

Workshop on Assessment of FMD risks via Social Network Analysis

11 - 15 February 2013, Bangkok, Thailand

GCP/RAS/283/ROK

Report

25 February 2013

By: Angel Ortiz Pelaez



1. Summary of presentations and discussions during the workshop

Background

The contact between infected and non-infected animals is one of the major risk factors for the spread of FMD and other infectious animal diseases. Network Analysis allows the description of the contact structure of livestock populations. Potential routes of Foot and Mouth Disease FMD transmission can be investigated based on known transmission routes within animal networks. SNA is formally addressing the role of the pattern of interactions between units (traders, herds, markets, etc.) helping to explain the occurrence and spread of the disease. SNA is a well-established methodology applied in veterinary epidemiology and can be applied to identify nodes in the livestock supply chain which pose a high risk of FMD spread. Understanding the epidemiology of FMD is a key principle of the Progressive Control Pathway (PCP) for FMD.

FAO-RAP is implementing this activity as part of the joint efforts of two main projects including the Korean funded project "FMD Control in Southeast Asia through Application of the Progressive Control Pathway (RoK-FMD)" and the European Union (EU) funded "Regional cooperation programme on Highly Pathogenic and Emerging Diseases in South and Southeast Asia" project. The projects aim to improve the control and management of FMD through the application of the PCP for FMD in each of the following participating countries: Cambodia, Lao PDR, Myanmar and Vietnam.

Approach

The workshop agenda is shown in Annex I. Participants (Annex II) were introduced to the concept of SNA by defining networks and explaining the principles behind the network paradigm. Applications of SNA in veterinary epidemiology and other fields were presented as well as abundant reading material (Annex III). Practical exercises followed theoretical sessions where given datasets were analyzed using the statistical software R. Self-explanatory notes for the practical sessions were provided. The training was followed by a group exercise where participants had to design a small network study, for which they had to collect, analyze and present network data. The software was used to analyze networks at different levels: node, sub-group, entire network and network structures. A module on data requirements and implications for data collection in the field and a presentation by Kasetsart University highlighted the intricacies and practicalities of collecting different types of network data.

Participating countries were requested to present latest data and situation of FMD in their respective countries. This was done after the presentations of the group exercise and Kasetsart

University and before the workshop. The last day a facilitated group discussion identified potential applications of SNA for FMD in participant's countries.

Overall learning objectives

The main objective of the workshop was to transfer social network analysis capacity to epidemiologists in public veterinary services or veterinary research institutes of countries in the region. As a follow-up activity FAO intends to support trainees in FMD risk assessments via the use of SNA in order to enhance the understanding of FMD epidemiology.

Specific learning objectives

By the end of the week participants were expected to be able to:

- Explain the concepts of network framework, network structure and nature of network data.
- Explain the different levels of network analyses: node level, group level and whole network, and understand some of the basic network parameters and network outputs.
- Build a network using "ad hoc" collected data, import into a network software, visualize and conduct a basic descriptive analysis.
- Understand and contribute to the potential applications of network analysis to the study FMD epidemiology in the region.

Competences required to participate in the workshop:

- Medium computer skills
- Basic knowledge of Microsoft Excel
- Basic understanding of animals diseases in the country/region of origin with special emphasis of FMD
- Advance skills in field epidemiology of infectious animal diseases

Expected Outputs:

- Participants will gain knowledge in the required data for SNA and conducting SNA with suitable software.
- Participants will develop data collection studies for SNA in their respective countries.

Expected Outcome:

- To apply the acquired SNA skills for the collection and analysis of livestock sector network data in order to enhance the understanding of FMD epidemiology

2. Conclusions of the workshop. Country proposals

The conclusions of the workshop were presented by representatives of each of the five participating countries in the form of concept proposals for the assessment of FMD risk in selected areas. The concept proposals help conceptualized main elements of proposed studies. Further refinements and clarification of the concept proposals will be done through consultations at a country level, with assistances from FAO ECTAD RAP and subject matter experts as needed.

Cambodia:

The team proposed to study the role of cattle traders in the spread of FMD in Cambodia. The selected study areas are Phnom Penh/Kampong Speu/Kampong Cham. The focus will be the movements of cattle from “source” to slaughter. The network framework will be applied by selecting traders or their locations (not clearly specified) as the nodes and collect data on their trade pattern until live cattle are delivered at slaughterhouses. Although the links between the nodes were described as directed, binary and based on actual collected data, the definition of the links was not clear. In addition, further clarification is needed on how the contact pattern of traders will be established and collected. The team has access to FMD data for the selected areas for 2012 and also to available socio-economic data collected by other complementary projects, including ACIAR (animal movement) and University of Study (economic impact of FMD in small hold cattle farmers).

Some data are available in official databases or other reports on: cattle population in the area, FMD incidence for 2012 in the identified areas and FMD vaccination records. Additional data will be collected through questionnaire delivery and direct interviews using the snowball approach.

The study will be led by officials of the DAHP. The implementation will require the approval by its Director and duration of six months is estimated, including data collection (3 months), data analysis (2 months) and report production (1 month).

Lao PDR

The team proposed to focus on a single study area: Xayabouly province in the north. The objective of the study will be the study of the trade and contact (common grazing points, watering points, vaccinator teams, and fresh meat vendors) patterns of live cattle, buffaloes and pigs in this province as potential risk factors for the occurrence of FMD amid a comment on the practicality and importance of pigs in FMD transmission. The identification and characterization of central nodes in the network could be used to target interventions (extension campaign, intensive vaccination)

The nodes will be defined as traders and farmers linked via movement of live animals (directed and valued). The field data collection in the eight districts of Xayabouly will require a full time dedicated team during at least 3 months, preferably during the FMD risk period (Jan-Feb). Another possible study suggested by the team is the investigation of an FMD outbreak using an ego-centric network approach in Vientiane area but it was not discussed any further.

Attribute data will be collected along with the network data and will consist of: frequency of the activities of traders, number of animals/trip, number of household visited/trip, etc. Possible extensions of the study could include the collection of data on biosecurity at farm level in a nearby province which has not had FMD outbreaks and compare it with that of Xayabouly. Data will be collected via a questionnaire survey and direct observation.

The project will be led by Dr. Khamphut Vongxai (DLF) after approval by PAFO/DAFO officers in Xiayabouli. The total duration of the study is estimated 11 months, including: study and questionnaire design and local contacts (3 months), data collection (3 months), data management (1 month), data analysis (1 month) and report production (2-3 months).

Myanmar

The team from Myanmar proposed to study the association between domestic movement of live cattle (local breed) and traders in selected districts of the Mandalay and Sagaing regions. FMD data are available from official sources (outbreaks, sero-surveillance results, vaccine coverage, census of susceptible domestic species, live cattle markets). The study will focus on the collaboration of TVO (township veterinary officer), village chieftain and the FMD national laboratory in Yangon. Additional socio-economic data are available from other studies (price of live cattle, cost for transportation, meat and milk price, education level).

Network data will consist of village and markets linked between them via movements (directed, valued and time-related) of live cattle by traders. Additional attribute data are expected to be collected from villages (cattle population, households, location), markets (location, throughput, operation times) and traders (volume).

Field data will be collected via a questionnaire survey delivered through interviews to traders conducted by third parties: TVO or commissioned institute. The study is expected to last 6 months (March-August)

The project will be led by the Research and Disease Control Division of the LBVD. Potential partners were suggested: FAO, MLF (MDY, Sagaing), local authorities and FMD Central Laboratory (Yangon).

Thailand

The Thai team proposed two studies in two distinctive regions:

Study 1: description of the network of cattle movement through livestock markets in DLD region 4, in the North-Eastern region of Thailand. The objective will be the identification of the main actors in the contact network of live cattle in the region in order to generate recommendations for the prevention and control of FMD in the area. Complementary spatial analysis will allow the description of the patterns and distribution of FMD outbreaks.

The network framework will be applied by considering livestock markets, abattoirs, farms and collection points as nodes, linked via movements of live cattle during a 3-month period: January-March 2013. Field data will be collected at sub-district level using an ego-network approach (not clear the gap between the sub-district level of data collection and identification of the nodes). Additional data will be collected for the nodes: markets (Frequency of operations and throughput, number of traders, species traded), FMD outbreak data, etc.

Study 2: network of goat movements in the north part of Southern Thailand. The objective of this study will be the description of the network of goat movements in 2012 (June-December) with the intention to recommend measures for the prevention and control of FMD in the area.

The network will consist of traders, abattoirs, farms and collection points as nodes, linked via movements of live goats during a 6-month period: June-December 2012. The study population comprises approximately 500 farms in 7 provinces. Field data collection will be done via a tailor-made questionnaire delivered to farmers during group meetings, taking advantage of regular gatherings of goat farmers organized by DLD. Complementary network data will be extracted from the database holding data from the e-service of the DLD on animal movements. It contains FMD outbreak data as well. Farm demographic and biosecurity data will also be collected.

Vietnam

The team proposed to investigate the putative influence of movements of live cattle and buffaloes (for breeding and from farm to market and abattoir via traders) in the spread of FMD in Vietnam. Two secondary objectives were also identified: the investigation of the impact of animal health workers (AHW) activities in the spread of FMD when they visit farms to treat other diseases or when conducting FMD vaccination; and the investigation of fresh meat and other animal byproducts in the spread of FMD from abattoirs and slaughter points to farms.

The study areas selected are two high risk control zones for FMD: in the Mekong delta: Long An and Dong Thap, and in the Red river delta (high land, risk zone): Son La. FMD outbreak and socio-economic data from other studies (USDA in Son La) are available.

Point locations with live cattle and buffalo (commune, grazing field, aggregation point, market, slaughterhouse/point) will define the nodes of the network whereas the links will be the actual movements of live cattle and buffaloes between these locations (directed and valued) during the last two weeks. A complementary network is proposed by collecting AHW activities as links between point locations with live cattle and buffaloes

Field data will be collected via a questionnaire administered by province & district veterinarians with help of AHWs after being trained. Third parties could also collect data, like district veterinarians with local knowledge. Additional attribute data on biosecurity status of the nodes was suggested.

There are some available data sources like between-province movements (S-DAH), but it is unlikely this type of data will be useful for this study. AHW details can be provided by S-DAH as well as bovine population per commune. District veterinarians will have information about markets and traders.

The project is expected to have duration of 8 months, including; questionnaire design and test (2 months), data collection (2 months), data entry and manipulation (1 month) and analysis and reporting (3 months with the additional support from FAO-RAP & SNA expert/KU).

The study will be led by the DAH that will appoint a coordinator and a focal point.

Overall comments:

- The work done during the workshop by country teams is a good starting point for the design of field studies using the network framework. However they will require further elaboration with support from project leader and experts in order to produce final protocols.
- Although most of the participants gained a good understanding of the concept of a network and how to do network analysis, it is still important that the studies are clearly oriented to create additional/new evidence to better understand the epidemiology of FMD in their own settings. The research questions need to be more precise. This will require further follow up activities and consultations at the country level with relevant stakeholders.
- Most of the participants were not aware of the intricacies and practicalities of collecting field network data probably due to lack of experience, in some cases by selecting very large study areas (Myanmar, Cambodia) or by selecting an excessive number of actors with which to build contact networks (Lao PDR, Vietnam, Thailand). While experts from Kasetsart University highlighted this issue during the presentation, the participating countries will require further technical assistance during the study implementation as situations will vary greatly from countries to countries.
- Some of the proposed studies include multiple and differentiated objectives that will demand the data collection to build various networks (Vietnam) or the adoption of non-network approaches (Lao PDR). It will be of paramount importance that specific objectives are agreed prior to the implementation of the studies and if necessary to apply other types of epidemiological studies if necessary.
- It is important that whatever the implementing agency will be, the training and workshop participants should remain involved in the design, implementation and evaluation of the studies.

3. Evaluation results of each session the training workshops

Based on the voluntary (anonymous or not) completion of the course assessment form by the participants.

Rate the relevance of the SNA to your work. Number of respondents (14)

11 (Strongly relevant: important concept and the SNA conceptual framework will be applied within the next 12 months)

3 (Relatively relevant: useful concept but the SNA conceptual framework is unlikely to be applied within the next 12 months)

0 (Not relevant: the concept and method is unlikely to be applied)

Please assess the level of your knowledge and skills before the training and now (score 1-5, with 5 is the highest):

<i>Knowledge & Skills</i>	<i>Before</i>	<i>Now</i>
Understanding of the SNA conceptual framework	Respondents: 12 Average: 1.6	Respondents: 12 Average: 4
Ability to apply the SNA conceptual framework (in studying disease transmission pathways and risk factors)	Respondents: 12 Average: 1.7	Respondents: 12 Average: 3.9
Ability to develop SNA study protocols	Respondents: 12 Average: 1.7	Respondents: 12 Average: 3.6
Familiarity with R software	Respondents: 12 Average: 1.4	Respondents: 11 Average: 3.5
Ability to work with datasets	Respondents: 12 Average: 2.1	Respondents: 12 Average: 3.9
Ability to produce SNA outputs using R software	Respondents: 12 Average: 1.2	Respondents: 11 Average: 3.5

Your rating for each aspect of the course

Ordered categories for assessment: Excellent 5 4 3 2 1 Very poor

a) Relevance of the course

Number of respondents (14): Average: **4.6**

b) Information provided prior to the workshop

Number of respondents (14): Average: **4.2**

c) Quality of the course notes during the training

Number of respondents (14): Average: **4.8**

d) Quality of the lectures

Number of respondents (14): Average: **4.9**

e) Quality of instruction on R software

Number of respondents (14): Average: **4.5**

f) Overall rating of the course in meeting your learning objectives

Number of respondents (13): Average: **4.7**

Annex I Agenda

Monday 11th February 2013

8:30-9:00h	<ul style="list-style-type: none"> Arrival and registration 	C. Ausui
9:00-9:30h	<ul style="list-style-type: none"> Opening speech by the Assistant Director General (ADG) of the Food and Agriculture Organization of the United Nations Regional Office for Asia and the Pacific (FAO-RAP) 	H. Konuma (ADG FAO-RAP)
9:30-10:30h	<ul style="list-style-type: none"> Introduction of organizers, trainer and participants Korean FMD project overview and socio-economic activities Context of this training and follow-up work General overview of the course: program 	J. Hinrichs A. Ortiz
10:30-11:00h	Coffee break	
11:00-11:45h	<ul style="list-style-type: none"> Introduction to network analysis. What is a network? The network paradigm. Applications of network analysis 	A. Ortiz
11:45-13:00h	Practical: <ul style="list-style-type: none"> Software packages for network analysis General Introduction to R software Introduction to datasets for practicals R software installation 	A. Ortiz
13:00-14:15h	Lunch break	
14:15-15:00h	<ul style="list-style-type: none"> Analysis of individual nodes. Centrality 	A. Ortiz
15:00-16:15h	Practical using R: <ul style="list-style-type: none"> Building a network Data manipulation Importing attribute data Visualising a network 	A. Ortiz
16:15-16:30h	Coffee break	
16:30-17:30h	<ul style="list-style-type: none"> Network data collection: network study design, data collection, sources of network data, sampling methods 	A. Ortiz

Tuesday 12th February 2013

9:00-10:15h	Practical using R: <ul style="list-style-type: none"> Analysis of individual nodes. Centrality 	A. Ortiz
10:15-11:00h	<ul style="list-style-type: none"> Analysis of a network: visualization, types of networks, demographics, connection, distance, cohesion, clustering 	A. Ortiz

11:00-11:30h	Coffee break	
11:30-12:15h	<ul style="list-style-type: none"> • Network topology. Models of network graphs 	A. Ortiz
12:15-13:30	Practical using R: <ul style="list-style-type: none"> • Analysis of a network 	A. Ortiz
13:30-14:45h	Lunch break	
14:45-15:30h	<ul style="list-style-type: none"> • Applications of network analysis to veterinary epidemiology (FMD) • Concept clarification: Terms and concepts: value chain, infection chain, network path... 	A. Ortiz
15:30-16:45h	Practical using R: <ul style="list-style-type: none"> • Network topology 	A. Ortiz
16:45-17:00h	Coffee break	
17:00-17:45h	<ul style="list-style-type: none"> • Analysis of groups and regions in a network 	A. Ortiz

Wednesday 13th February 2013

9:00-10:15h	Practical using R: <ul style="list-style-type: none"> • Analysis of groups and regions in a network: components, equivalence 	A. Ortiz
10:15-11:00h	<ul style="list-style-type: none"> • Sampling network data: partial network sampling methods, issues with network data 	A. Ortiz
11:00-11:30h	Coffee break	
11:30-12:00h	Group Exercise: <ul style="list-style-type: none"> • Description group exercise (4 groups) 	A. Ortiz
12:00-13:30h	Exercise: <ul style="list-style-type: none"> • Study design • Network data collection. 	A. Ortiz
13:30-14:45h	Lunch break	
14:45-16:00h	Exercise: <ul style="list-style-type: none"> • Network data input and analysis 	A. Ortiz

16:00-16:15h	Coffee break	
16:15-18:00h	Exercise: <ul style="list-style-type: none"> • Network data input and analysis • Preparation of presentations of exercise results 	A. Ortiz

Thursday 14th February 2013

9:00-10:30h	Exercise: <ul style="list-style-type: none"> • Presentation of exercise results 	A. Ortiz
10:30-10:45h	Coffee break	
10:45-12:15h	Other topics of network analysis: <ul style="list-style-type: none"> • Data manipulation • Statistical analysis of network data • Network modelling • Books, references and useful information 	A. Ortiz
12:15-12:30h	<ul style="list-style-type: none"> • Evaluation form 	T. Bui
12:30-13:30h	Lunch break	
13:30-14:30h	Presentation: <ul style="list-style-type: none"> • Experience in network analysis at Kasertsat University. Challenges and lessons learnt 	S. Kasemsuwan
14:30-15:30h	Presentation: <ul style="list-style-type: none"> • FMD situation and potential data for Social Network Analysis Cambodia Lao PDR Myanmar 	H. Sinel I. Phouangsouvanh Z. Min Latt
15:30-16:00h	Coffee break	
16:00-16:30h	Presentation: <ul style="list-style-type: none"> • FMD situation and potential data for Social Network Analysis Thailand Vietnam 	O. Arjkumpa. P. Thi Thu Hien

16:30-17:30h	Presentation <ul style="list-style-type: none"> Workshop to design studies to assess FMD risk using network analysis 	J. Hinrichs
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Friday 15th February 2013

08:30-10:30h	<ul style="list-style-type: none"> Group work discussion (country). Facilitators: Cambodia Lao PDR Myanmar Thailand Vietnam 	R. Morales S. Kasemsuwan K. Wongsathapornchai C. Poolkhet J. Hinrichs
10:30-11:00h	Coffee break	
11:00-12:30h	<ul style="list-style-type: none"> Group work discussion (country) 	
12:30-13:30h	Lunch break	
13:30-15:00h	<ul style="list-style-type: none"> Group work discussion (country) 	
15:00-16:30h	<ul style="list-style-type: none"> Presentation of proposed studies by country teams: Cambodia Lao PDR Myanmar Thailand Vietnam 	P. Peda I. Phouangsouvanh H. Min O. Arjkumpa P. Srisai P. Thi Thu Hien
16:30-17:00h	<ul style="list-style-type: none"> Closing remarks 	J. Hinrichs

Annex II List of participants (Attendance. All week if blank)

Cambodia

Mr. Holl Sinel

Chief of Animal Health Information Analysis
Office,
NaVRI/DAHP
Sangkat Stung Meanchey, Khan Meanchey, St.
371 (Sola), Phnom Penh
Tel : +855 92 450 275
Email: hollsinel@yahoo.com

Mr. Pich Peda

Vice Chief of Animal Health Office DAHP
Sangkat Stung Meanchey, Khan Meanchey, St.
371 (Sola), Phnom Penh
Tel : +855 89 697 986
Email: pichpeda@yahoo.com

Lao PDR

Mr. Viliddeth Souriya

Technician Staff, Epidemiology Unit
National Animal Health Center
Department of Livestock and Fisheries
Khounta tha village, Sikottabong Dist.,
Vientiane Capital, Lao PDR
Tel : +856 20 99530222
Email : souriyazz@gmail.com

Mr. Intha Phouangsouvanh

Virologist of Viral Unit
National Vaccine Production Center
Department of Livestock and Fisheries
Nongtaeng village, Sikottabong Dist.,
Vientiane Capital, Lao PDR
Tel: +856 20 56658959
Email: inthpsv@yahoo.com

Myanmar

Mr. Zin Min Latt

Researcher
Epidemiology Unit, LBVD Office
Ministry of Livestock and Fisheries
Naypyitaw Myanmar
Tel: +9567 408044/408262
Fax : +9567 408342
Mobile: +959 4211 23395
Email : icxyu69@gmail.com

Mr. Htun Min

Researcher
Epidemiology Unit, LBVD Office
Ministry of Livestock and Fisheries
Naypyitaw, Myanmar
Tel: +9567 408044/408262
Fax : +9567 408342
Mobile: +959 50 83113
Email : htunmin97@gmail.com

OIE (World Organisation for Animal Health)

Mr. Karanvir Kukreja (Mon and Fri)

Programme Officer
Sub-Regional Representative for Southeast Asia
c/o DLD, 69/1 Phaya Thai Road,
Ratchathewi 10400,
Bangkok, Thailand
Telp : +66-2-6534864
Fax : +66-2-6534904
E-mail : k.kukreja@oie.int; srr.seasia@oie.int

Thailand

Mr. Prakitsai Srisai

Senior Veterinary Officer
Nakhonphanom Provincial Livestock Office.
Central Avenue.
Nakhon Phanom 48000.
Tel. 0-4251-1029
Mobile: 081-8792177
Fax: 0-4251-1167
Email: prakitsai@hotmail.com;
pvlo_kop@dld.go.th

Ms. Supathida Pisek

Veterinary Officer
Mahasarakham Provincial Livestock Office
No. 157 Roadsarakham - Wapi Mahasarakham
44000.
Tel: 043 – 777960 – 1
Mobile: 085-0110166
Fax: 043 – 777961
Email: golfobia@hotmail.com;
pvlo_msk@dld.go.th

Ms. Orapun Arjkumpa

Veterinary Officer

Veterinary Research and Development Center
(Thung Song)
Veterinary Research and Development Center
(South Region)
124/2 Moo 7, Thung Song - Huay Yod, T. Wang,
A. Tung Song, Nakhon Si Thammarat 80110.
Tel: 0-7577-0008-9, 0-7577-0128-130
Mobile: 081-9792304
Email: arjkumpa@hotmail.com;
vrd_sp@dld.go.th.

Ms. Suwicha Kasemsuwan
Department of Veterinary Public Health
Faculty of Veterinary Medicine
Kasetsart University
Email: fvetswk@ku.ac.th

Mr. Chaithep Poolkhet
Department of Veterinary Public Health
Faculty of Veterinary Medicine
Kasetsart University
Tel: +6686 5580441
Email: fvetctp@ku.ac.th

Ms. Waraphon Phimprapai
Department of Veterinary Public Health
Faculty of Veterinary Medicine
Kasetsart University
Tel: +6634 351901-3
Mobile: +6681 8540091
Email: fvetwrp@ku.ac.th

Ms. Thitiwan Pattanasathienkul
Kasetsart University
Email: thitiwan.patanasathienkul@gmail.com.

Vietnam

Ms. Pham Thi Thu Hien
Staff – Epidemiology Division
Department of Animal Health
15/78 Phuong Mai road, Dong Da ward, Ha Noi,
Viet Nam
Tel: +84.4.38685104
Fax: +84.4.38686339
Mobile: + 84.912832516
Email: pthuhien@gmail.com

RAP

Mr. Subhash Morzaria (Mon morning)
Regional Manager
FAO RAP
39 Phra Athit Road

Bangkok 10200, Thailand
Tel: +66-2-697-4138
Fax: +66-2-697-4445
Mobile: +66-8-1827-5771
Email: subhash.morzaria@fao.org

Ms. Wantanee Kalpravidh (Monday)
Regional Project Coordinator
FAO RAP
39 Phra Athit Road
Bangkok 10200, Thailand
Tel: +66-2-697-4231
Fax: +66-2-697-4445
Mobile: +66-8-9203-2128
Email: wantanee.kalpravidh@fao.org

Mr. Mansub Shin
Regional Project Coordinator
FAO ECTAD -RAP
39 Phra Athit Road Bangkok 10200
Thailand
Tel: +662 697 4331
Fax: +662 697 4445
Email: mansub.shin@fao.org

Mr. Jan Hinrichs
Animal Health Economist
FAO ECTAD -RAP
39 Phra Athit Road Bangkok 10200
Thailand
Tel: +662 697 4169
Fax: +662 697 4445
Email: jan.hinrichs@fao.org

Mr. Angel Ortiz Pelaez
Social Network Analysis Expert
FAO ECTAD -RAP
39 Phra Athit Road Bangkok 10200
Thailand
Email: angortpel@yahoo.com

Mr. Kachen Wongsathapornchai (Friday)
Regional Support Unit (RSU) Coordinator
FAO RAP
39 Phra Athit Road
Bangkok 10200, Thailand
Tel: +66-2-697-4137
Fax: +66-2-697-4445
Mobile: +66-8-1830-1229
Email: kachen.wongsathapornchai@fao.org

Mr. Reildrin Morales
RSU Animal Health Officer
FAO ECTAD-RAP
39 Phra Athit Road Bangkok 10200

Thailand
Tel: +662 697 4220
Fax: +662 697 4445
Email: reildrin.morales@fao.org

Ms. Blesilda Verin (Monday)

EPT+ Regional Coordinator
FAO RAP
39 Phra Athit Road
Bangkok 10200, Thailand
Tel: +66-2-697-4104
Fax: +66-2-697-4445
Mobile: +66-8-4874-8909
Email: blesilda.verin@fao.org

Ms. Thuy Ha Bui (Thursday)

Regional Monitoring & Evaluation Officer

FAO ECTAD-RAP
39 Phra Athit Road Bangkok 10200
Thailand
Tel: +662 697 4375
Fax: +662 697 4445
Email: thuyha.bui@fao.org

Mr. Sothyra Tum (Mon-Tue-Wed)

Regional Support Unit (RSU) Regional
Epidemiologist Expert
FAO Regional Office for Asia and the Pacific
39 Phra Athit Road
Bangkok 10200, Thailand
Tel: +662 697 4150
Fax: + 662 697 4445
Email: sothyra.tum@fao.org

Annex III Presentations/training materials.

A memory USB drive was delivered to all participants including the following folders:

- Lectures: pdf files of all lectures (10)
- Practicals: pdf files of all practical sessions (5)
- Software: R software (exe file), two packages for download on to R software (sna and igraph) with manuals (pdf files) and a file with a short summary of R commands
- Datasets: all datasets used in the practical sessions
- Supplementary material: 21 scientific papers on applications of network analysis in veterinary epidemiology and a list of books on the subject

On Thursday 14th, an extra folder was delivered to all participants including:

- Four practical sessions with typos corrected
- Amended pdf file of lecture 3 (Analysis of individual nodes. Centrality)
- Two files including commands for data manipulation using R
- Two programmes for data manipulation using Pajek
- One document containing instructions for data manipulation using UCINET

The coordinator/director of the workshop (Jan Hinrichs) has a copy of the USB drive with all the material.