities. In particular, the role of human activities in mediating the spread of dog RABV is unclear, nor is it known how landscape characteristics, including human infrastructures such as roads, affect RABV dispersal within dog populations.

Integrating socio-eco-epidemiological approaches into health research

Nicolas Gaidet and Sophie Molia
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Sixty percent of emerging infectious diseases events are zoonotic and among those, 72% are caused by pathogens of wildlife origin. The distribution and intensity of most animal and zoonotic diseases have changed in recent years in response to environmental disruption, anthropization and globalization: with increased trade and climate change, health risks have become global, and concern every single country in the world. In an interconnected world, human, animal and environmental healths are inextricably linked. A strong integration of ecology, epidemiology, geography and social science into a cross-disciplinary research framework is crucial for preventing and controlling animal and zoonotic diseases.

Research conducted by the AGIRs research unit of CIRAD and its partners is developed within such an integrative eco-epidemiological framework. CIRAD is an FAO and OIE collaborating center for the diagnosis, epidemiology and control of animal diseases and AGIRs' research focuses on the following areas: (i) understanding the ecological and manmade processes that drive the transmission of animal and zoonotic diseases; (ii) optimizing surveillance systems and control strategies; and (iii) assessing the perception of disease risk. The research approach used combines tools and methods developed in ecology (satellite tracking, capture-recapture), epidemiology (risk analysis, modeling), and socio-economical sciences (social network analysis, cost-benefit analysis).

In Southeast Asia, AGIRs' activities are implemented within the framework of the animal health and veterinary public health network GREASE "Management of emerging risks in Southeast Asia". This regional network associates academic and research organizations in five Southeast Asian countries (Philippines, Thailand, Vietnam, Laos and Cambodia). It aims to improve, through synergy and sharing of skills on a regional level in Southeast Asia, the management of risks associated with transboundary and emerging diseases.

Annex 5: Agenda of the rabies meeting

FRENCH TEAM VISITATION TO CIPTO MANGUNKUSUMO HOSPITAL

Cipto Mangunkusumo Hospital, Radiotherapy Auditorium 3rd Floor RSCM
Monday, 5th November 2012

09:00 – 09:30	• Welcome Speech from the Dean of FKUI *Ratna Sitompul* • Speech from the Attache of the French Embassy in Indonesia for the University Cooperation, Scientific and Technique *Joel LeBail* • Opening speech from Director of Cipto Mangunkusumo Hospital (RSCM) *Akmal Taher*	
	Session A (GDLN – 1st Floor IASTH Building of FKUI) **Rabies in Indonesia: Potential Collaboration between French & Indonesian Research Institutes**	**Session B (Radiotheraphy Auditorium RSCM)** **Research Education Hospital Management**
09:30 – 09:45	• Welcome speech from CIRAD regional director *Gilles St Martin (Director of CIRAD)*	• International Hospital Accreditation and Its Implication to Education & Research *Akmal Taher*
09:45 – 10:10	• Presentation on the situation of rabies in Indonesia *Dr Rita Kusriarti* *Director, Communicable Diseases of Animal Sources-Dir Gen of Disease Control & Environment Health, the Ministry of Health RI*	• The Articulation Between The Mission of Care and The Mission of Research in a University Hospital in France *Jean-Pierre Dewitte – Director, The University Hospital of Poitiers*
10:10 – 10:30	• Review of Pasteur Institute work on rabies research with special emphasis on South-East Asia	**10 :10 – 11 :00** • Round Table Discussion: o Research Collaboration o Staff mobility in hospital management
10:30 – 10:50	• Review of CIRAD work on integrated approaches for health research	**11:00 – 11:15 COFFEE BREAK**
10:50 – 11:00	• COFFEE BREAK	**11:15 – 12:30** • Visit to: o Radiotherapy Facilities o ICTEC o Pharmacy Instalation o Integrated Laboratory o RSCM Kencana
11:00 – 12:00	A. Round table: on-going research work and research needs for rabies in Indonesia B. Round table on identification of potential collaboration on rabies between French and Indonesian research institutes	
12:00 – 12:30	Visit to IHVCB lab (BSL-3)	
12:30 – 13:30	**LUNCH (Dean's Room Foyer FKUI)**	

Annex 6: Abstracts from journal articles on wildlife health in Indonesia

Diverse contexts of zoonotic transmission of simian foamy viruses in Asia. Emerg Infect Dis. 2008.

Lisa Jones-Engel* ✉, Cynthia C. May†, Gregory A. Engel*‡, Katherine A. Steinkraus†, Michael A. Schillaci, Agustin Fuentes¶, Aida Rompis#, Mukesh K. Chalise**, Nantiya Aggimarangsee††, Mohammed M. Feeroz‡‡, Richard Grant*, Jonathan S. Allan§§, Arta Putra#, I. Nengah Wandia#, Robin Watanabe*, LaRene Kuller*, Satawat Thongsawat††, Romanee Chaiwarith††, Randall C. Kyes*, and Maxine L. Linial†

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Abstract: In Asia, contact between persons and nonhuman primates is widespread in multiple occupational and nonoccupational contexts. Simian foamy viruses (SFVs) are retroviruses that are prevalent in all species of nonhuman primates. To determine SFV prevalence in humans, we tested 305 persons who lived or worked around nonhuman primates in several South and Southeast Asian countries; 8 (2.6%) were confirmed SFV positive by Western blot and, for some, by PCR. The interspecies interactions that likely resulted in virus transmission were diverse; 5 macaque taxa were implicated as a potential source of infection. Phylogenetic analysis showed that SFV from 3 infected persons was similar to that from the nonhuman primate populations with which the infected persons reported contact. Thus, SFV infections are likely to be prevalent among persons who live or work near nonhuman primates in Asia.

Risk assessment: a model for predicting cross-species transmission of simian foamy virus from macaques (*M. fascicularis*) to humans at a monkey temple in Bali, Indonesia. Am. J. Primatol. 68:934–948, 2006

Gregory Engel[1,*], Laura L. Hungerford[2], Lisa Jones-Engel[1], Dominic Travis[3], Richard Eberle[4], Agustin Fuentes[5], Richard Grant[6], Randall Kyes[7], Michael Schillaci[8,9]

[1] National Primate Research Center, University of Washington, Seattle, Washington, [2] Department of Epidemiology and Preventive Medicine, University of Maryland School of Medicine, Baltimore, Maryland, [3] Davee Center for Veterinary Epidemiology, Lincoln Park Zoo, Chicago, Illinois, [4] Department of Veterinary Pathobiology, Center for Veterinary Health Sciences, Oklahoma State University, Stillwater, Oklahoma, [5] Department of Anthropology, University of Notre Dame, Notre Dame, Indiana, [6] Viral Diagnostic Laboratory, National Primate Research Center, University of Washington, Seattle, Washington, [7] Division of International Programs, Washington National Primate Research Center, University of Washington, Seattle, Washington, [8] Department of Social Sciences, University of Toronto at Scarborough, Scarborough, Ontario, Canada, [9] Macaque Risk Analysis Workshop Group, Davee Center for Veterinary Epidemiology, Lincoln Park Zoo, Chicago, Illinois.

Abstract: Contact between humans and nonhuman primates (NHPs) frequently occurs at monkey temples (religious sites that have become associated with free-ranging populations of NHPs) in Asia, creating the potential for NHP–human disease transmission. In March 2003 a multidisciplinary panel of experts participated in a workshop designed to model the risk of NHP–human pathogen transmission. The panel developed a risk assessment model to describe the likelihood of cross-species transmission of simian foamy virus (SFV) from temple macaques (*Macaca fascicularis*) to visitors at monkey temples. SFV is an enzootic simian retrovirus that has been shown to be transmitted from NHPs to humans. In operationalizing the model field data, laboratory data and expert opinions were used to estimate the likelihood of SFV transmission within this context. This model sets the stage for a discussion about modeling as a risk assessment tool and the kinds of data that are required to accurately predict transmission.

The anthropogenic environment lessens the intensity and prevalence of gastrointestinal parasites in Balinese long-tailed macaques (Macaca fascicularis). Primates, 2011, 52:117-128.

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Abstract : The distribution of wildlife parasites in a landscape is intimately tied to the spatial distribution of hosts. In parasite species, including many gastrointestinal parasites, with obligate or common environmental life stages, the dynamics of the parasite can also be strongly affected by geophysical components of the environment. This is especially salient in host species, for example humans and macaques, which thrive across a wide variety of habitat types and quality and so are exposed to a wealth of environmentally resilient parasites. Here, we examine the effect of environmental and anthropogenic components of the landscape on the prevalence, intensity, and species diversity of gastrointestinal parasites across a metapopulation of long-tailed macaques on the island of Bali, Indonesia. Using principal-components analysis, we identified significant interaction effects between specific environmental and anthropogenic components of the landscape, parsing the Balinese landscape into anthropogenic (PC1), mixed environment (PC2), and non-anthropogenic (PC3) components. Further, we determined that the anthropogenic environment can mitigate the prevalence and intensity of specific gut parasites and the intensity of the overall community of gut parasites, but that non-anthropogenically driven landscape components have no significant effect in increasing or reducing the intensity or prevalence of the community of gut parasites in Balinese macaques.

Serological Evidence of Ebola Virus Infection in Indonesian Orangutans. Plos One, 2012

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Abstract: Ebola virus (EBOV) and Marburg virus (MARV) belong to the family Filoviridae and cause severe hemorrhagic fever in humans and nonhuman primates. Despite the discovery of EBOV (Reston virus) in nonhuman primates and domestic pigs in the Philippines and the serological evidence for its infection of humans and fruit bats, information on the reservoirs and potential amplifying hosts for filoviruses in Asia is lacking. In this study, serum samples collected from 353 healthy Bornean orangutans (Pongo pygmaeus) in Kalimantan Island, Indonesia, during the period from December 2005 to December 2006 were screened for filovirus-specific IgG antibodies using a highly sensitive enzyme-linked immunosorbent assay (ELISA) with recombinant viral surface glycoprotein (GP) antigens derived from multiple species of filoviruses (5 EBOV and 1 MARV species). Here we show that 18.4% (65/353) and 1.7% (6/353) of the samples were seropositive for EBOV and MARV, respectively, with little cross-reactivity among EBOV and MARV antigens. In these positive samples, IgG antibodies to viral internal proteins were also detected by immunoblotting. Interestingly, while the specificity for Reston virus, which has been recognized as an Asian filovirus, was the highest in only 1.4% (5/353) of the serum samples, the majority of EBOV-positive sera showed specificity to Zaire, Sudan, Cote d'Ivoire, or Bundibugyo viruses, all of which have been found so far only in Africa. These results suggest the existence of multiple species of filoviruses or unknown filovirus-related viruses in Indonesia, some of which are serologically similar to African EBOVs, and transmission of the viruses from yet unidentified reservoir hosts into the orangutan populations. Our findings point to the need for risk assessment and continued surveillance of filovirus infection of human and nonhuman primates, as well as wild and domestic animals, in Asia.

H5N1 Surveillance in Migratory Birds in Java, Indonesia. VECTOR-BORNE AND ZOONOTIC DISEASES 2009.

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Abstract: We sought to elucidate the role of migratory birds in transmission of H5N1 in an enzoonotic area. Resident, captive, and migratory birds were sampled at five sites in Java, Indonesia. Mist nets were used to trap birds. Birds were identified to species. RNA was extracted from swabs and reverse transcriptase polymerase chain reaction (RT-PCR) conducted for the HA and M genes of H5N1. Antibodies were detected by enzyme-linked

immunosorbent assay and hemagglutination inhibition test. Between October 2006 and September 2007, a total of 4,067 captive, resident, and migratory birds comprising 98 species in 23 genera were sampled. The most commonly collected birds were the common sandpiper (6% of total), striated heron (3%), and the domestic chicken (14%). The overall prevalence of H5N1 antibodies was 5.3%. A significantly higher percentage of captive

birds (16.1%) showed antibody evidence of H5N1 exposure when compared to migratory or resident birds. The greatest number of seropositive birds in each category were Muschovy duck (captive), striated heron (resident), and the Pacific golden plover (migratory). Seven apparently well captive birds yielded molecular evidence of H5N1 infection. Following amplification, the HA, NA, and M genes were analyzed. Phylogenetic analysis of the HA gene showed that the isolates were 97% similar to EU124153.1 A/chicken/West Java/Garut May

2006, an isolate obtained in a similar region of West Java. While no known markers of neuraminidase inhibitor resistance were found within the NA gene, M segment analysis revealed the V27A mutation known to confer resistance to adamantanes. Our results demonstrate moderate serologic evidence of H5N1 infection in captive birds, sampled in five sites in Java, Indonesia, but only occasional infection in resident and migratory birds.

These data imply that in an enzoonotic region of Indonesia the role of migratory birds in transmission of H5N1 is limited.

Hunting of flying foxes and perception of disease risk in Indonesian Borneo. Biological Conservation 144 (2011) 2441–2449

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e Faculty of Forestry, Universitas Mulawarman, Samarinda 75117, East Kalimantan, Indonesia f Durrell Institute of Conservation and Ecology, School of Anthropology and Conservation, University of Kent, Canterbury CT2 7NR, UK g School of Biological & Chemical Sciences, Queen Mary University of London, Mile End Road, London E1 4NS, UK.
Abstract: Widespread hunting of flying foxes has generated concern regarding population declines and the spread of emerging infectious diseases. To investigate the potential impacts of this trade, we conducted questionnaires in 45 settlements across 12 population centres within Central Kalimantan, Indonesia, a region previously identified as a hunting hotspot. By combining results from 63 hunter and 88 vendor interviews, we highlight two population centres (Palangka Raya and Buntok/Tamiang Layang) with higher hunting rates than other areas, which act as flying fox trading hubs. Flying fox populations were perceived to be declining province-wide: declines in captures and sales were reported by 81% of hunters and 60% of market vendors, who also reported availability as the key factor underlying temporal variations in trade. There was substantial risk of zoonotic disease transmission between bats, hunters and traders: the vast majority of respondents were unaware that flying foxes carry potentially fatal viruses, and so few people protected themselves from physical contact. Moreover, both hunters and vendors were frequently bitten and the majority of bites drew blood. Most hunters (58%) also reported unintentional by-catches that included keystone bird species and slow lorises. The scale of hunting over Central Kalimantan represents a serious threat to the long-term viability of flying fox populations (and potentially those of other species), and could have serious public health implications. Reducing or eliminating hunting and trade would mitigate the risk of disease transmission, while maintaining the economic and ecosystem benefits that flying foxes provide, in terms of pollination and seed dispersal.

Annex 7: Abstracts from recent International Conferences on animal health in Indonesia

XXIIIe ISVEE conference, Maastricht August 2012

H5N1 Avian Influenza

The role of domestic ducks in the endemicity of highly pathogenic avian influenza H5N1 virus in Indonesia

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In some countries domestic ducks play an important role in endemicity of highly pathogenic avian influenza (HPAI), however, for Indonesia the role of domestic ducks in HPAI is not yet well understood. A cross-sectional survey was conducted to determine the prevalence of HPAI H5 in unvaccinated duck flocks in two H5N1-endemic provinces in western Java. Samples were obtained from 194 farms and were tested using hemagglutination inhibition and PCR. The flock seroprevalence was 31.4% (95% CI 24.9-38.5%). Within positive flocks the prevalence was 7% (95% Cl 3.3-23.3%). The overall bird-level seroprevalence was 2.2%. Out of 194 farms surveyed, 29 farms (14.9%) tested PCR positive for influenza type A but only 4 farms (2.1%) tested PCR positive for H5 subtype influenza. The within-farm virus prevalence in positive farms was low for both influenza A and H5 PCR. The flock prevalence for influenza A tended to be higher in nomadic flocks compared to stationary flocks. Farmers of positive duck flocks did not report any illness in the past indicating that apparently healthy ducks do seroconvert and shed virus. The survey shows that ducks can be a reservoir for H5 virus but shedding seems to be low. Low prevalence of HPAI in the ducks showed by this study was consistent with recent study in other part in Indonesia. Although the role of the ducks is not yet clear, it could be that they are rather indicators for the virus pressure in the area than that they play an active role in driving the endemicity of the disease in Indonesia.

Determination of HPAI H5N1 spatio-temporal dynamics in Indonesian poultry

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Data collected by the Disease Surveillance and Response Programme (PDSR) programme between April 2008 and September 2010 for Java, Bali and Lampung Province of Sumatra were used to examine the spatial-temporal dynamics of HPAI H5N1 outbreaks in Indonesia. Ecological approaches were used to identify potential drivers of outbreak maintenance and spread. The study set out to determine: (1) the probability of a district becoming infected after a period of freedom (90 days), referred to as the 'colonization probability'; (2) the probability of an outbreak persisting in a district, referred to as the 'persistence probability'; (3) how a district's HPAI status in a previous period influenced the occurrence of outbreaks (colonization and persistence) in that district; and iv) the effect of risk factors such as human and poultry population densities on the probability of outbreaks (colonization and persistence) at a district. The analysis was conducted at the district level for nine 90-day rolling period. The analyses suggested that there were strong temporal and spatial differences in outbreak probabilities across the areas examined. The analyses also showed that the occurrence of outbreaks in each study district was affected by poultry and human densities and the number of villages in the district assigned to controlled status during a previous period. These findings provide an opportunity to guide future surveillance efforts in the Indonesian poultry sector.

Why implementing co-ordinated systematic H5N1 post-vaccination systems is so hard and what needs to be done

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Vaccination against HPAI H5N1 has been practised in Indonesia since 2004, particularly in the commercial layer sector. Whilst this vaccination – combined with improved biosecurity – has successfully prevented massive mortalities and production loss, ongoing evolution of the virus requires the development of surveillance systems to ensure that vaccination continues to be effective. Nevertheless, to date this has been difficult to implement due to the need to co-ordinate, for a given vaccine H5N1 seed antigen, the appropriate sampling regime together with the most effective test antigen in the haemagglutination inhibition (HI) test. In addition, post-vaccination test results can be difficult to interpret without knowledge of the infection status of the sampled birds. To progress a solution to this complex problem, we have worked with a small number of commercial layer producers in West Java, which is one of the areas of Indonesia worst affected by H5N1. Initially we undertook a cross-sectional survey to better understand vaccination and biosecurity practices, and this enabled us to develop an effective strategy of sero-sampling at the point-of-lay stage of pullets where vaccination is routinely practised. This has also assisted us to define quantifiable baseline serological responses, and to define clearly questions that require parallel studies regarding vaccine responses to test antigens. As importantly, we have defined a role for a DIVA (Differentiating Infected from Vaccinated Animals) ELISA based upon the M2e antigen to detect birds actively excreting virus. These concepts are now being implemented in follow studies in West and Central Java in an intensive longitudinal study of about 40 Sector Three poultry farms.

Social network analyses of Bali live bird markets

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This paper presents the results of a survey of live-bird markets in Bali during September 2010, analysed using Social network analyses. The objective of the study was to describe contact structures within the live-bird marketing system across Bali to identify important sources and destinations of live-birds as a means to identify areas at higher risk of HPAI incursion or transmission. Within markets, vendors, drivers and market authorities were interviewed. Eighty-four out of 86 (response rate of 97.6%) officially listed live bird markets were visited. The study identified a number of districts as important sources of live birds at markets during the study period. These districts should therefore be targeted as part of a surveillance/prevention programme for poultry diseases. Contact were made across all districts in Bali, implying a potential for rapid disease or information spread through markets across the island. A small number of markets in four districts had relatively high betweeness scores indicating their role in controlling the flow of live-birds across Bali. The movement of birds to markets did not appear to have a seasonal influence which may be a reflection of the large number of festivals which occur throughout the year in Bali. A number of markets were identified as riskier in terms of their potential role in the spread of disease based on a number of criteria. To better identify risky markets it may be necessary to have a group of experts from Bali rank each market in terms of risk. This then would provide a more informed categorization of market risk for disease transmission or spread.

What promotes the circulation of HPAI H5N1 in Indonesia: a descriptive analysis of a network of moving duck farmers, rice paddy owners, duck transporters and hatcheries

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Ducks can harbour HPAI H5N1 virus, thereby promoting its spread in the field. HPAI H5N1 endemicity in Indonesia is likely associated with the high density of ducks in that country. Consequently previous investigations focussed on identifying hazards related to the management of duck flocks by their owners, but various other occupations are also associated with duck production. For example, moving duck flock farmers are part of a network that also comprises rice paddy owners who provide paddies for scavenging, duck transporters who move ducks to and from scavenging locations and hatcheries which purchase eggs and sell ducklings to the farmers. Therefore, in 2009 we conducted cross-sectional surveys and interviewed total of 121 rice paddy owners, 30 transporters and 75 hatchery owners in Indonesia. We used descriptive statistics, descriptive social network analysis and descriptive spatial analysis to identify interrelationships of members of this network, movement patterns of duck flocks and bio-security factors possibly influencing the dissemination of HPAI virus. For example, the number and frequency of duck flocks allowed scavenging per paddy and the disposal practices of carcasses found by rice field owners were identified as important risk factors for HPAI spread. Furthermore, the cost-reducing practice of combining flocks from different farms or the mixture of duck flocks with other poultry types and poultry feed during transport as well as a lack of disinfection in both, transport vehicles and hatcheries, presented further high-risk management practices. The complexity of the duck production network was further highlighted in the identified spatial travel patterns of moving duck flocks. Based on our results, we highlight recommendations for HPAI control that go beyond the management of ducks on farms and also consider other members of the community involved in duck production.

Transmissibility and other characteristics of HPAI in Indonesian village poultry

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This study was designed to measure the transmissibility of Type A H5N1 highly pathogenic avian influenza (HPAI) in mixed populations of backyard and small-scale commercial chickens in Java. An approach adapted from infection tree reconstruction was used to trace affected chickens and households in neighborhoods (RTs) in which HPAI had been diagnosed by Indonesia's surveillance system. Of the 41 outbreaks studied, 15 were in RTs participating in a mass vaccination program. The study found that backyard chickens were free range, visiting a mean 4.2 households. Commercial poultry were present within the village in nearly half of the outbreaks, although they were affected in only 7.3%. The distance from the index to the closest unaffected household was significantly greater than that from the index to the closest affected. Mean morbidity was 80.9±28.8%, mortality 77.6±27.7%, and case fatality 97.3±12.3%. There was significant risk for outbreaks to occur in households where Muscovy ducks, non-commercial chickens, broilers and geese were kept, but there was not a significant risk associated with keeping pigeons or ducks (Anatidae family not including Muscovy). Introduction of new birds to a household flock was most frequently documented to have led to the introduction of the disease to an RT, while contact between birds from different household flocks was most frequently documented to have contributed to spread. Transmission between birds within flocks was significantly higher than transmission between flocks, between birds within flocks in vaccinated areas was significantly lower than in unvaccinated areas, and between flocks in vaccinated areas was significantly lower than in unvaccinated areas. Our findings indicate that backyard poultry populations as they occur on Java provide the necessary environment for indefinite HPAI transmission.

Population dynamics in Kampong chicken and consequences for HPAI vaccination: results of a field trial in Java

Unger, F.[1], Priyono, W.[2], Siregar, E.[3], Azhar, M.[3], Bett, B.[1], Mclaws, M.[1], Jost, C.[1] and Mariner, J.C.[1], [1]International Livestock Research Institute, Kenya, [2]Disease Investigation Centre, Wates, Indonesia, [3]FAO, Campaign Management Unit, Indonesia; F.Unger@cgiar.org

Until today HPAI in poultry is considered to be endemic in most of the Indonesian provinces since it was officially declared in 2004. Vaccination is used as one of the control strategies targeting layer and breeder farms but also Kampong (village) chicken. Limited information is available on the scope of off-take and replacement occurring in Kampong chicken populations under field condition and their effects on HPAI vaccination. To collate information on population dynamics in Kampong chicken, twelve communities with 300-500 chickens each have been enrolled in this trial. Chicken exit/entries as well as disease/mortality events were intensively monitored in weekly intervals. The trial was carried out between July 2008 and August 2009 in two Districts of Yogyakarta, Java. Results indicate that 39-44% of chickens were younger than two months of age over time and more than two-thirds of chickens were younger than four months, respectively. Adult chickens represented only 10% (male) and 20% (female) of

the total population. Though overall population size within the selected communities was relatively stable, the number of chickens changed widely within age classes. In each observed quarter, there was a 43% or higher turnover of the population (43-72%). Observed changes were related to socio-cultural events such as holidays or begin of school. From our results we can conclude that approximately 40% of a natural backyard population will be un-vaccinated by 60 days after the onset of a vaccination campaign. Considering this high population turnover rate, even a quarterly vaccination regime including a booster round is required will have difficulty achieving effective flock immunity levels. This results in high costs, poses a significant logistical challenge and suggests mass vaccination is not a practical approach to sustained control of HPAI.

Population dynamics in Kampong chicken and consequences for HPAI vaccination: results of a field trial in Java

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Rabies

Response to a rabies epidemic in Bali, Indonesia

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Bali was historically rabies free until 2008 when the disease was confirmed in the Bukit Peninsula. Initial attempts at containment by dog vaccination and culling were unsuccessful due to factors including lack of emergency funding and contingency plans, the large free-roaming dog population and its high turnover, limited availability of long-lasting vaccines and means to identify vaccinated animals and patchy cold chain arrangements. Over the next three years more than 130 people died of rabies, at least 130,000 dog bites required post-exposure prophylaxis and over 500 cases were confirmed by the fluorescent antibody test. Following trials in 2009 to pilot dog catching teams for conducting mass vaccinations and a switch to long-lasting vaccines; successive island-wide vaccination campaigns were completed in 2010 and 2011 respectively. More than 200,000 dogs were vaccinated in each of these campaigns and coverage estimates approached or exceeded 70% in most sub-villages in Bali. At the start of the first island-wide campaign 140 villages were infected, and during the mass vaccination, rabies spread into new areas and re-infected previously rabies-free villages. However, by the end of the second campaign only 30 villages remained infected, rates of spread had declined from ~10 new infected villages each month, down to less than 2, incidence had decreased from ~45 cases/month to ~11, attack rates had dropped from 0.027% down to 0.01% and bite injuries had declined from 6,256 to 4,197 bites/month. Mass dog vaccinations to date have significantly reduced rabies incidence and spread, however bite incidence remains high and repeat dog vaccination campaigns are necessary to eradicate rabies from Bali.

Costs of the current rabies control strategies on Flores Island

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Rabies is a zoonotic disease and always fatal once clinical signs appear in human. The disease transmits to humans through an animal bite. Dogs are the main vector of rabies in humans on Flores island, Indonesia, resulting in about 19 deaths annually. Therefore, it is necessary to control the disease. Currently, the rabies control program at Flores island includes post exposure treatment of humans, mass vaccination and culling of dogs, and surveillance in dogs. Although the program has been in place for several years, it seems that rabies is not yet controlled. Therefore, an evaluation of the program is needed. The objective of this study is to estimate the net costs of the current control program of rabies on Flores island. A deterministic economic model has been developed to calculate the net costs of the rabies control program and of the individual components from the year 2000-2011. Data from the Health Department and Husbandry Department of East Nusa Tenggara Province were used as inputs. The result shows that the annual net costs due to vaccination, culling of dogs and surveillance (prevention) were calculated to be respectively $US 90,420 (Rp 809.71 million), $US 2,670 (Rp 23.9 million) and $US 4,755 (Rp 42.6 million). The annual net costs of the post exposure treatment in humans (cure) was estimated to be $US 172,389 (Rp 1.5 billion). Summarizing, the annual costs involved in the rabies control program add up to $US 270,234 (Rp 2,4 billion) in total, with the post exposure treatment program

being the most expensive component. The preventive measures do not seem to be effective, but the amount of money spent in prevention is lower than the amount of money spent in cure. This means that an improved control of Rabies might become cost-effecitve.

Dog ecology in Bali, Indonesia and implications for rabies transmission

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Over 100 human rabies deaths occurred during an ongoing epidemic in Bali, Indonesia. The basic reproductive number from this epidemic (1.2) is similar to estimates from elsewhere in the world, despite the high densities of dogs in Bali (>100 /km2). This lack of density dependent transmission has important implications for rabies control, but is difficult to explain. We investigated ecological factors affecting rabies transmission and spread in Bali. Household surveys (n=6,152) confirmed the high dog densities and that most owned dogs are free-roaming, with only 7% and 19% restrained in rural and suburban areas respectively, and these mostly restrained during the day only. We randomly selected and observed continuously 69 free-roaming dogs for 48 hours to quantify behaviour and movement during a period similar to the infectious period of rabies. Home ranges were small (90% kernel, median=0.6 km2, mean=3 km2), but some displacements exceeded 4 km and most movements were constrained to roads. The skewed distribution of movements was similar to observations of rabid dogs. Most activity and contact occurred between 6-10am and 4-8pm, when dogs were less likely to be restrained. Despite small home ranges, high dog densities and frequent opportunities for contact demonstrate potential for sustained transmission and suggest that sociality can help explain the lack of density dependent transmission. Close correlation between movement and road networks should be used to improve epidemiological models and suggests means for strategic measures to contain rabies spread.

Rabies surveillance methods in Bali and Flores, Indonesia

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Rabies is spreading in Indonesia, entering Flores in 1997, Maluku in 2003, North Maluku in 2006, Bali in 2008 and Nias and Larat in 2010, and extending its range in West Java. Early detection of new incursions and levels of prevalence is extraordinarily difficult due to rabies' long incubation period and very short period of clinical signs. Experience in combating rabies in Bali and Flores will be drawn on to discuss the different surveillance methods and strategies which are needed for early detection of rabies incursions to new areas, effectiveness of control strategies and programs, and eventual proof of freedom. Human deaths from rabies are often the first sign of new infected areas and by this time the disease may have been present for at least six months and be widespread in the local dog population. Media reports and increased public awareness can increase the rate of reporting of dog bites which increases the perception of disease spread but may not really reflect true incidence. Surveillance of dog brains is a more effective means of detecting rabies but selection of dogs for sampling can be very controversial, may be perceived as blanket culling, and may cause people to move their dogs, increasing the risks of spread. Some means to overcome the practical, social and institutional impediments to effective rabies surveillance in Indonesia will be suggested.

Determinants of vaccination coverage and consequences for rabies control in Bali, Indonesia

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Maintaining high vaccination coverage is key to successful rabies control, but mass vaccination of dogs is difficult and population turnover erodes coverage. Incidence decline following successive island-wide vaccination campaigns in Bali suggest good prospects for rabies eradication. To find gaps in coverage we used household surveys of owned dogs (n=12,234) and 23 transects of free-roaming dogs (n=1,079). Coverage was 10% higher in confined than in unconfined owned dogs, with more confinement in urban (77.3%) than rural areas (7.4%). Coverage was higher in adults (90%) than juveniles (<1 yr, 51%) due to births and insufficient targeting of pups. Fecundity studies suggest owners do not report pups which may be an obstacle for vaccinators. Villages with recent culling (4/27) in response to rabies reports had marginally lower coverage and higher proportion of juveniles than villages with no culling, suggesting replacement of culled dogs with unvaccinated pups. Coverage estimates from transects were much lower (39.9%) than household surveys (83.4%), possibly due to loss of vaccination collars, but also because free-roaming dogs include unowned or difficult to vaccinate dogs. Future campaigns should put more effort in vaccinating free-roaming dogs particularly in rural areas, with advertising to ensure owners vaccinate pups. Culling appears counterproductive to coverage, but sterilization could stabilize it by reducing births. Long-lasting collars would help identify vaccinated animals and reassure communities that campaigns are successful.

Towards eradication of rabies in Bali: review of progress

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Bali had been historically rabies free until the diagnosis of rabies in a human and in a dog in November 2008. As the first suspected case of rabies in Bali was diagnosed in a person, it is likely that the disease had previously gone undetected for some time in the dog population. A dog incubating rabies may have been brought in early 2008 by fishermen through unofficial ports into Bukit peninsula, Badung district in south Bali. By June 2010 rabies had spread throughout the island. Disease control efforts to date have been divided into three phases, namely district-by-district central point dog vaccination (December 2008-September 2010) then a first (October 2010-March 2011) and second (May 2011-September 2011) island-wide door-to-door mass dog vaccination program. In October-December 2011, all parameters used to evaluate control program success (average number of rabid dogs per month, apparent monthly attack rate, rate of spread, detection/village, number of known infected villages, human deaths, and incidence rate of dog bites over dog population) showed reduction since the first phase. Rabies was not eradicated from Bali, but in this period was almost entirely found in the owned free-roaming dog population with an increased proportion of puppies infected.

Complexity and controlling rabies in Bali, Indonesia

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The first case of rabies in any species in Bali, Indonesia was diagnosed in November, 2008, resulting in at least 100 human deaths and hundreds of canine deaths. We used business decision management tools to examine the management response to rabies in Bali and conclude that the response has gone through a cycle of problem recognition which influenced control features. In October 2011, 14 participants of the Building Ecohealth Capacity in Asia project implemented by VWB/VSF-Canada met in Chiang Mai to discuss complexity of ecohealth problems. The Cynefin Framework is an application that matches a situation with a response, helping to distinguish among simple, complicated, complex, and chaotic contexts. We asked: (1) how is the situation being framed (simple, complicated, complex, and chaotic); (2) what are the implications of this framing relative to situational response; and (3) what are appropriate ways of managing rabies control based on the basis of this framing. Problem identification and response started as a simple process (kill the dogs), moved to a more complicated phase when cultural factors were identified as being important, and occasionally shifted into stages when control seemed out of reach (chaos according to systems theory). Currently in the complex phase vaccination, understanding dog ecology, and education programmes are being used concurrently. The vaccine confers solid protection but the ecohealth picture of rabies in Bali makes it difficult to analyze and control. Our team advocates an ecohealth approach addressing the fourth and final component of complex systems theory, complexity itself. We suggest identification and understanding of the phases of complex problems such as rabies is important to developing sustainable solutions.

CSF

Quantitative risk assessment of formal pig movements in eastern Indonesia and transmission of classical swine fever

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A quantitative risk assessment was conducted on formal pig movements across Nusa Tenggara Timur Province in eastern Indonesia to assess the likelihood of classical swine fever virus (CSFV) transmission between pigs. Pigs in this region have high cultural and economic importance with most held in smallholder herds of 1-2 sows. Classical swine fever, a highly contagious viral disease, was first confirmed in the province in 1998. Since its introduction, substantial losses have been reported with infection spreading to uninfected islands as recently as 2011. This risk assessment sought to identify pathways in the live pig market chain with the greatest risk of CSFV transmission and to assess the effect of mitigation measures to reduce CSFV transmission. A modular risk model approach was used considering only live pig to pig transmission. Data obtained from market and farmer surveys on West Timor, Flores and Sumba islands, published literature and expert opinion were utilised. A Monte Carlo simulation was performed with @Risk (Palisade) with 10,000 iterations. Modules were divided based on market chain movement processes from village to market. Outputs included the number of infected and clinical pigs at market and the probability a market was infected with CSF. Mitigation strategies assessed were vaccination and pre-entry market inspection. The baseline model demonstrated that markets in West Timor and Sumba had the highest number of infected pigs. For market inspection to be effective, it needed to be strict with sensitivity >75% required to reduce the probability a market was infected. With increased vaccination coverage, there was a reduction in the number of infected and clinical pigs arriving at market. However, CSFV was not eliminated from the market environment. This work in combination with other analyses such as Social Network Analysis will be used to guide policy on CSF control in eastern Indonesia.

Informal pig movements across eastern Indonesia: risk for classical swine fever transmission

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Classical swine fever (CSF), a highly contagious Pestivirus has caused substantial socio-economic loss for pig farmers in Indonesia since introduction in 1994. Live pig movements are believed to have facilitated CSF introduction into Nusa Tenggara Timur province (NTT), in eastern Indonesia. This province has the largest pig population with 85% of households owning at least one pig. Pigs have high cultural and economic importance being used for financial security and traditional ceremonies. The number of reported CSF cases in NTT is still increasing with newly infected islands as recent as 2011. To investigate informal movement of pigs, a survey of smallholder pig farmers was conducted on West Timor, Flores and Sumba islands from March to April 2010. Using multi-stage sampling, 18 villages were selected across the three islands and 289 pig farmers interviewed. Information on trading practices, source and destination locations and pig volumes being moved was obtained to conduct a Social Network Analysis (SNA). Over half of farmers (55%) moved pigs informally, most commonly during August to October. Inter and intra island movement was detected.

West Timor had a highly connected network with pigs moving across Timor Island reaching the border with East Timor. Flores and Sumba islands had fragmented networks with localised movement influenced by terrain. Rindi Village in Sumba represented a high risk location for CSF spread with the greatest exiting pig volume (78 pigs) from 2009-2010. Nanbaun Delha Village in West Timor was a high risk location for CSF introduction with external contact from 13 other villages. SNA was used to identify high risk movement pathways and locations to inform decision making for policy development to control CSF in eastern Indonesia.

Brucellosis

POSTER: Brucellosis in West and East Timor

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Eastern Indonesia has grasslands ideal for breeding beef cattle for meat or breeding stock, helping to address food security and rural poverty in both Indonesia and East Timor. However this opportunity is constrained by endemic bovine brucellosis on Timor island. Brucellosis impacts profoundly on smallholder livelihoods due to severe reduction in reproductive efficiency of affected cows. Export of breeding cattle from Timor to other parts of Indonesia is banned due to brucellosis, lowering prices of Timorese cattle. Control attempts since the early 1990s have been hampered by disrupted veterinary services in East Timor, and variable budgets and policies due to regional autonomy in West (Indonesian) Timor. Eradication of the disease remains a distant aim. Results of a scoping study in East and West Timor from January to June 2012 will be reported. The study team will visit the central governments of Indonesia and East Timor, the provincial government of East Nusa Tenggara, five West Timor district governments and some of East Timor's thirteen districts. With information on brucellosis prevalence and impacts and cattle production systems and market supply chains, prospects for improved brucellosis control will be assessed, and a plan for a three country (Indonesia, East Timor and Australia) integrated whole-of-Timor control program developed. Major issues will include integrated government policy and implementation at central, provincial and district levels, and improved cattle identification and movement control, diagnostics, and veterinary services capacity.

61st International Conference of the Wildlife Disease Association (WDA) and the 10th Biennial Conference of the European Wildlife Disease Association (EWDA), Lyon July 2012

CLINICAL DENGUE VIRUS INFECTIONS IN ORANGUTANS

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Dengue viruses (DENV) are considered to have an asymptomatic sylvatic cycle in wild non-human primates and Aedes mosquitos. In humans, DENV infection can cause dengue fever, which may progress to fatal haemorrhagic shock syndrome (HSS).Wild orangutans have previously been documented with IgG antibodies against DENV, but not with clinical disease. Habitat destruction is the main threat for wild orangutans, and more than 600 are housed at the Nyaru Menteng reintroduction centre, in preparation for their release. The aims of this study were to document preliminary clinical and haematological data of 30 captive orangutans which tested positive in a commercial rapid test for DENV-specific IgM antibodies. The most common clinical signs of DENV infected orangutans were fever (> 38.50C) and lethargy. Mean haematological parameters showed lymphopenia, monocytosis, and anemia, but not thrombocytopenia. Twenty-one of these animals also harboured a Plasmodium infection, which exacerbated clinical signs, and included thrombocytopenia, although no clinical signs associated with HSS were seen. All 30 animals recovered following symptomatic treatment and, where indicated, with antimalarial drugs. Seven animals were treated for suspected secondary bacterial infections. Our results show that DENV infections do cause disease in naturally infected orangutans, exacerbated by co-infection with Plasmodium spp. Research to elucidate the DENV serotype(s), DENV ecology, and Plasmodium spp is ongoing.

INTERACTION BETWEEN HOST DISPERSAL AND PARASITE SPATIAL STRUCTURING AND SPREAD IN LONG-TAILED MACAQUES

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The relationship between host dispersal and parasite spatial structuring is one of ultimate importance in understanding infectious disease transmission. On the Indonesian island of Bali, long-tailed macaques (Macaca fascicularis) thrive in populations associated with large Hindu temple complexes across the island. The interactions of macaques within and between temple sites create a dynamic system to study the role of host population structure on parasite burdens. Using GIS tools combined with genetic analyses of 15 macaque populations, we apply three analytical approaches to understand these relationships. In the first approach, we make a direct comparison between genetic and geographical distance using Mantel tests. In the second approach, we incorporate GIS data for Bali in two spatial genetic analysis tools – kriging and wombling – to understand how macaque utilization of the anthropogenic landscape limits or enhances dispersal and gene flow. Finally, we incorporate parasite burden into our analysis to evaluate how well spatial and genetic structuring of host populations corresponds to parasite distributions to identify potential barriers and corridors for parasite transmission and spread.

Asia-Pacific Conference on Wildlife Borne Diseases 19-23 July 2010 Beijing, China

The Asia Pacific Conference on Wildlife Borne Diseases with theme “Research, prevention and control of important wildlife borne diseases in Asia-Pacific” was held in Beijing, July 2010. It aimed to understand wildlife diseases through the communication and cooperation among multi-countries and multi-fields. The conference was attended by over 100 participants from 12 countries (Bangladesh, Canada, China, Cambodia, Indonesia, Mongolia, Nepal, Philippines, Russia, Thailand, United States of America, and Vietnam) and 5 international organizations. In this event, Center for Indonesian Veterinary Analytical Studies (CIVAS) was invited as a participant from Indonesia.

The conference aims to promote collaboration in the field of wildlife diseases among countries and districts in the Asia-Pacific region, share activities related to investigation, surveillance, and research on wildlife diseases, and coordinate the cooperation and communication of specialists in multiple fields and areas such as wildlife conservation and management, veterinary, ecology, and biology. Special emphasis was given to Highly Pathogenic Avian Influenza (HPAI), Rabies, West Nile Virus, Japanese Encephalitis, diseases associated with feral swine, and plague, along with other wildlife borne diseases. The conference was organized by the Bureau of Life Science and Biotechnology, Chinese Academy of Sciences; Wildlife Services, Animal and Plant Inspection Service, United States Department of Agriculture; and Department of Wildlife Conservation and Nature Reserve Management, State Forestry Administration, China.

The first day of conference held a discussion on the establishment of the Asia-Pacific Wildlife Disease Network. As result, over 60 participants from 10 countries and 5 international organizations had joined the network. In the second and third day of the conference were scientific presentations. There were 33 presentations divided into 4 categories: Avian Influenza, Viral Diseases, Wildlife Disease Issues, and Bacteria, Fungi, and Parasites. In this session, CIVAS gave a presentation on “Wildlife Health in Indonesia” under the Wildlife Disease Issue category.

Wildlife health in Indonesia

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Wildlife health is commonly a supportive component in wildlife programs in Indonesia, hence not much is known about diseases in wild populations. Only recently has there been active surveillance after the discovery of wildlife-borne zoonoses, such as Henipavirus and AI. Studies conducted on animal health and disease are mostly on primates, with few studies on non-primates as the flagship species. By national law, wildlife health is under the authority of two ministries; the Ministry of Forestry for nature conservation and the Ministry of Agriculture for animal health. This division has made it difficult for wildlife health components in the government to develop, as regulations for both ministries have never recognized animal health in conservation. It has only been recently defined in Act 18 for 2009 on Livestock and Animal Health. Currently, there are very few wildlife veterinarians in the government and medical cases are mostly handled by veterinarians from NGOs and private zoos. Medical attention is mainly required for animals rescued from conflict incidents or confiscated from illegal trade. Unfortunately, not all cases could be reached in time due to limitations in rescue facilities and medical personnel. Similar restrictions are also found in animal rescue and rehabilitation centers. In zoos and safari parks, health incidents are mostly related to animal management practices. In conclusion, to improve wildlife health in Indonesia, communication and understanding in both the Ministry of Forestry and Ministry of Agriculture should be improved. Disease surveillance and studies should also be conducted more actively to detect potential disease and health risks for both animals and human. And lastly, animal rescue and rehabilitation facilities should be improved and more medical personnel should be trained to overcome the shortage of wildlife veterinarians and paramedics in Indonesia.