FLOODING EFFECTS ON *T. GONDII* INFECTION OF CATTLE IN THAILAND

Sathaporn Jittapalapong, Soichi Maruyama, Sinsamuth Saengo, Nongnuch Pinyopanuwat, Wissanuwat Chimnoi, Chanya Kengradomkij, Aurelie Binot, Stephane Herder, Serge Morand , Sayamchai Suksai, Noppawan Thaprathom, Sarawut Yangtara, and Marc Desquesnes

Department of Parasitology, Faculty of Veterinary Medicine, Kasetsart University, Bangkok. 10900. Thailand.

Climate change

- **Climate change** is one of many anthropogenic factors linked to the disruption of ecosystem around the world

- **Climate change** including warmer temperature, altered patterns of precipitation, increased frequency and severity of extreme climatic events (Typhoon, volcanoes eruption, tsunami) and flooding

Typhoon Haiyan

Environmental changes

- Environmental modification due to deforestation, flooding, global warming, and climatic changes create alteration of ecological conditions for animals and pathogens

Climate change on parasitic zoonoses

- For parasitic zoonoses, **climate change** has the potential to shift boundaries for **spatial distributions, host-parasite associations, demographic rates, life cycles, relationship within the ecosystem, virulence, and pattern of infections and diseases**
- **Climate change has also the potential to shift migration patterns for hosts**
- **Floodings** generate modifications of ecological conditions for pathogen, hosts, reservoirs, and vectors, which will condition their population dynamic, densities, and interrelations with the environment
- **Consequences of floods** influence the circulation and the incidence of some parasitic zoonoses, in ways which are hardly predictable and need data record and analyses

MATERIAL & METHOD

Floods may favor some parameters and thus increase epidemiological links between the actors, thus leading to an increase in circulation of the pathogens

1) Negative effects on the disease systems:

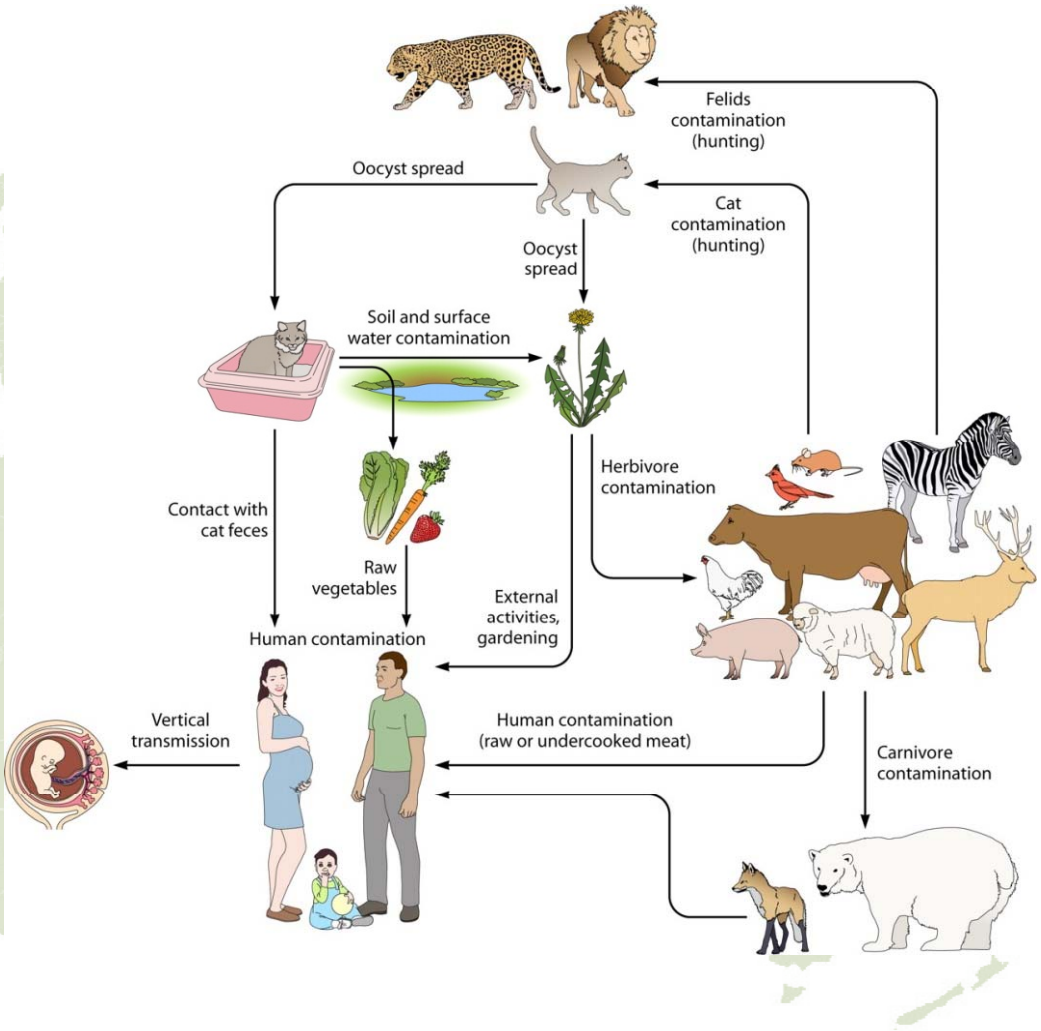
- **Flash-floodings** can wash and kill larval stages of biting-insects (tabanids, stomoxes, flees) thus reduce the transmission of diseases
- Flash-floodings can wash off environmental pathogens or they can kill rodents or destroy their habitats, thus reduce their population and role as reservoir
-Very large collection of water dilute water-pathogens to a non infecting level

2) Positive effects on the disease systems

- **Floodings** can induce a diapause in the larval stages of biting-insects, thus could be followed by a peak of insect emergences and densities (tabanids, stomoxes)
- **Floodings** can regroup rodents in the higher parts of the land thus creating high densities favorable to disease transmission thus increasing their incidence
- **Flooding** may constitute water reservoirs highly contaminated and thus increase the risk of human exposure to some zoonoses
- Floods can induce migration and thus **regroupment** of livestock species (and humans) which are not usually bred together and thus create a risk of inter-species transmission including human transmission

Toxoplasmosis

- **Toxoplasmosis is a widespread zoonoses caused by *Toxoplasma gondii***
- It infects humans and many warm-blooded animals, inducing abortions and neonatal mortality in goats and sheep
- **Asymptomatic animals could harbor pathogens and may act as carriers to other animals including humans**
- **The infections in cattle does not usually cause clinical symptoms as they have a high natural resistance to the parasite**



Country	Prevalence	References
Australia	30- 40 %	Johnson et al., 1980
Africa	71.4%	Lopez et al., 1992
Brazil	73.3%	Cavalcante et al., 2006
France	75%	Tenter et al., 2000
Indonesia	70%	Terazawa et al., 2003
Korea	6.9%	Lee et al., 2000
Malaysia	20-30%	Nissapatorn et al., 2004
Taiwan	23%	Fan et al., 2002
Thailand*	12.4%*	Sukthana et al., 2000
USA	22.5%	Jones et al., 2001
Vietnam	20%	Sery et al., 1998

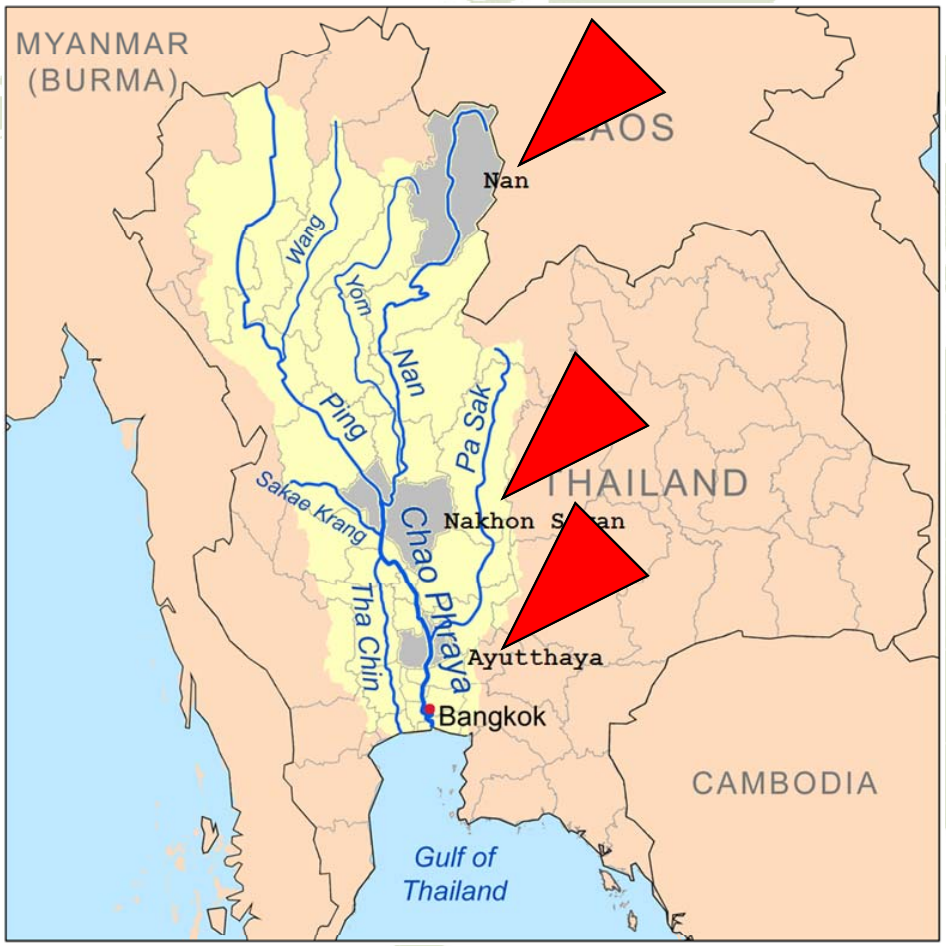
- ***Toxoplasma gondii*** infections are widely prevalent in animals and humans worldwide particularly in Thailand

Animal	Prevalence (%)	References
Rodents	4.6	Jittapalapong et al., 2010
Cats	7.3-11.6	Jittapalapong et al., 2007; Sukthana, 2006
Dogs	9.4	Jittapalapong et al., 2007
Pig	15.5	Tuntasuvan et al., 1999
Goats	27.9	Jittapalapong et al., 2005
Dairy cows	22.3	Jittapalapong et al., 2007
Elephant	25.6	Tuntasuvan et al., 2001
Wild animals (Tiger)	15.4	Thiangtum et al., 2006

Objective

The objective of this study is to compare the seroprevalence of *T. gondii* infections in cattle of flooding areas between dry and rainy season in Thailand

MATERIAL & METHOD



Method: Cattle sera of Nan (70&116), Nakhon Sawan (81&110), and Ayutthaya (90&103) were collected at the same location respectively during rainy/ dry season and tested by using latex agglutination test (LAT) (cutoff ≥ 1:64, Eiken, Japan). The positives LAT were confirmed by IFAT (Indirect Fluorescence test)

Condition of flooding

-**Nan**: flash-floodings with fast flooding but last lone less than 1 week

-**Nakhon sawan: M**oderate flooding with large flooding but last long less than 1 month

-**Ayutthaya** : Heavy flooding with very large collection of water and last long more than 3 months

Material & Method

RESULTS

Disease	Provinces	Season	Cattle		Sex		Age (years)	
			No.	% positive	Sex	% positive	0-5	> 5
Toxoplasmosis 18.95% (108/570)	Nan	Raining	70	17.1	Male	13.64 (3/22)	14.29 (3/21)	0
					Female	18.75 (9/48)	14.71 (5/34)	28.58 (4/14)
		Dry	116	18.9	Male	17.91 (12/67)	17.91 (12/67)	0%
					Female	20.41 (10/49)	20.45 (9/44)	20 (1/5)
	Nakhon sawan	Raining	81	4.9	Male	0	0	0
					Female	5.97 (4/67)	7.14 (4//56)	0
		Dry	110	15.5	Male	10.53 (2/19)	11.11 (2/18)	0
					Female	16.48 (15/91)	15.66 (13/83)	25 (2/8)
	Ayutthaya	Raining	90	25.6	Male	16.22 (6/37)	16.22 (6/37)	0
					Female	35.07 (17/53)	37.78 (17/45)	0
		Dry	103	29.1	Male	27.27 (3/11)	27.27 (3/11)	0
					Female	29.35 (27/92)	32.14 (27/84)	0

- The overall seroprevalence of *T. gondii* infections in cattle from Nan, Nakhon Sawan, and Ayutthaya was 18.3 % (34/186), 10.9% (21/191), and 27.5% (53/193), respectively

- The effect of season was compared and shown as the prevalence in Nan (R: D =17.7: 18.9), Nakhon Sawan (R: D=4.9:15.5), and Ayutthaya (R: D=25.6:29.1)

- The animal with 0-5 year had the higher prevalence (19.66%, 101/514) than > 5years group (12.28%, 7/56)

- All animal age groups (0-5 years and >5 years) had the higher *T. gondii* infections in dry season compared to the rainy season

Results

province	Season	number of farms			male			female		
		no. of farms	positive	% positive	no. of farms	positive	% positive	no. of farms	positive	% positive
Nan	Raining	8	4	50 (4/8)	6	2	33.33 (2/6)	8	3	37.5 (3/8)
	Dry	4	4	100 (4/4)	4	4	100 (4/4)	4	4	100 (4/4)
Nakhon sawan	Raining	4	2	50 (2/4)	3	0	0	4	2	50 (2/4)
							0			
	Dry	4	4	100 (4/4)	4	1	25 (1/4)	4	4	100 (4/4)
Ayutthaya	Raining	8	4	50 (4/8)	4	2	50 (2/4)	8	4	50 (4/8)
	Dry	8	4	50 (4/8)	2	2	100 (2/2)	8	4	50 (4/8)
total	Raining	20	10	50 (10/20)	13	4	30.77 (4/13)	20	9	45 (9/20)
	Dry	16	12	75 (12/16)	10	7	70 (7/10)	16	12	75 (12/16)

Results

Province	season	No.	1:32	1:64	1:128	1:256	1:512	1:1,024	1:2,048
Nan	Raining	70	17.14 (12/70)	1.43 (3/70)	2.86 (2/70)	5.71 (4/70)	2.86 (2/70)	0.0 (0/70)	1.43 (1/70)
	Dry	116	18.96 (22/116)	11.21 (13/116)	2.59 (3/116)	2.59 (3/116)	1.72 (2/116)	0.86 (1/116)	0.0 (0/116)
Nakhon sawan	Raining	81	4.94 (4/81)	1.23 (1/81)	2.47 (2/81)	1.23 (1/81)	0.0 (0/81)	0.0 (0/81)	0.0 (0/81)
	Dry	110	15.45 (17/110)	6.36 (7/110)	4.54 (5/110)	4.54 (5/110)	0.0 (0/110)	0.0 (0/110)	0.0 (0/110)
Ayutthaya	Raining	90	25.56 (23/90)	11.11 (10/90)	8.89 (8/90)	4.44 (4/90)	0.0 (0/90)	0.0 (0/90)	1.11 (1/90)
	Dry	103	29.13 (30/103)	4.85 (5/103)	12.62 (13/103)	7.77 (8/103)	1.94 (2/103)	1.94 (2/103)	0.0 (0/103)
Total	Raining	241	16.18 (39/241)	5.81 (14/241)	4.98 (12/241)	3.73 (9/241)	0.83 (2/241)	0.0 (0/241)	0.83 (2/241)
	Dry	329	20.97 (69/329)	7.60 (25/329)	6.38 (21/329)	4.86 (16/329)	1.22 (4/329)	0.91 (3/329)	0.0 (0/329)

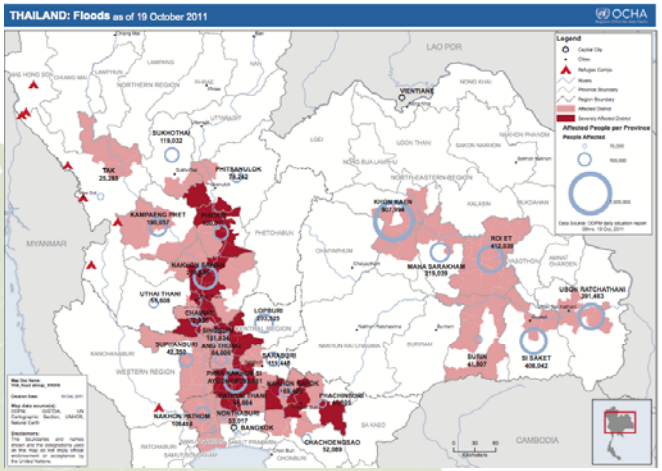
DISCUSSION

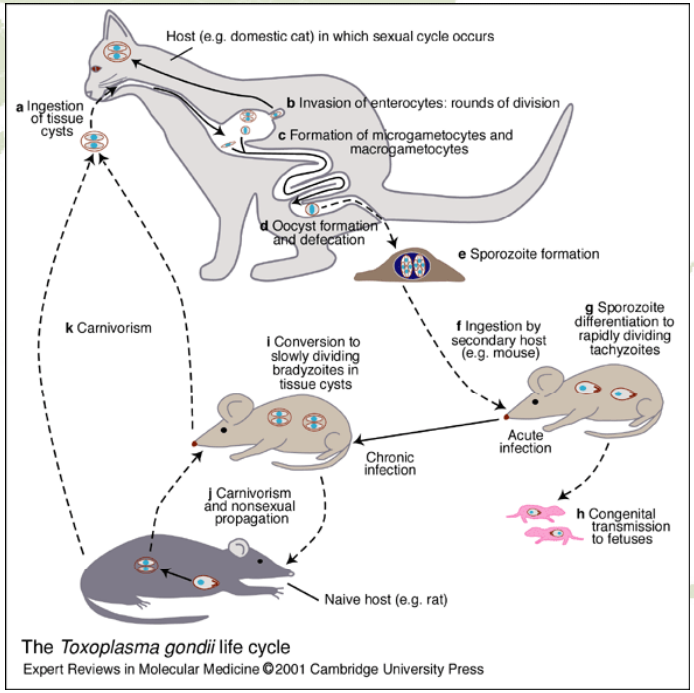
- The result indicated that possible factors associated with transmission might be disappeared or inactive during rainy season

- One potential factor, rodents as reservoir hosts were forced to leave their habitats during the flooding period

- The dry season might influence rodents to be more active for food and other activities leading to increasing prevalency

- Finally, negative and positive effects of flooding combined with seasonal effect might create the new environment to establish the association between reservoirs and pathogens





The *Toxoplasma gondii* life cycle
Expert Reviews in Molecular Medicine ©2001 Cambridge University Press

Acknowledgment

- This project (**PERDO/2555-01)** was funded by Center of Agricultural Biotechnology, Science and Technology Postgraduate Education and Research Development Office, Commission on Higher Education, Ministry of Education

Southeast Asian Regional
Platform for Research and Training on
"Biotechnology in Zoonoses"