Pestforecast: Surveillance and early warning systems for climate sensitive diseases in Vietnam

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Pestforecast mid-term meeting
Hanoi, Vietnam
23 September 2016





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INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

PPRI

CGIAR RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security CCAFS

Outline

- Introduction of Pestforecast
- Progress update
- Preliminary results
- Future plans

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- Progress update
- Study design
- Preliminary results
- Future plans

Pestforecast

Main objective: develop tools to forecast climate sensitive diseases (CSD) in Vietnam

i) Developin

ii) Developin CSD

iii) Exploring lel for aflatoxins

Japanese encephalitis
- A vector-borne virus disease
- 3 billion people live in endemic areas
- Fatality rate reached 60% in humans
- Pigs are the main amplifying hosts

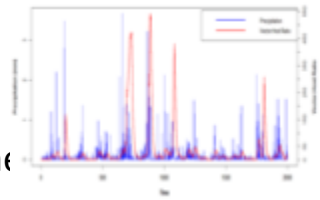
Leptospirosis
- A bacterial disease, outbreak is associated with heavy rainfall
- Fatality rate from 5% to 30% in humans
- Rodents, pigs, horses, dogs and sheep/goats are the common reservoirs.

Aflatoxin-associated diseases
- Toxin produced by Aspergillus spp.
- Fungi infect crops and animals via feed
- Responsible for around 1 in 4 human cases of live cancer

Early Warning and Forecasting System concept

Met-Data

Model developme
Forecast, mapping



Decision support tools

Notification to farmers

Public and Farmers

Responses
- Vaccination
- Harvesting
- Selling
- …

Climate sensitive diseases data
- Surveillance system
- Field survey

Adapted from ICRAF (2014)

Activity	Outputs/MS, achievements	Comments
Lit. review	Lit. review climate sensitive zoonotic diseases -JE, leptospirosis and aflatoxin in Vietnam	Completed
Coordinating project in Vietnam	**- CRA with NIVR and PPRI** - Midterm financial and technical reports - Project site visits (Son La, Son Tay and An Giang) - sampling, survey and lab analysis - Meeting: once a month **- Weather data** (last 30 years, ~2013) **- 28 infectious diseases in humans** (last 30 years, ~ 2013): *zoonotic, vector/water borne diseases which are affected by climate factors* *- Discussions with NIHE, MOH,HSPH and IMHEN* - Ethics approval	NIVR (ongoing) - Lepto (Not yet) - An Giang PPRI (completed)
Publications	- **Dengue** manuscript (submitted to PLOS NTD) - revision **- Shigella** manuscript (submitted to IDP) - **VE** manuscript (submitted to AJTMH) - revision	17May 2016 8 June 2016 13 June 2016
Research proposal	- Zoonotic diseases: EOI (USAID) - Zoonotic diseases (target: US$ 0.85 million, 3yrs): KOICA - collaboration with universities in Korea	17 June 2016 29 July 2016

Study design

Introduction of Partners in Vietnam

- **National Institute of Veterinary Research (NIVR)**
  - JE, leptospirosis and Aflatoxin M1 in swine
  - Urine/Serum samples from slaughterhouses
  - Demographic information will be collected
  - Perception / knowledge of diseases will be measures

- **Department of Animal Health (DAH) / FAO**
  - JE and leptospirosis in swine
  - Use of serum samples for EPT+ program and Swine influenza surveillance

- **Plant Protection Department (PPD)**
  - Aflatoxin B1 in maize
  - Maize samples from farms, local markets and retailers
  - Perception / knowledge of diseases will be measures

Introduction of Partners in Vietnam

- **Institute of Meteorology, Hydrology and Climate change (IMHEN)**
  - Climate data from 1960 to 2014 at province/station level
  - Precipitation, temperature, pressure and humidity etc..

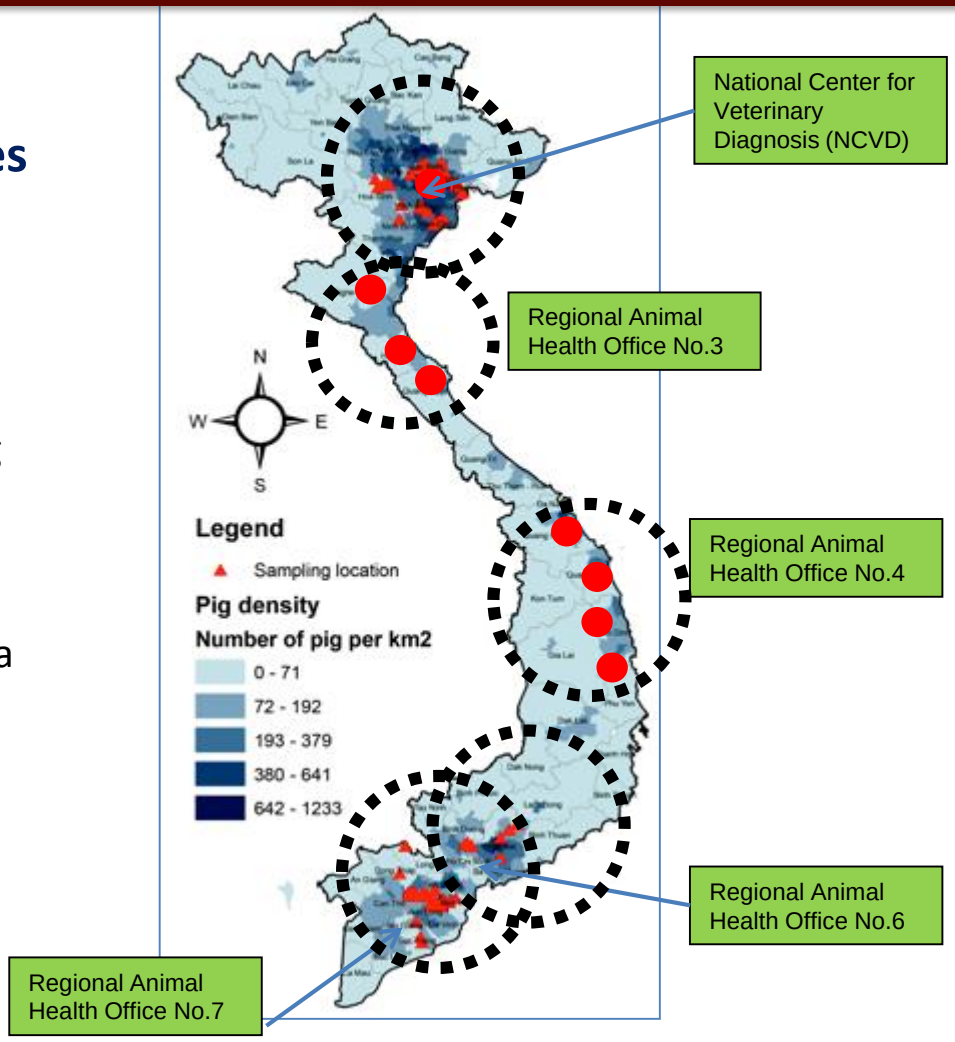
- **Ministry of Health (MoH) and Hanoi School of Public Health (HSPH)**
  - Human cases for viral encephalitis (VE) and leptospirosis from 1970 to 2013 at province level

Sampling areas in Vietnam (DAH) – JE and lepto

Sampling sites

19 Provinces

- North:
  - 1 Bac Ninh
  - 2 Ha Noi
  - 3 Hai Phong
  - 4 Vinh Phuc
  - 5 Ha Nam
  - 6 Hung Yen
  - 7 Thanh Hoa
  - 8 Nghe An
  - 9 Ha Tinh



- Central
  - 10 Quang Nam
  - 11 Quang Ngai
  - 12 Phu Yen
  - 13 Binh Dinh

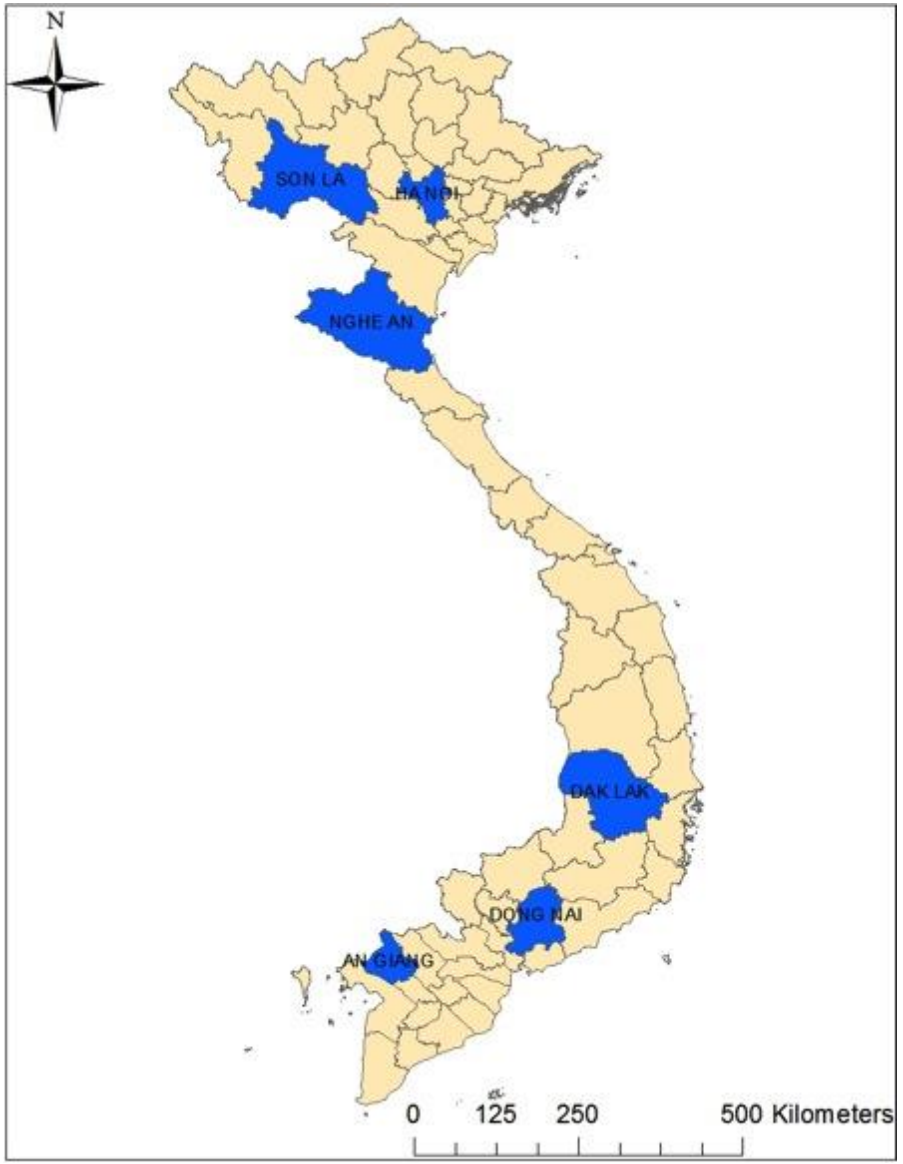
- South:
  - 14 Dong Thap
  - 15 Vinh Long
  - 16 Dong Nai
  - 17 Ben Tre
  - 18 Binh Duong
  - 19 Soc Trang

No. of samples (Sow)	No. of samples (Piglet)	Total samples
740	1,690	2,430

EPT+

Sampling areas in Vietnam (NIVR and PPD)

- 6 provinces based on agro-ecological zones
- 2,310 maize/swine urine samples
  - 385 samples / province
  - Aflatoxin B1&M1
- 1,936 swine serum samples
  - 323 samples / province
  - JE and leptospirosis
- Demographic information will be collected

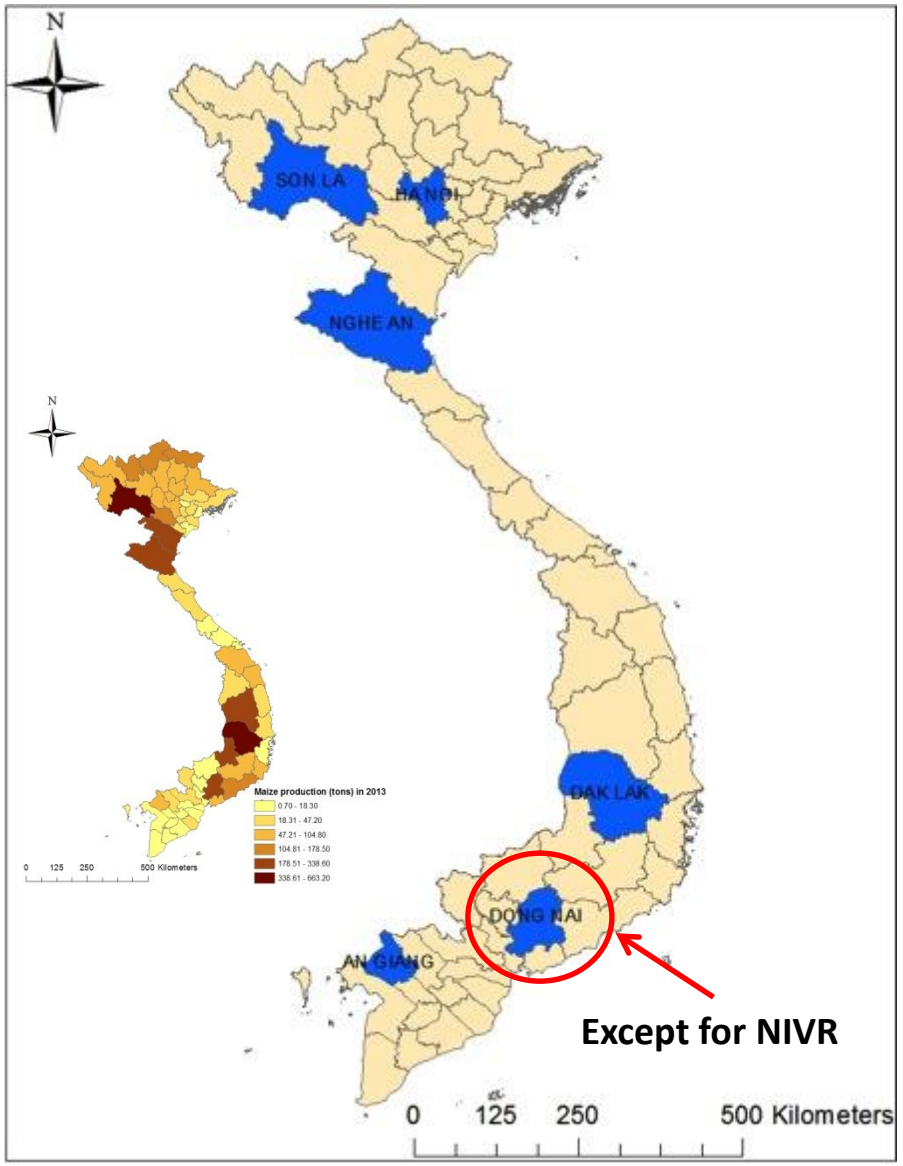


Sampling areas (NIVR and PPRI)

- Swine urine/sera samples from 5 provinces (excluding Dong Nai)
  - NIVR (target samples: 1,925)
  - 385 samples / province
  - Slaughterhouses
  - JE, Lepto(sera)&AFM1(urine)
  - sampling information & Questionnaires (ongoing)

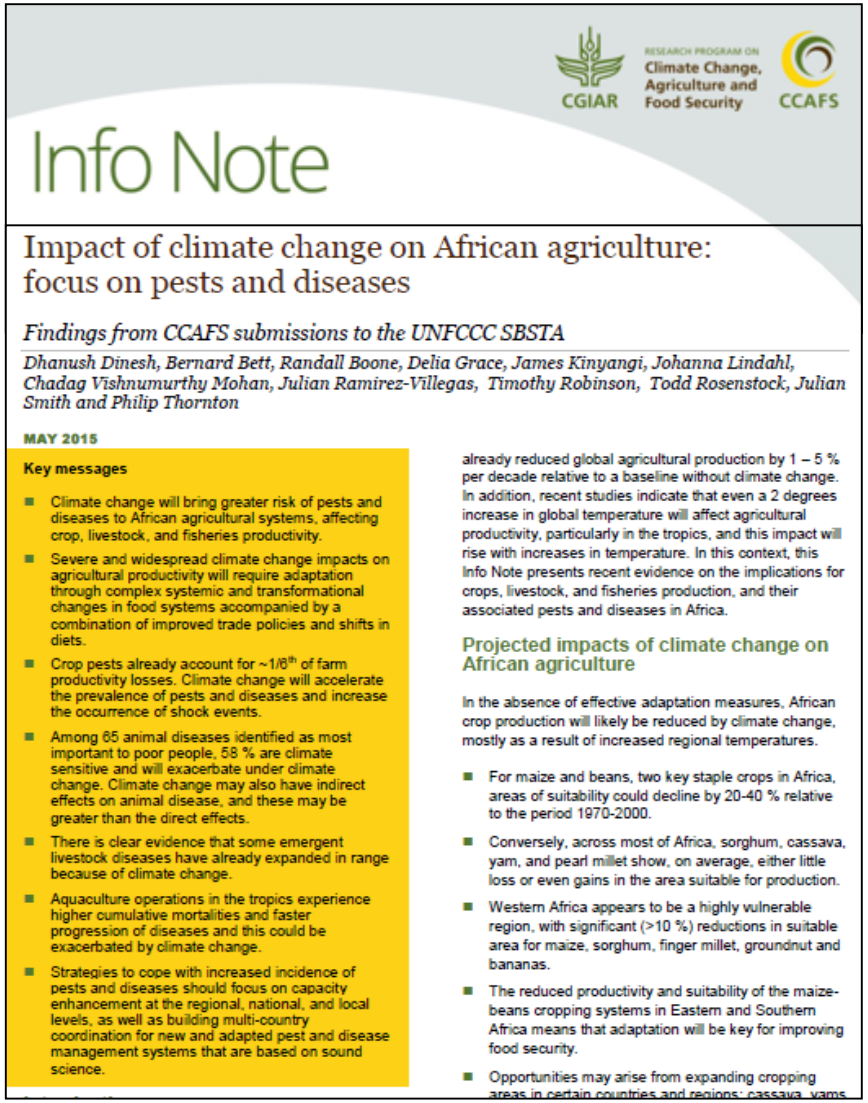
- Maize samples from 6 provinces
  - PPRI (target samples: 2,310)
  - 385 samples / province
  - Aflatoxin B1
  - sampling information & Questionnaires (558 people)

Sample size (each province): 50% prevalence, 95% CI, precision 5%



Preliminary results

Some early outputs



CGIAR RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security CCAFS

Info Note

Impact of climate change on African agriculture: focus on pests and diseases

Findings from CCAFS submissions to the UNFCCC SBSTA

Dhanush Dinesh, Bernard Bett, Randall Boone, Delia Grace, James Kinyangi, Johanna Lindahl, Chadag Vishnumurthy Mohan, Julian Ramirez-Villegas, Timothy Robinson, Todd Rosenstock, Julian Smith and Philip Thornton

MAY 2015

Key messages

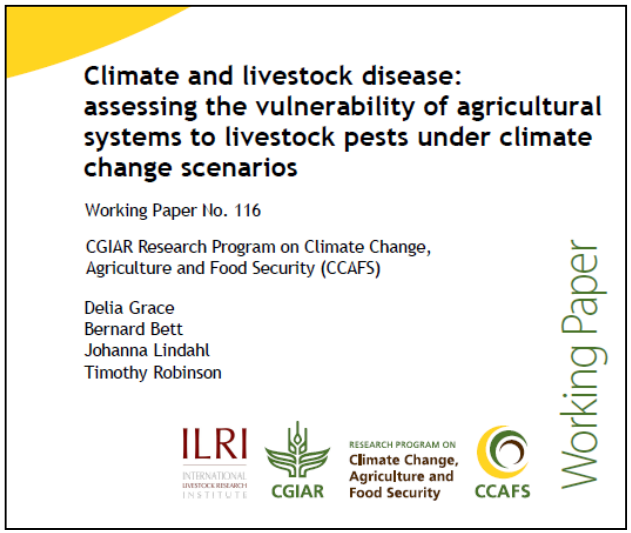
- Climate change will bring greater risk of pests and diseases to African agricultural systems, affecting crop, livestock, and fisheries productivity.
- Severe and widespread climate change impacts on agricultural productivity will require adaptation through complex systemic and transformational changes in food systems accompanied by a combination of improved trade policies and shifts in diets.
- Crop pests already account for ~1/6th of farm productivity losses. Climate change will accelerate the prevalence of pests and diseases and increase the occurrence of shock events.
- Among 65 animal diseases identified as most important to poor people, 58 % are climate sensitive and will exacerbate under climate change. Climate change may also have indirect effects on animal disease, and these may be greater than the direct effects.
- There is clear evidence that some emergent livestock diseases have already expanded in range because of climate change.
- Aquaculture operations in the tropics experience higher cumulative mortalities and faster progression of diseases and this could be exacerbated by climate change.
- Strategies to cope with increased incidence of pests and diseases should focus on capacity enhancement at the regional, national, and local levels, as well as building multi-country coordination for new and adapted pest and disease management systems that are based on sound science.

already reduced global agricultural production by 1 – 5 % per decade relative to a baseline without climate change. In addition, recent studies indicate that even a 2 degrees increase in global temperature will affect agricultural productivity, particularly in the tropics, and this impact will rise with increases in temperature. In this context, this Info Note presents recent evidence on the implications for crops, livestock, and fisheries production, and their associated pests and diseases in Africa.

Projected impacts of climate change on African agriculture

In the absence of effective adaptation measures, African crop production will likely be reduced by climate change, mostly as a result of increased regional temperatures.

- For maize and beans, two key staple crops in Africa, areas of suitability could decline by 20-40 % relative to the period 1970-2000.
- Conversely, across most of Africa, sorghum, cassava, yam, and pearl millet show, on average, either little loss or even gains in the area suitable for production.
- Western Africa appears to be a highly vulnerable region, with significant (>10 %) reductions in suitable area for maize, sorghum, finger millet, groundnut and bananas.
- The reduced productivity and suitability of the maize-beans cropping systems in Eastern and Southern Africa means that adaptation will be key for improving food security.
- Opportunities may arise from expanding cropping areas in certain countries and regions: cassava, yams



Climate and livestock disease: assessing the vulnerability of agricultural systems to livestock pests under climate change scenarios

Working Paper No. 116

CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)

Delia Grace
Bernard Bett
Johanna Lindahl
Timothy Robinson

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Working Paper

Forum

EcoHealth

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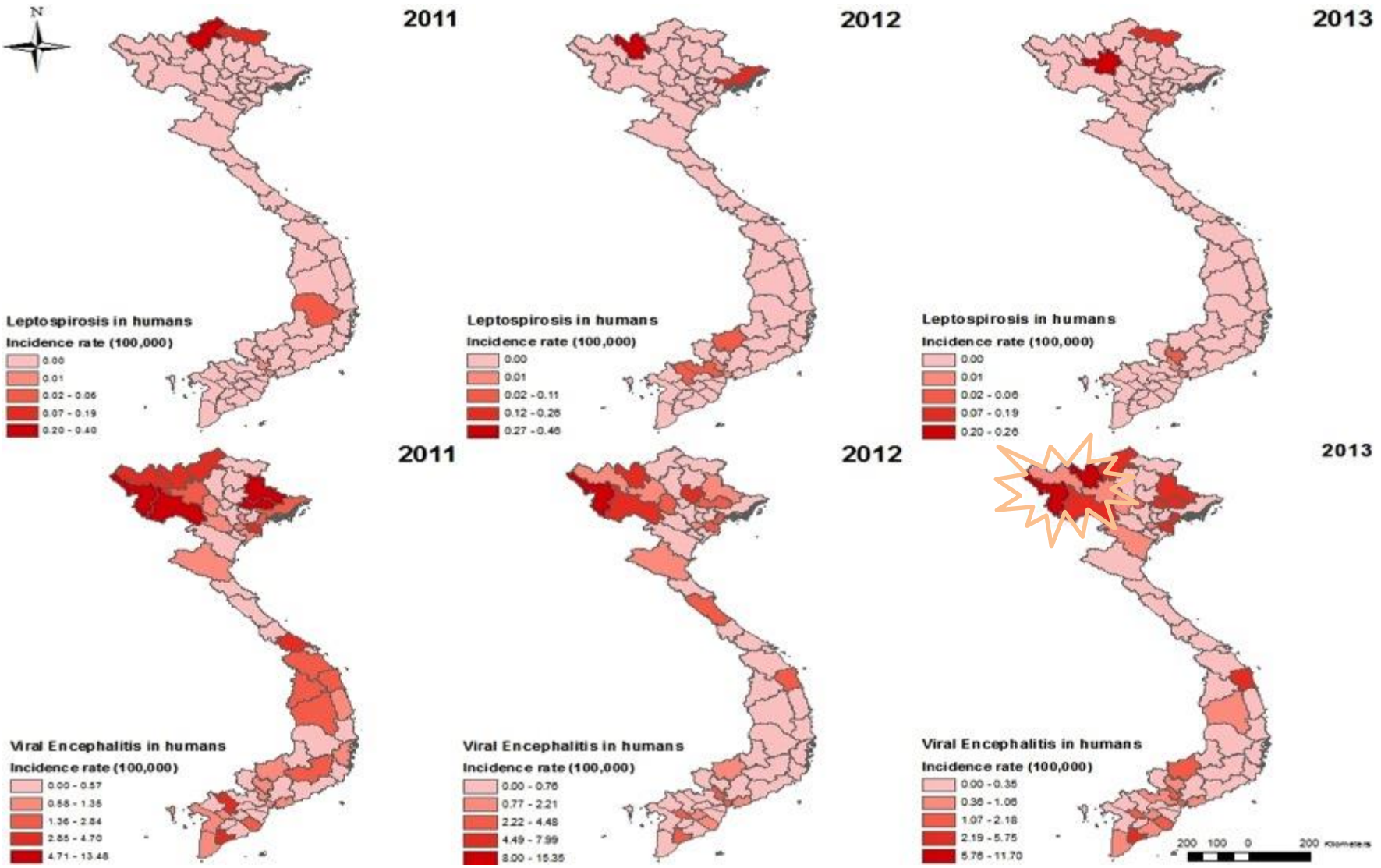
Toward Operational Criteria for Ecosystem Approaches to Health

Carsten H. Richter,[1,2] Jennifer A. Steele,[3] Hung Nguyen-Viet,[4,5] Jianchu Xu,[6] and Bruce A. Wilcox[7]

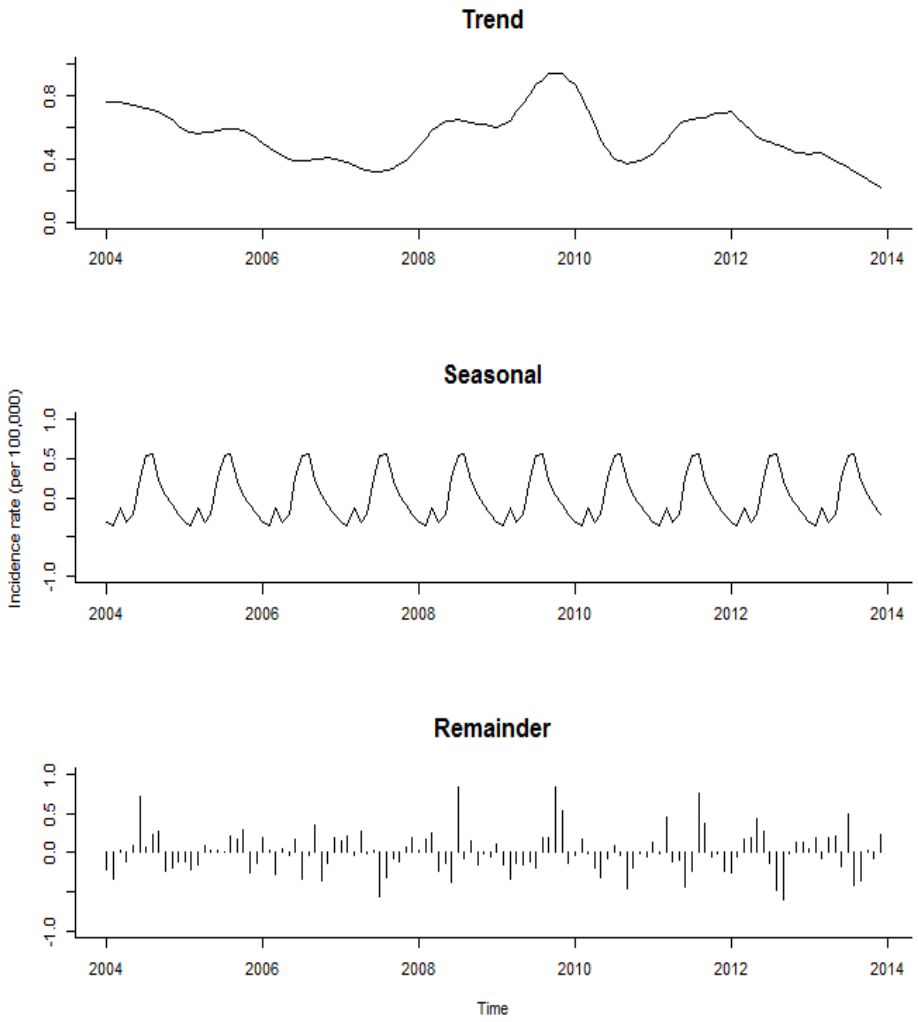
Systematic literature review of zoonotic diseases and aflatoxins in Vietnam

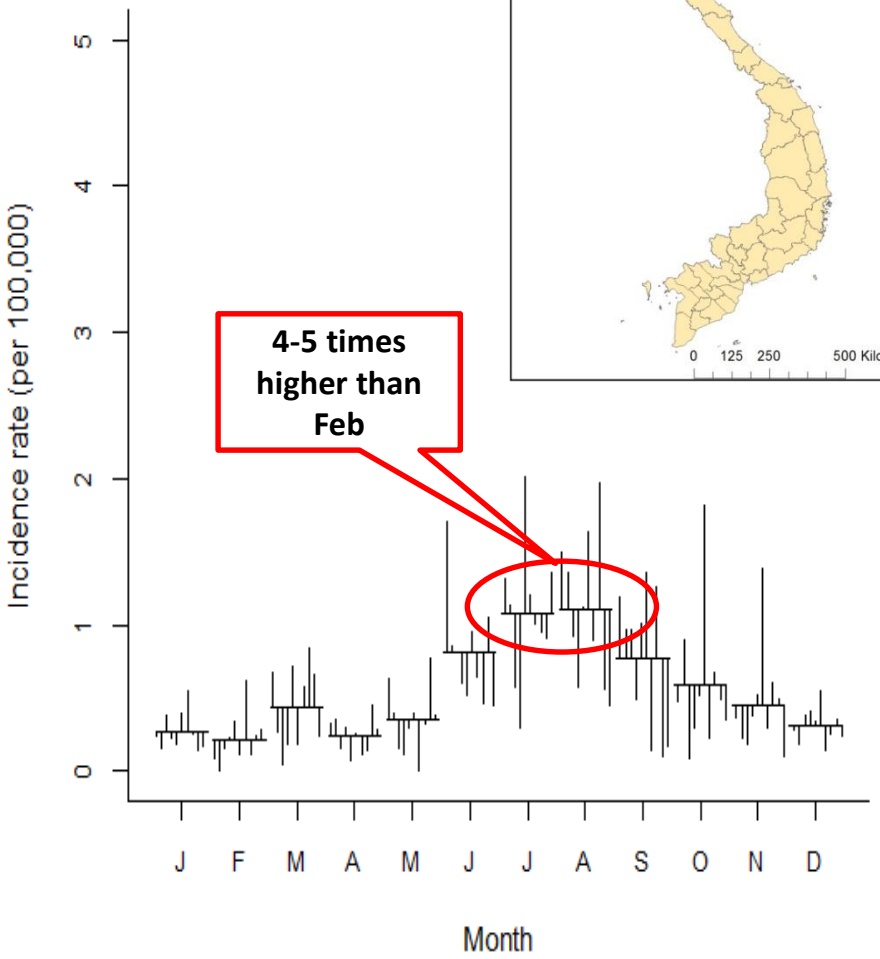
Annual incidence rates for lepto and VE in humans



*Previous study showed that 17~71% of VE were caused by JE in Vietnam

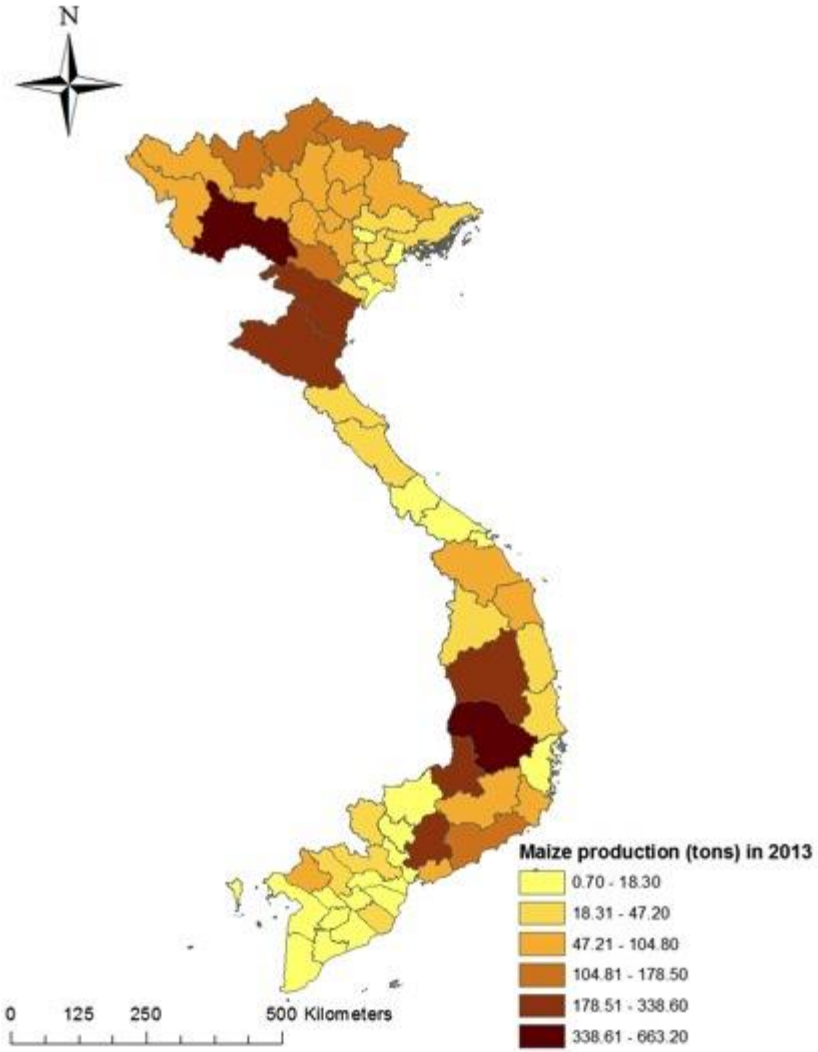
Seasonality of VE in humans between 2004 and 2013 (Dien Bien, Hoa Binh, Lai Chau and Son La)

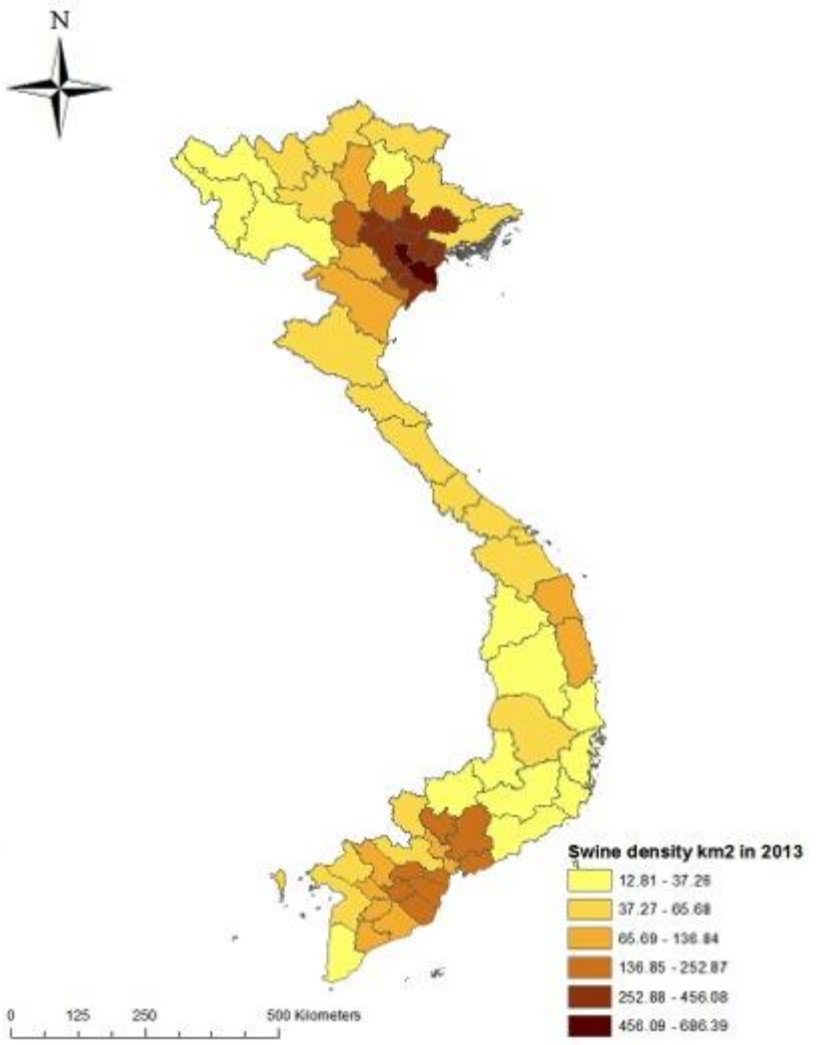




*Previous study showed that 17~71% of V

Maize production (tons) and swine density (km^2) in 2013





JE results in pigs - NIVR

JE OD
< 0.2 --> Negative
0.2-0.4 --> Suspected
> 0.4 --> Positive

Provine	District	Tested samples	ELISA results (no. of pos.)			ELISA results (% of pos.)		
			Pos	Sus	Neg	%pos	% sus	% neg
	All total	1538	76	57	1405	4.94	3.71	91.35
Daklak	***Total***	***385***	***6***	***9***	***370***	***1.56***	***2.34***	***96.10***
Daklak	Buôn Đôn	81	0	2	79	0.00	2.47	97.53
Daklak	Cư Mgar	77	2	0	75	2.60	0.00	97.40
Daklak	Krông Bôr	67	0	0	67	0.00	0.00	100.00
Daklak	M'Đrăk	79	0	0	79	0.00	0.00	100.00
Daklak	TP. Buôn I	81	4	7	70	4.94	8.64	86.42
Hà Nội	***Total***	***389***	***47***	***34***	***308***	***12.08***	***8.74***	***79.18***
Hà Nội	Chương M	57	10	7	40	17.54	12.28	70.18
Hà Nội	Đan Phượ	80	2	4	74	2.50	5.00	92.50
Hà Nội	Hoài Đức	56	8	2	46	14.29	3.57	82.14
Hà Nội	Thanh Oai	106	20	14	72	18.87	13.21	67.92
Hà Nội	Vạn Phúc	90	7	7	76	7.78	7.78	84.44
Nghệ An	***Total***	***380***	***12***	***9***	***359***	***3.16***	***2.37***	***94.47***
Nghệ An	Diễn Châu	73	0	0	73	0.00	0.00	100.00
Nghệ An	Đô Lương	77	0	3	74	0.00	3.90	96.10
Nghệ An	Nam Đàn	68	5	0	63	7.35	0.00	92.65
Nghệ An	TP. Vinh	95	6	5	84	6.32	5.26	88.42
Nghệ An	Yên Thành	67	1	1	65	1.49	1.49	97.01
Sơn La	***Total***	***384***	***11***	***5***	***368***	***2.86***	***1.30***	***95.83***
Sơn La	Mai Sơn	77	7	1	69	9.09	1.30	89.61
Sơn La	Mộc Châu	77	0	0	77	0.00	0.00	100.00
Sơn La	Thuận Châ	76	0	0	76	0.00	0.00	100.00
Sơn La	TP Sơn La	77	4	3	70	5.19	3.90	90.91
Sơn La	Yên Châu	77	0	1	76	0.00	1.30	98.70

Leptospirosis results in pigs - NIVR

- 16 serovars are tested using MAT (Microscopic Agglutination Test)
- All samples will be tested by the end of June (Except for An Giang)

Province	District	No. of Samples	No. of positive samples	Sero-positive (%)	Identified serovars
Hanoi	Van Phcu	90	5	9.09	*L. Autumnalis(1)* *L. Javanica (2)* *L. Tarassovi Mitis Johnson (1)* *L. Sejroe (1)*
Son La	Moc Chau	77	1	1.30	*L. Tarassovi Mitis Johnson (1)*
Son La	Yen Chau	77	18	23.38	*L. Australis (6)* *L. Autumnalis(3)* *L. Hebdomadis (1)* *L. Icterohaemorrhagiae (2)* *L. Javanica (3)* *L. Tarassovi Mitis Johnson (1)*
Total		***209***	***24***	***11.48***	

Aflatoxin M1 results in pigs - NIVR

Range: 0.02~ 13.66 ppb

Province	Tested samples (confirmed)	Positive samples (>5 ppb)	Positive % With 95% CI	Positive samples (>20 ppb)	Positive % With 95% CI
Hanoi	385	3	0.78 (0.16-2.26)	0	3.78 (2.13-6.16)
Nghe An	375	0	0	0	0.75 (0.15-2.18)
Son La	383	26	6.79 (4.48-9.79)	0	0
Dak Lak	384	2	0.52 (0.06-1.87)	2	0.52 (0.06-1.87)

Aflatoxin B1 in Maize - PPRI

Max. acceptable level for aflatoxins in each country
- 5 ppb - Vietnam (human) , (animal feed X)
- 20 ppb - USA (?)
- 4 ppb – EU (?)
- 10 ppb – Kenya (?)

Province (Hu:An)	Tested samples	Positive samples (>5 ppb)	Positive % With 95% CI	Positive samples (>20 ppb)	Positive % With 95% CI
Hanoi (13:384)	397 (327)	163	41.06 (36.18-46.07)	15	3.78 (2.13-6.16)
An Giang (131:268)	400 (197)	64	16 (12.5-20.0)	3	0.75 (0.15-2.18)
Dak Lak (184:195)	389 (336)	13	3.34 (1.79-5.65)	0	0
Dong Nai (194:201)	395 (356)	157	39.75 (34.89-44.76)	7	1.77 (0.72-3.62)
Nghe An (3:391)	394 (229)	87	62.69 (57.70-67.48)	12	3.05 (1.58-5.26)
Son La (0:395)	395 (334)	203	51.39 (46.34-56.42)	4	1.01 (0.28-2.57)
Total	2,370 (1,779)	687	28.99 (27.17-30.86)	41	1.73 (1.24-2.34)

Future Plans

- Building a website: update on the progress of Pestforecast (wiki)
- Master student (VNUA): aflatoxin in Maize, supervised by Hu Suk, Hung and Prof. Thuy (Dean of VUNA)
- Developing more manuscripts using secondary datasets as well as Pestforecast data
  - Potential papers: 3 or 4 (JE, lepto and aflatoxin)
  - GIS works with Bernard
    - Maybe starting with Dengue and Malaria or enteric diseases
  - Aflatoxin with Johanna and Hung
- Workshop: Oct or Nov 2016
- CCAFS Flagship 2 Science Meeting, 17-19 October, NY USA
- Conference of research workers in animal diseases (CRWAD) in Chicago: Dec 2016 -> topic might be lepto in pigs
- Sampling during the rainy season in Vietnam & activities in Laos
- CCAFS dairy production project in Indonesia (~ April 2019)
  - Development of historical maps on climate sensitive diseases

Thank you

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