Surveillance and early warning systems for climate sensitive diseases in Vietnam

Hung Nguyen-Viet, Hu Suk Lee, PD Phuc, NV Khong, HM Thanh, BN Vuong, NV Huyen, Johanna Lindahl, Bernard Bett, Fred Unger and Delia Grace

3rd annual progress reporting and coordinating meeting on CCAFS projects and climate-smart village implementation in Southeast Asia

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20–22 November 2017

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INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

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RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security

CGIAR CCAFS

Pestforecast

Objective: to develop tools to forecast climate-sensitive animal diseases in Vietnam

i) Developing and disseminating maps of hotspots of climate-sensitive animal and zoonotic diseases in Vietnam;

ii) Developing and piloting a real-time prediction system for climate sensitive diseases

iii) Exploring the potential for weather-based forecasting for aflatoxin mitigation in Vietnam

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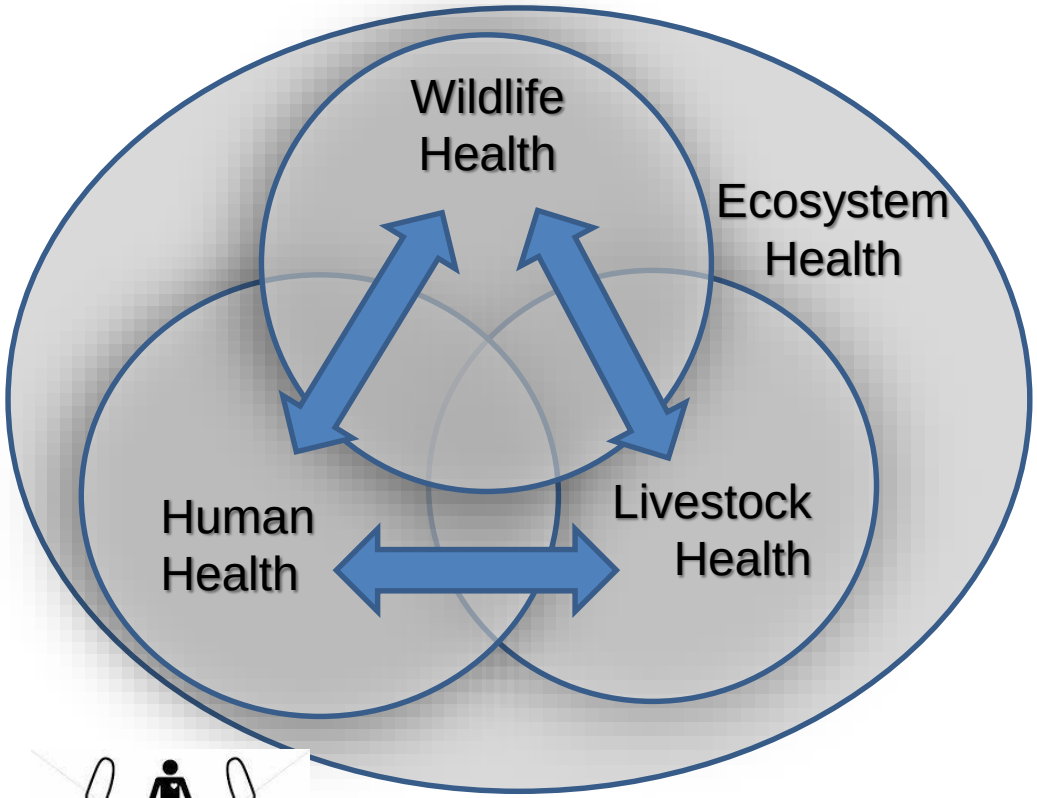
One health approach & issues

Animal/Plant – Human – Environmental Health

Focus hazards and risks

- Zoonoses

- Aflatoxin in maize



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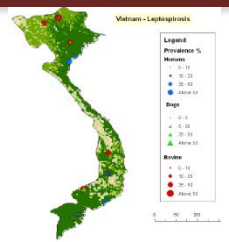
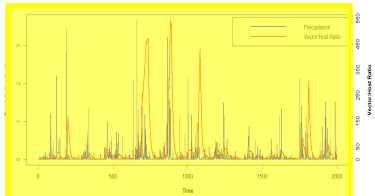
Activities: Early Warning and Forecasting System concept





Maps of hotspots of zoonotic diseases	Real-time prediction tool (eg., for leptospirosis and JE)	Aflatoxin mitigation in Vietnam	Climate service and EWS for rubber plantations in Laos
-Systematic literature review on CSDs -Risk maps, maps of hot spots	-Climate-based prediction tool development -Dynamic models -Models validation	-Risk-prediction model of toxin accumulation -Value chain assessment -Aflatoxins levels survey	-Mapping rubber distribution -Climatic risk assessment -Real-time forecasting system

Decision support tools

Notification to farmers

Responses

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Partners

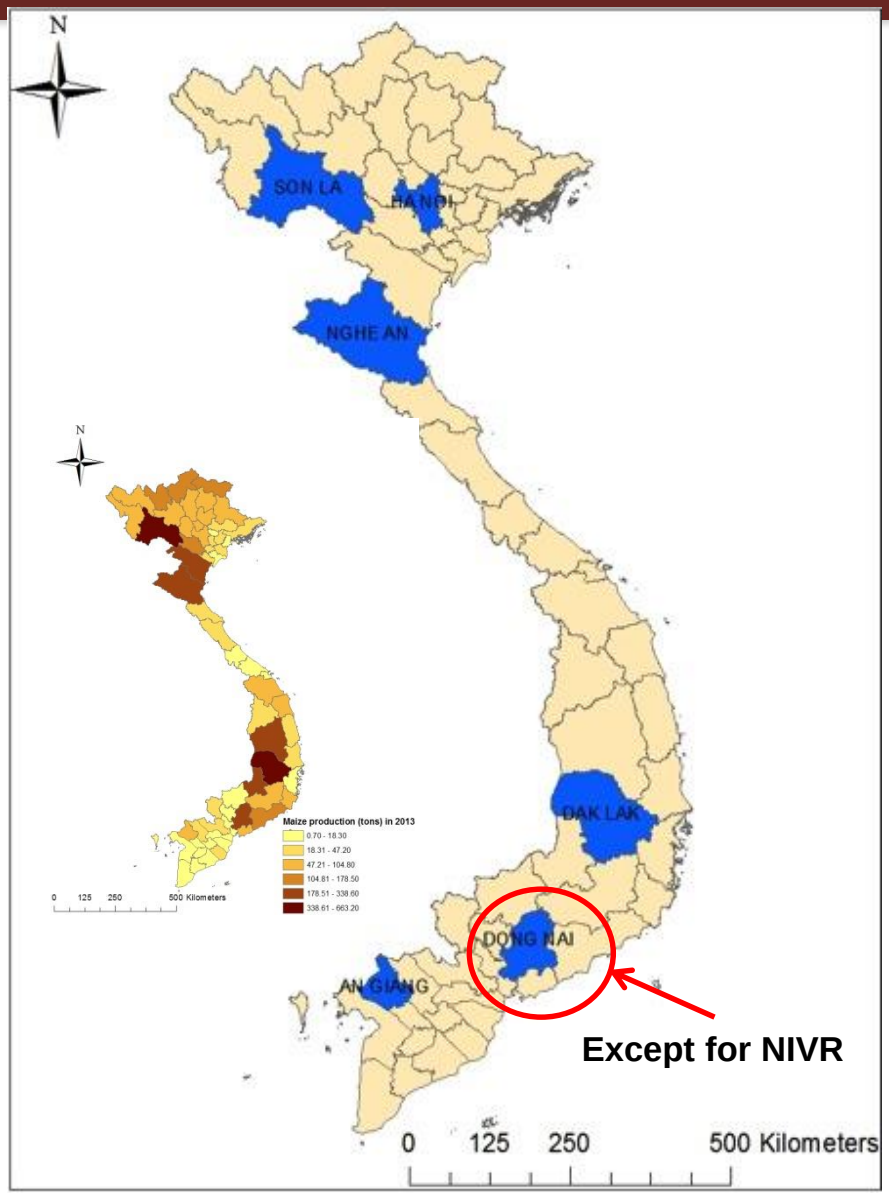
- NIVR
- PPRI
- Hanoi University of Public Health and NIHE
- IMHEN
- Sub-DAHs

Sampling areas

- Swine urine/sera samples from 5 provinces
  - Total sample: 1,925
  - 385 samples / province
  - JE, Lepto(sera) and AFM_1(urine)
  - KAP survey (252 people)

- Maize samples from 6 provinces
  - Total sample: 2,310
  - 385 samples / province
  - AFB_1
  - KAP survey (551 people)

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



Research Team - NIVR

Blood Sampling - Slaughterhouses

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Research Team - PPRI

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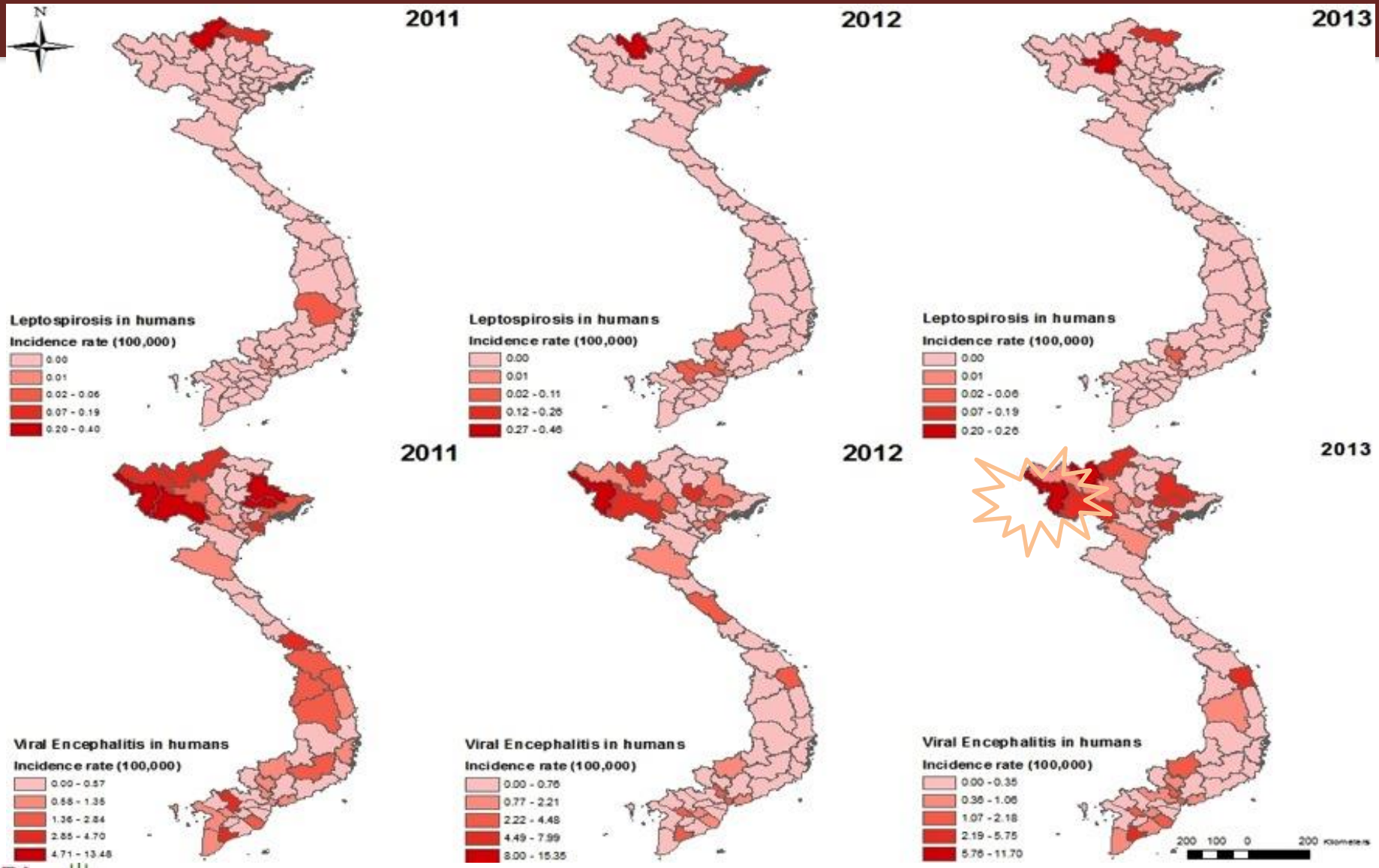
Results and Outputs

Annual incidence rates for lepto and VE in humans



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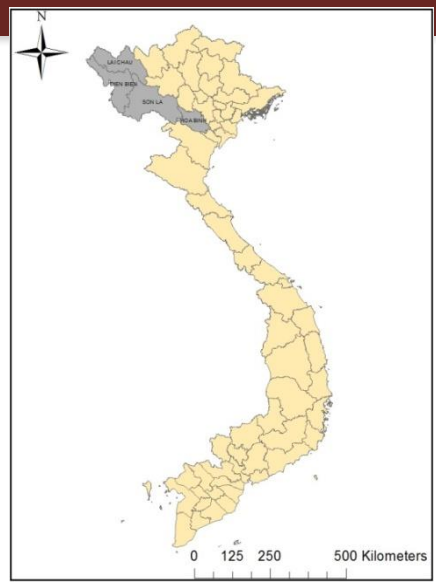
*Previous study showed that 17~71% of VE were caused by JE in Vietnam

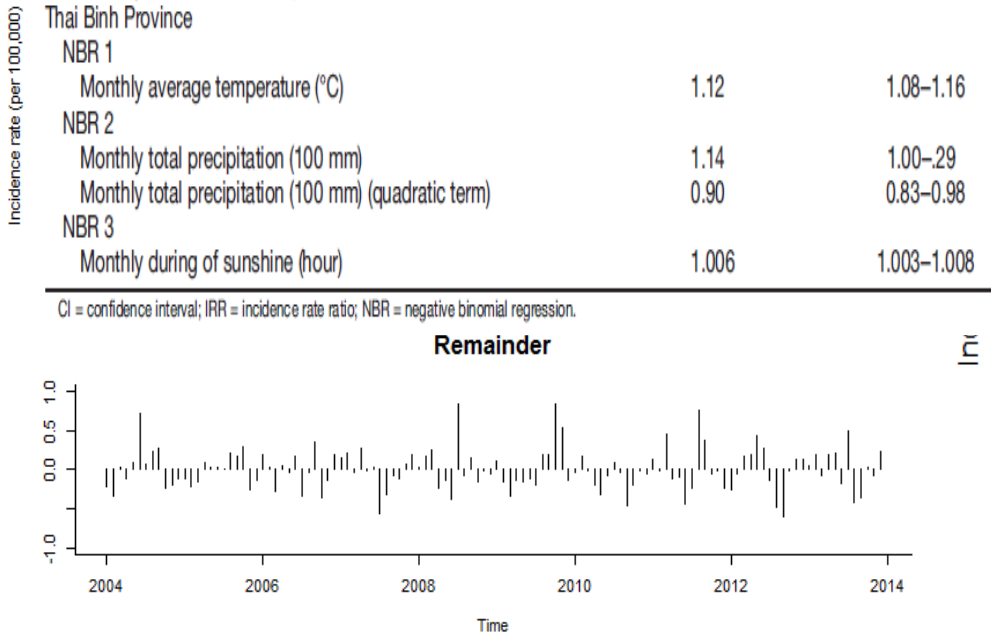
Seasonality of VE in humans between 2004 and 2013

Final NBR models with associated risk factors of viral encephalitis incidence rates in Son La and Thai Binh Provinces, 2004–2013.

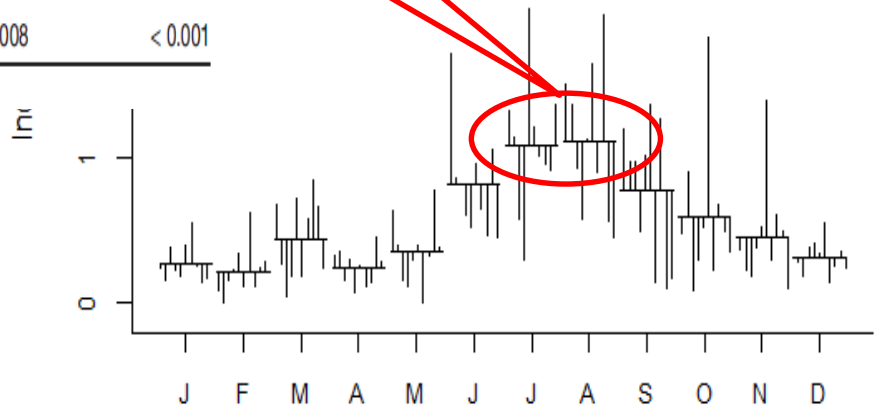
Province/variable	Adjusted IRRs	95% CI	*P* value
Son La Province			
NBR 1			
Monthly average temperature (°C)	1.04	1.00–1.08	0.043
Monthly average humidity (%)	1.07	1.03–1.10	0.001
Monthly average humidity (%) (quadratic term)	1.01	1.00–1.01	0.002
NBR 2			
Monthly total precipitation (100 mm) in the preceding month	1.23	1.06–1.41	0.005
Monthly total precipitation (100 mm) in the same month	1.21	1.04–1.41	0.013
Thai Binh Province			
NBR 1			
Monthly average temperature (°C)	1.12	1.08–1.16	< 0.001
NBR 2			
Monthly total precipitation (100 mm)	1.14	1.00–.29	0.043
Monthly total precipitation (100 mm) (quadratic term)	0.90	0.83–0.98	0.011
NBR 3			
Monthly during of sunshine (hour)	1.006	1.003–1.008	< 0.001

CI = confidence interval; IRR = incidence rate ratio; NBR = negative binomial regression.





4-5 times higher than Feb



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

Distribution of aflatoxin B1 levels in maize for food and feed from six provinces

Province	Purpose (n)	No. with aflatoxin level >2 µg/kg (% with 95% CI)	No. with aflatoxin level >5 µg/kg (% with 95% CI)	Mean[1]
Hanoi	Human consumption (13)	3 (23.08%, 5.04-53.81)	3 (23%, 50.38-53.81)	7.8
	Animal feed (384)	181 (47.14%, 42.05-52.26)	160 (41.67%, 36.69-46.77)	11.8
Son La	Human consumption (0)			
	Animal feed (395)	230 (58.23%, 53.19-63.14)	203 (51.39%, 46.34-56.42)	12.0
Nghe An	Human consumption (3)	1 (33.33%, 0.84-90.57)	1 (33.33%, 0.84-90.57)	11.0
	Animal feed (391)	111 (28.39%, 23.97-33.14)	86 (21.99%, 17.99-26.43)	10.4
Dak Lak	Human consumption (187)	9 (4.81%, 2.22-8.94)	9 (4.81%, 2.22-8.94)	9.4
	Animal feed (202)	5 (2.48%, 1.09-5.69)	4 (1.98%, 0.54-4.99)	8.2
Dong Nai	Human consumption (194)	86 (44.33%, 37.22-51.62)	68 (35.05%, 28.36-42.21)	11.2
	Animal feed (201)	103 (51.24%, 44.11-58.34)	89 (44.28%, 37.29-51.44)	11.7
An Giang	Human consumption (131)	43 (32.82%, 24.88-41.57)	41 (31.06%, 23.30-39.70)	10.4
	Animal feed (269)	27 (10.04%, 6.72-14.27)	23 (8.55%, 5.50-12.55)	7.0

[1] Mean and median were calculated from the samples above the limit of detection (LOD); >1 µg/kg).

- 5 µg/kg: tolerated level for feedstuffs for dairy cattle in Europe
- 20 µg/kg and 300 µg/kg: FDA guidelines for total aflatoxin levels in animal feeds

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Distribution of aflatoxin M_1 levels in pigs from five provinces in Vietnam

Province (No.)	Samples above LOD (% with 95% CI)*	Mean (µg/kg)*	Median (µg/kg)*	Range (µg/kg)*
Hanoi (385)	292 (75.84, 95% CI 71.25-80.04)	0.41	0.19	<LOD - 8.05
Son La (383)	316 (82.51, 95% CI 78.32-86.18)	1.23	0.32	<LOD - 7.35
Nghe An (375)	245 (65.33, 95% CI 60.28-70.15)	0.24	0.18	<LOD - 1.42
Dak Lak (384)	167 (43.49, 95% CI 38.47-48.61)	0.50	0.18	<LOD - 13.66
An Giang (393)	15 (3.82, 95% CI 2.15-6.22)	0.19	0.17	<LOD - 0.30
Total (1,920)	1,035 (53.90, 95% CI 51.64-56.15)	0.63	0.20	<LOD - 13.66

*Mean and median were calculated from the samples above limit of detection (LOD ≥ 0.15 µg/kg)

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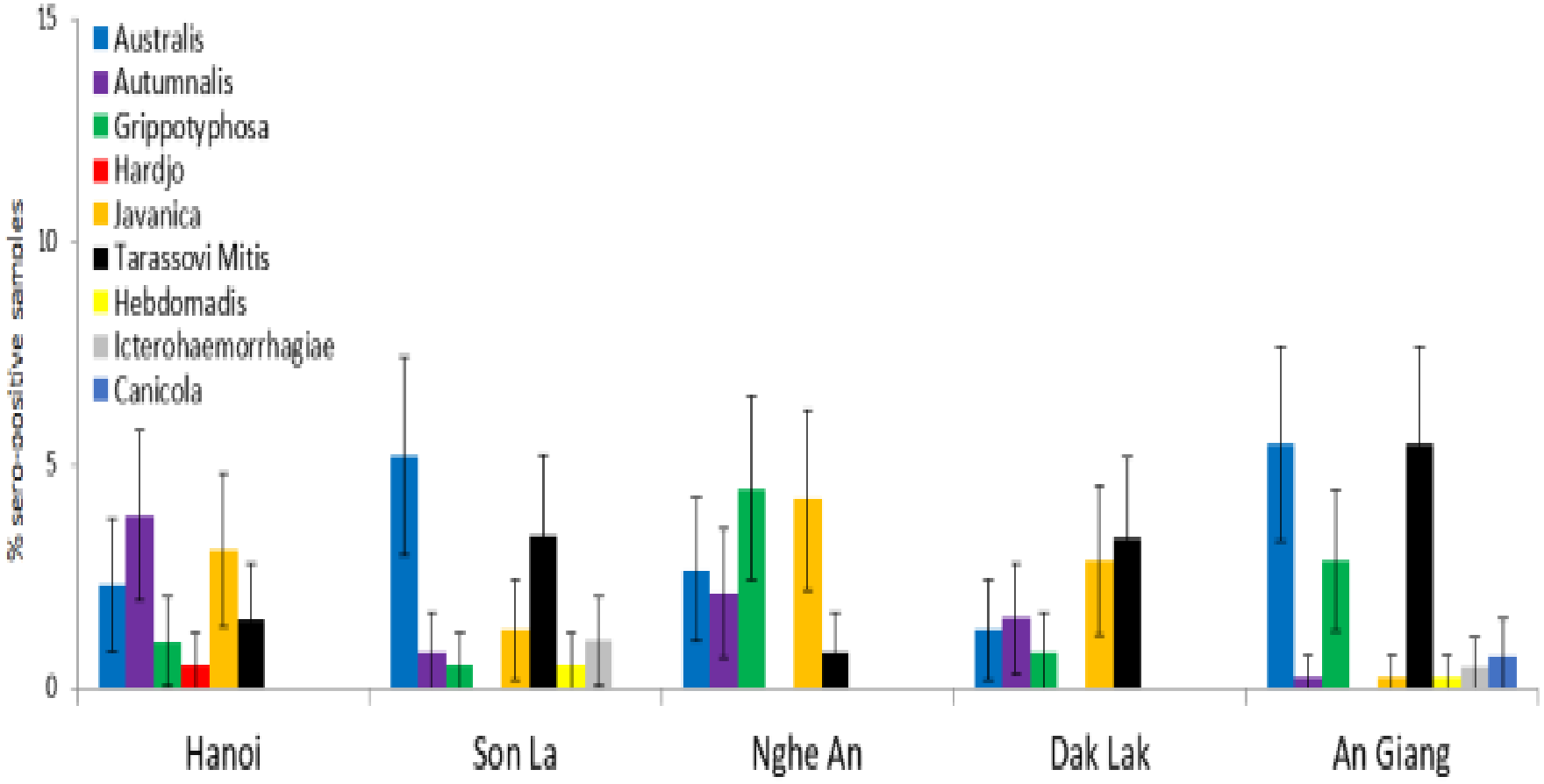
Leptospirosis sero-positive samples by serovar in pigs



Percentage with 95% confidence interval of sero-positive samples by serovar in each province using cutoff titer ≥ 1:100

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Japanese encephalitis in pigs

Province (No.)	Positive samples (% with 95% CI)	Suspected samples (% with 95% CI)
Hanoi (389)	47 (12.08, 95% CI: 9.01-15.74)	34 (8.74, 95% CI: 6.12-12.00)
Son La (384)	11 (2.86, 95% CI: 1.44-5.07)	5 (1.30, 95% CI: 0.4-3.01)
Nghe An (380)	12 (3.16, 95% CI: 1.64-5.45)	9 (2.37, 95% CI: 1.09-4.45)
Dak Lak (385)	6 (1.56, 95% CI: 0.57-3.36)	9 (2.34, 95% CI: 1.07-4.39)
An Giang (420)	2 (0.48, 95% CI 0.06-1.71)	4 (0.95, 95% CI 0.26-2.42)
Total (1,958)	78 (3.98, 95% CI: 3.16-4.95)	59 (3.01, 95% CI: 2.30-3.87)

Table 2. Seroprevalence of JE in pigs from five provinces in Vietnam

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Scientific outputs (2015-Present)

Forum

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]

DOI 10.1186/s12917-017-1044-1 BMC Veterinary Research

RESEARCH ARTICLE Open Access

Sero-prevalence of specific *Leptospira* serovars in fattening pigs from 5 provinces in Vietnam

Hu Suk Lee[1*], Nguyen Viet Khong[2], Huyen Nguyen Xuan[2], Vuong Bui Nghia[2], Hung Nguyen-Viet[1] and Delia Grace[3]

Am. J. Trop. Med. Hyg., 96(1), 2017, pp. 110–117
doi:10.4269/ajtmh.16-0471

Seasonality of Viral Encephalitis and Associated Environmental Risk Factors in Son La and Thai Binh Provinces in Vietnam from 2004 to 2013

Hu Suk Lee,[1*] Hung Nguyen-Viet,[1] Mihye Lee,[2] Phuc Pham Duc,[3] and Delia Grace[4]

[1]*International Livestock Research Institute, Hanoi, Vietnam;* [2]*Medical Microbiology Department, The Royal Bournemouth Hospital, Bournemouth, United Kingdom;* [3]*Center for Public Health and Ecosystem Research, Hanoi School of Public Health, Hanoi, Vietnam;* [4]*International Livestock Research Institute, Nairobi, Kenya*

World Mycotoxin Journal, 2017; 10 (2): 195-202

Wageningen Academic Publishers

A survey of aflatoxin B_1 in maize and awareness of aflatoxins in Vietnam

H.S. Lee[1*], H. Nguyen-Viet[1], J. Lindahl[2,3], H.M. Thanh[4], T.N. Khanh[4], L.T.T. Hien[4] and D. Grace[2]

[1]*International Livestock Research Institute (ILRI), Dept. of Food Safety and Zoonoses, Room 301-302, B1 Building, Van Phuc Diplomatic Compound, 298 Kim Ma Street, Ba Dinh District, Hanoi 00100, Vietnam;* [2]*International Livestock Research Institute (ILRI), Dept. of Food Safety and Zoonoses, 30709 Naivasha Rd, Nairobi, Kenya;* [3]*Swedish University of Agricultural Sciences, Institutionen för kliniska vetenskaper, P.O. Box 7054, 750 07 Uppsala, Sweden;* [4]*Plant Protection Research Institute (PPRI), Duc thang commune, Dong Ngac, Tu Liem District, Hanoi 084, Vietnam;* h.s.lee@cgiar.org

DOI 10.1186/s40249-017-0325-z Infectious Diseases of Poverty

RESEARCH ARTICLE Open Access

Seasonal and geographical distribution of bacillary dysentery (shigellosis) and associated clima… Province in Viet…

Hu Suk Lee[1*], T. T. Ha Hoang[2], Phuc … and Hung Nguyen-Viet[1,3*]

DOI 10.1186/s12879-017-2326-8 BMC Infectious Dise…

RESEARCH ARTICLE Open Ac…

Seasonal patterns of dengue fever and associated climate factors in 4 provinces in Vietnam from 1994 to 2013

Hu Suk Lee[1*], Hung Nguyen-Viet[1], Vu Sinh Nam[2], Mihye Lee[3], Sungho Won[4,5,6], Phuc Pham Duc[7] and Delia …

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

Working Paper

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…hopefully leading to outcomes

Informing Policy: One Health and zoonose

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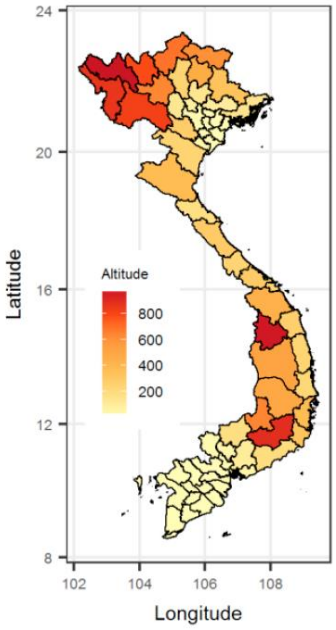
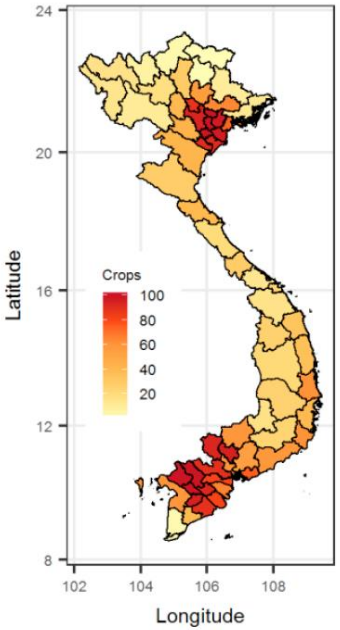
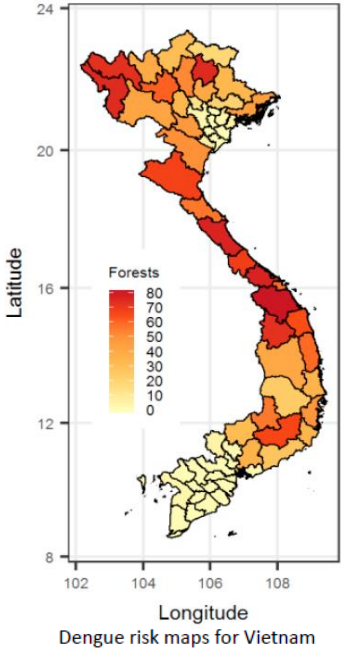
Altitude (m abl)



Cropland (%)



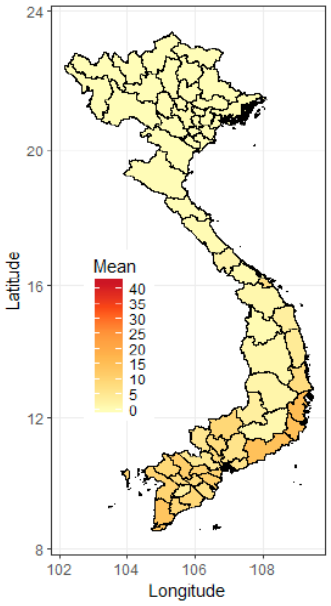
Forests (%)



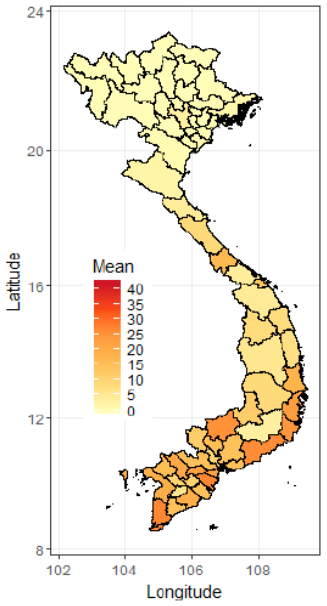
Dengue risk maps for Vietnam

- Risk maps
- Realtime prediction tools

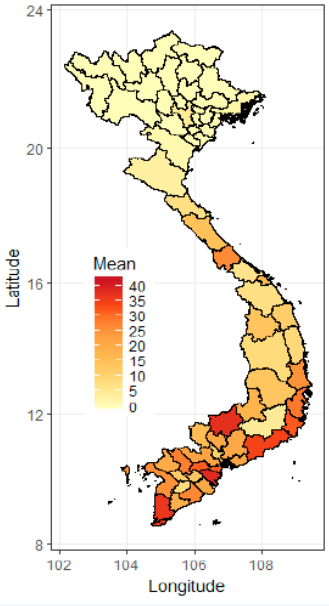
Dry season (December – April)



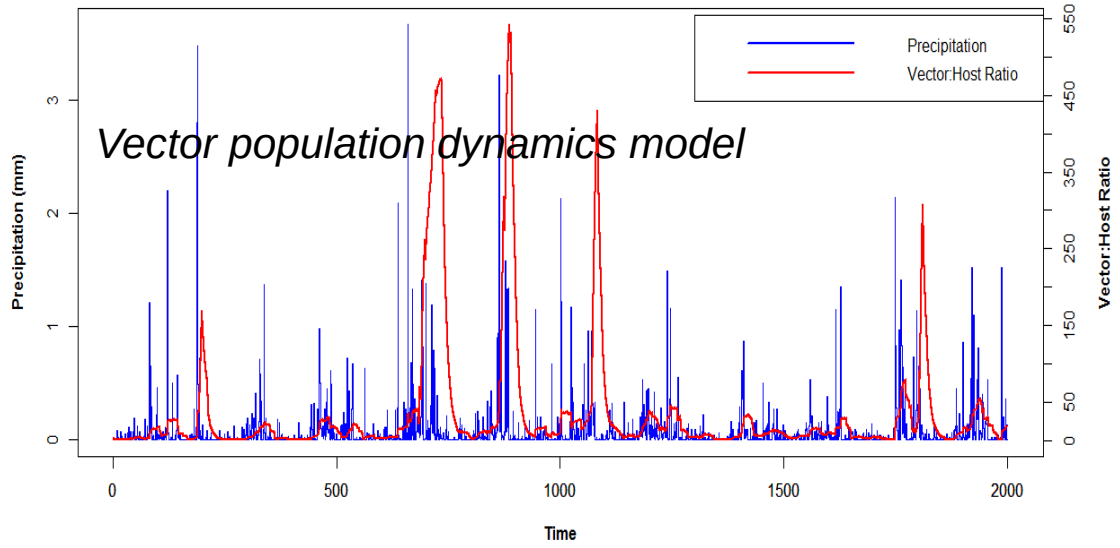
Overall mean combing wet and dry season

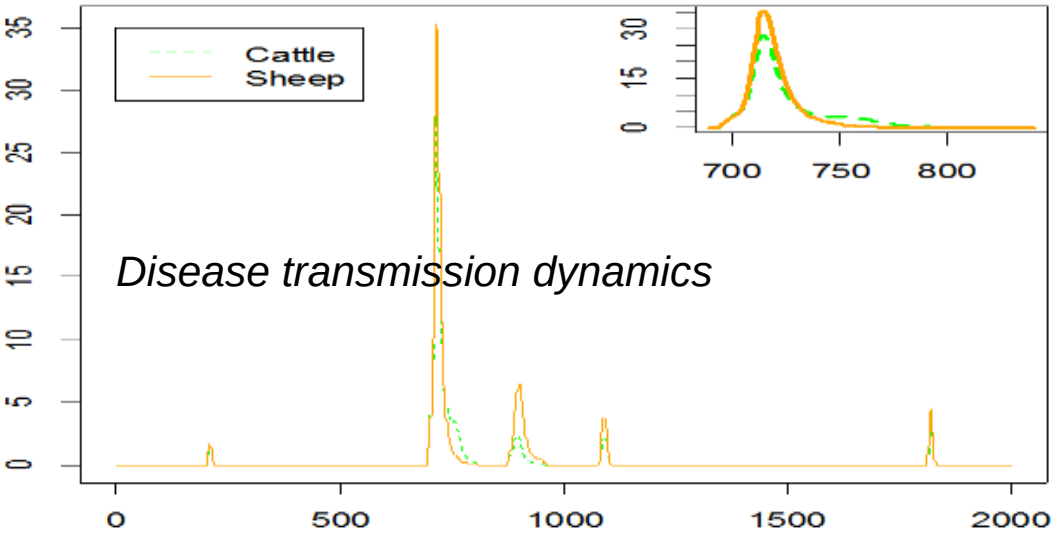


Wet season (May – November)



(Example) RVF simulation modelling for decision making





RVF outbreaks follow periods of excessive rains (TRMM precipitation data from NASA)

Interaction between environmental factors, immunity in the disease occurrence and impacts

Jan 2005

July 2010

Project Achievements (2015-2017)

- **Research outputs**
  - 6 international papers (peer-reviewed) & 3 papers (under review)
  - 15 conference presentations/posters
  - Risk maps and prediction models associated with climate factors and real-time prediction

- **Website and future application/tool**
  - Pestforecast wiki (https://pestforecast.wikispaces.com/Pestforecast+project)

- **Capacity building**
  - Vet. Epidemiology /GIS training for animal health workers
  - Master student

- **Linkage to Indonesian project : Dairy production and climate change**
  - Cow diseases

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Thank you!


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Box 30709, Nairobi 00100 Kenya
Phone +254 20 422 3000
Fax +254 20 4223001
Email ilri-kenya@cgiar.org

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