

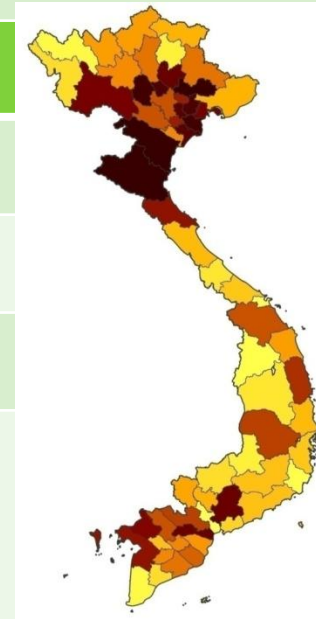
# LIMITS OF VACCINATION IN THE CONTROL OF HPAI IN EGYPT AND VIETNAM

## Social and Institutional issues



# General Contexts

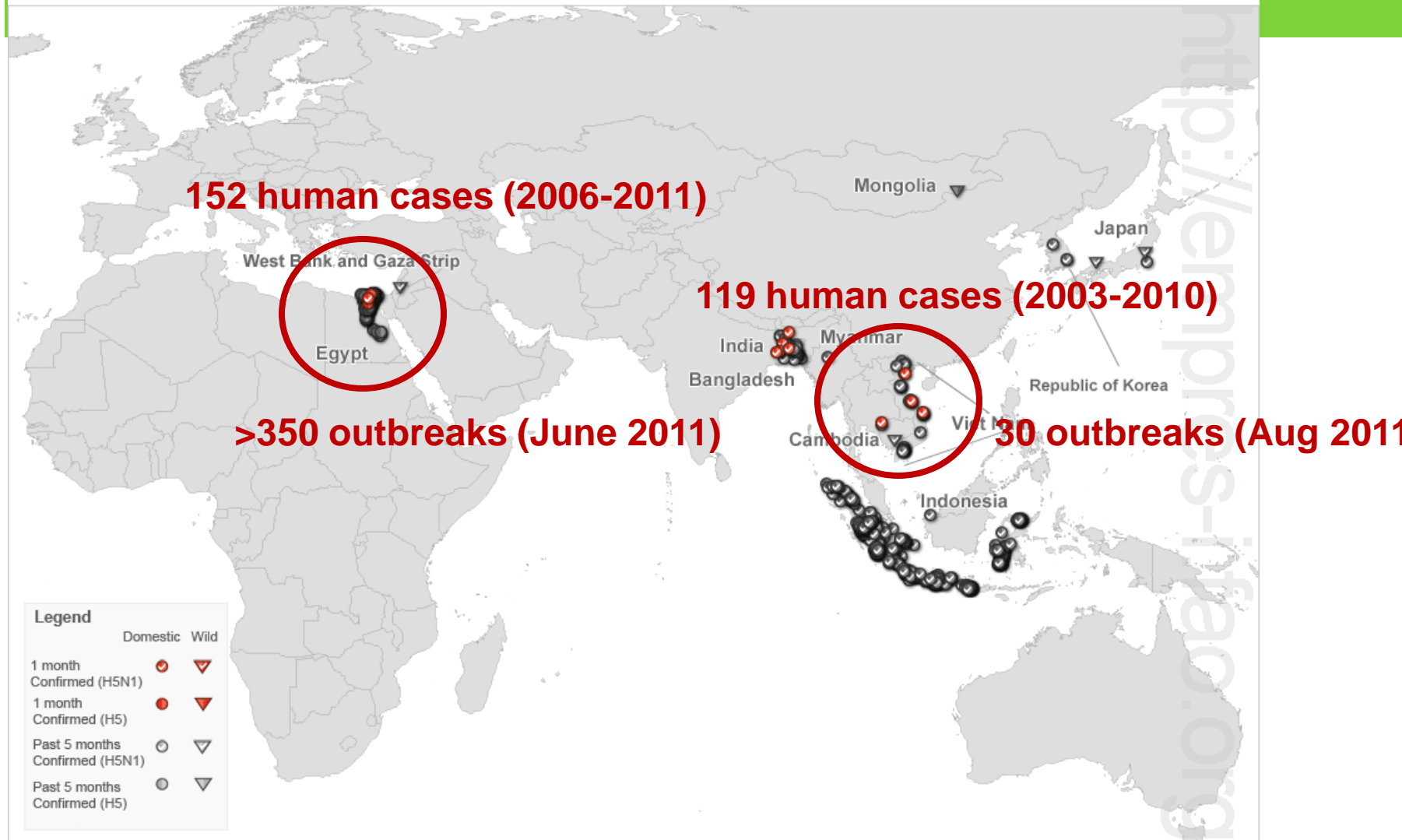
	EGYPT millions	VIETNAM millions
<b>Total Population (density) (2011)</b>	<b>82 (2000 h/km2 Delta, Nil)</b>	<b>90.5 (285 h/km2)</b>
<b>Total poultry population</b>	<b>1400</b>	<b>235</b>
Household poultry	600 (43%)	125 (55%)
<i>Ducks</i>	170 (30%)	12 (9%)
Commercial poultry	865	110
<i>Ducks</i>	9 (1%)	46 (42%)
Number of farms	25 000 (1450 duck farms - 6%)	2 837 (650 duck farms – 23%)



# HPAI Contexts

Highly Pathogenic Avian Influenza H5 confirmed outbreaks

22 March - 22 September 2011



# H5N1 HPAI Control Strategies

## EGYPT

- First case of H5N1 HPAI in Feb 2006
- Commercial sector vaccination: March 2006
- Household vaccination: May 2007 - June 2009
- Vaccination budget =>80%
- The MOST IMPORTANT control tool in Egypte : vaccination

## VIETNAM


- H5N1 virus infection since late 2003
- Commercial sector: responsible for their own vaccination
- Mass vaccination backyard: November 2005 – 2010
- Reinforcement of Biosecurity measures
- Outbreak management/ movement control

# Evaluation Framework

- Vaccine efficacy
  
- Vaccination efficacy (means of implementation)
  - Vaccine coverage
  - Post-vaccination immunity (vaccinated farms, 3wks pv)
  - Overall immunity (total population, all year)
  
- Vaccination effectiveness

# Vaccine efficacy

## EGYPT

- H5N2 (4 strains); H5N2/ND;  
H5N1 Re-1 China
  - 21 vaccine suppliers
  - H5N1 vs H5N2 not clear in the field
- 10% of doses <80% protection (since 2009)
- OFFLU project 2010: limited efficacy of some vaccines against variant strain
- 2008: Novel variant virus
- High viral mutation rate (Cattolli et al. Vaccine 2011)  
 Vaccine failure

## VIETNAM

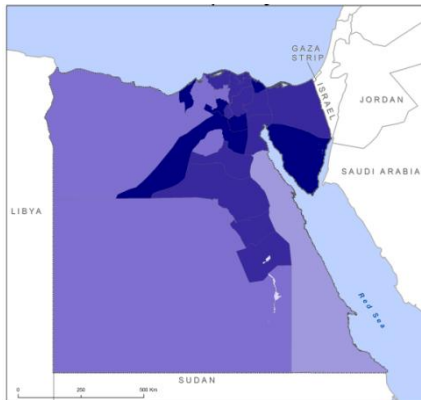
- Re-1 China and H5N2 Intervet
- 90-100% protection against Clades 2.3.2, 2.3.4 & Clade 1 (Ken Inui, FAO, 2008)
- Vaccine immunogenicity in the field (Desvaux et al, 2009)
  - Short term immunogenicity (<4 months): protection?
  - Lower level in ducks
- 2011: Re-5 China no protection 2.3.2.1
  - Stop vaccination in the North
  - Emergency vaccination in the South (potent against clade 1)

# Vaccination efficacy

## EGYPT

- **Limited coverage**
  - Household <10-30% (40% birds)
  - Small farms <30% (60% birds)
  - Large farms 50-80% (<2% birds)
- **No information on immunity levels**
- **Very limited post-vaccination monitoring**

(Peyre et al 2009. JMGM; ElMasry et al 2011)



Estimated vaccination coverage

Percentage of the vaccination

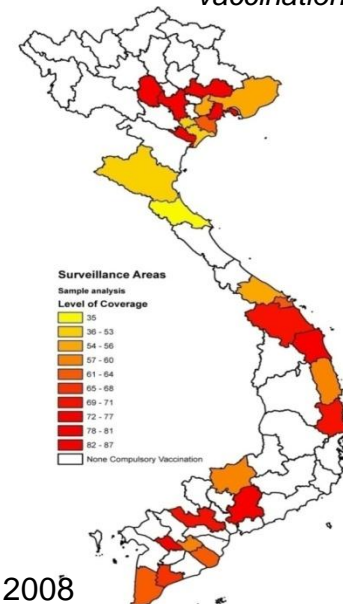


Source: M. Gely CIRAD 2011

## VIETNAM

- **Good vaccine coverage**
  - DAH, 3wks pv >70%
  - Desvaux et al 2011 = 40-70%
  - Henning et al 2009 ~50%
- **Variability in immunity levels**
  - Vaccinated birds = 20-80%
  - Overall population <30% all year round

Immunity coverage in tested flocks 3 wks post-vaccination



Source: DAH, 2008

# Vaccination effectiveness EGYPT

## □ Limited (nil?) impact of household vaccination

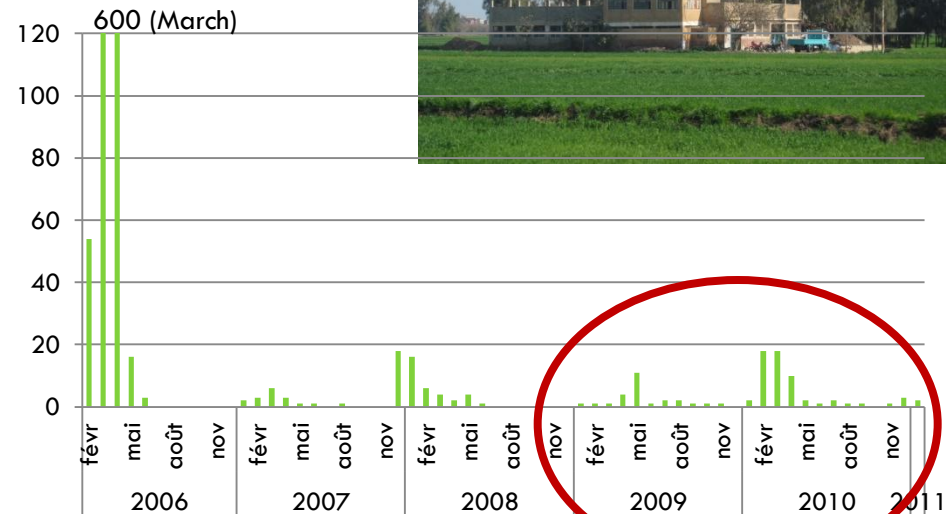
- No reduction in disease prevalence (LBM = 12% in 2009)
- No reduction in number of human cases

## □ Commercial vaccination effective until 2009

- 50% Parent flock losses in 2010
- Limited efficacy of the vaccines
- No official reports

## □ Evidence of sub-optimal immunity:

- virus circulation in vaccinated farms (*Hafez et al. Poultry Science 2010*)
- High viral mutation rate (*Cattoli et al. Vaccine 2011*)



*Peyre et al. 2009 JMGM*

*Peyre et al. 2011 (under publication)*



# Vaccination effectiveness VIETNAM (1)

## □ Reaching control objectives?

- Limited number of human cases (0-7 cases/year since 2006)
- Reduction of viral load in the environment

## □ Scientific evidences

- Low prevalence levels: <1% (DAH; Desvaux et al ; Henning et al)
- Reported outbreaks only in unvaccinated animals
- Reduction infection rate between commune (Walker et al 2010)
- Lower probability of infection if vaccinated twice (Henning et al 2009 )
- « Herd immunity » : lower risk of infection in area with protection >50% (Desvaux et al 2011) (VAHIP)
- Negative correlation between the frequency of H5 within Type A viruses and the protection level (scale: Province) (Delabouglise et al 2011, in preparation)

# Vaccination effectiveness VIETNAM (2)

## □ **Negative impact**

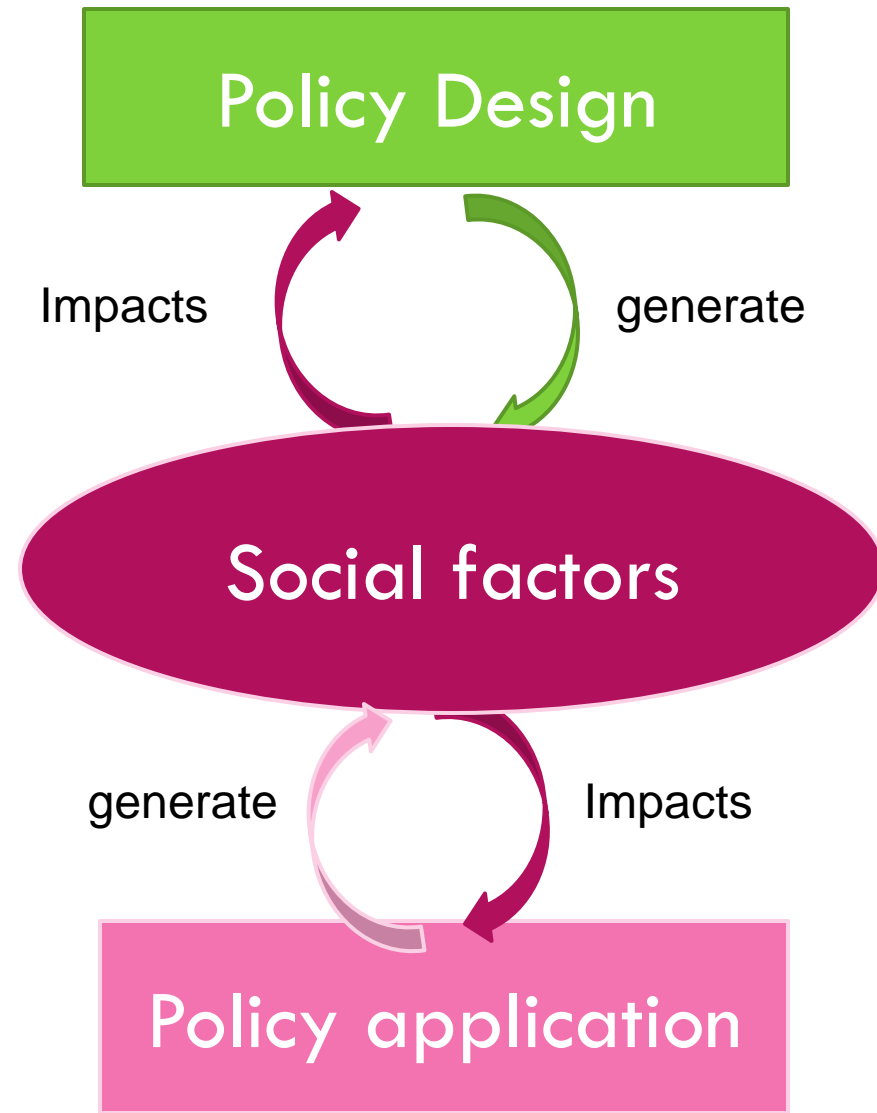
- No sterile immunity
- Changes in case definition: lower detection of outbreaks (*Minh et al 2011*); longer declaration period (*Walker et al 2010*)
- **Silent circulation of virus ???**
  - sentinel ducks prevalence = 1.53% (GETS)
  - Market prevalence = 1,5% (North) – 5.2% (South) (GETS, VAHIP) (highest in ducks) (2010 and 2011 data 10-15% Type A +; negative for H5)
  - H5 PCR + in vaccinated farm: pool of unvaccinated and vaccinated ducks (*Hennings et al 2010*)
- Role in virus persistency?

# SUMMARY

	EGYPT	VIETNAM
Vaccine efficacy	Limited since 2008	Good until 2011
Vaccination efficacy	Limited	Good
Passive reporting	biased	biased
Active Surveillance	Limited information	In place
H5N1 prevalence in Markets	12 % (2009)	0 – 5 % (2009-2011)
H5N1 Human cases	29 (2010) 33 (Nov 2011)	7 (2010) 0 (Nov 2011)
H5N1 Outbreaks in industrialised farms	YES	NO
Viral mutation rate	VERY HIGH in commercial sector	?

# SOCIAL factors linked to vaccination efficacy

- Loss of local community trust in Government regulation
- Public health risk
  - False sense of biosecurity
  - Cultural practices
- Under-reporting
  - Professional competences
  - Social network
  - Local risk management





*AI Vaccination (healthy birds)*



*Outbreak investigation (sick birds)*



*Outbreak investigation (sick duck)*



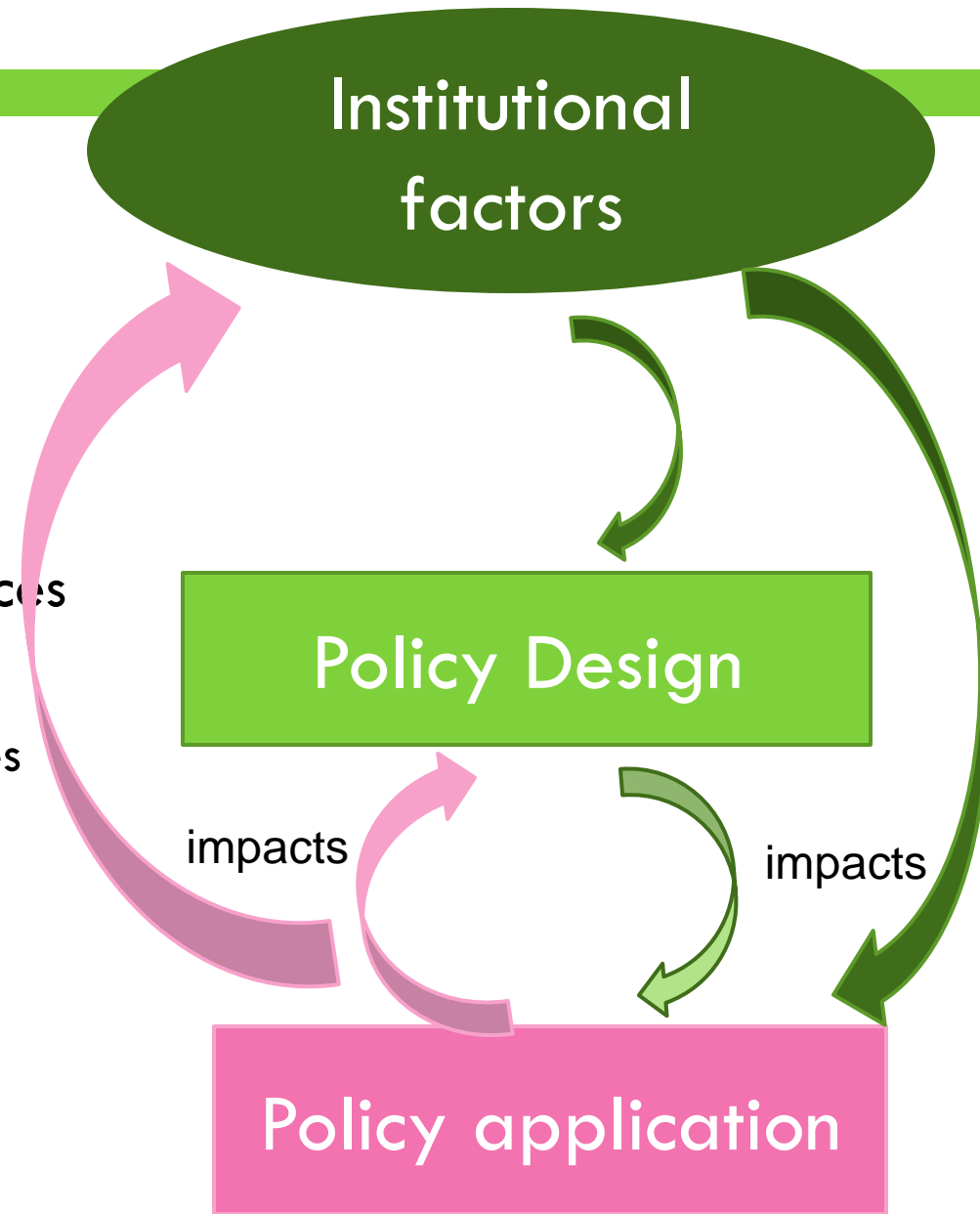
*Outbreak investigation (sick duck)*



*Outbreak investigation: burial of dead bird carcasses*

# INSTITUTIONAL factors


- Formalisation of regulation
  - Geographic differences
  - Environmental pressure for viral mutation
- Outbreak management practices
  - Disincentive for vaccination
  - Local risk management practices
- Surveillance strategy
  - Limited reporting
  - Changes in case definition



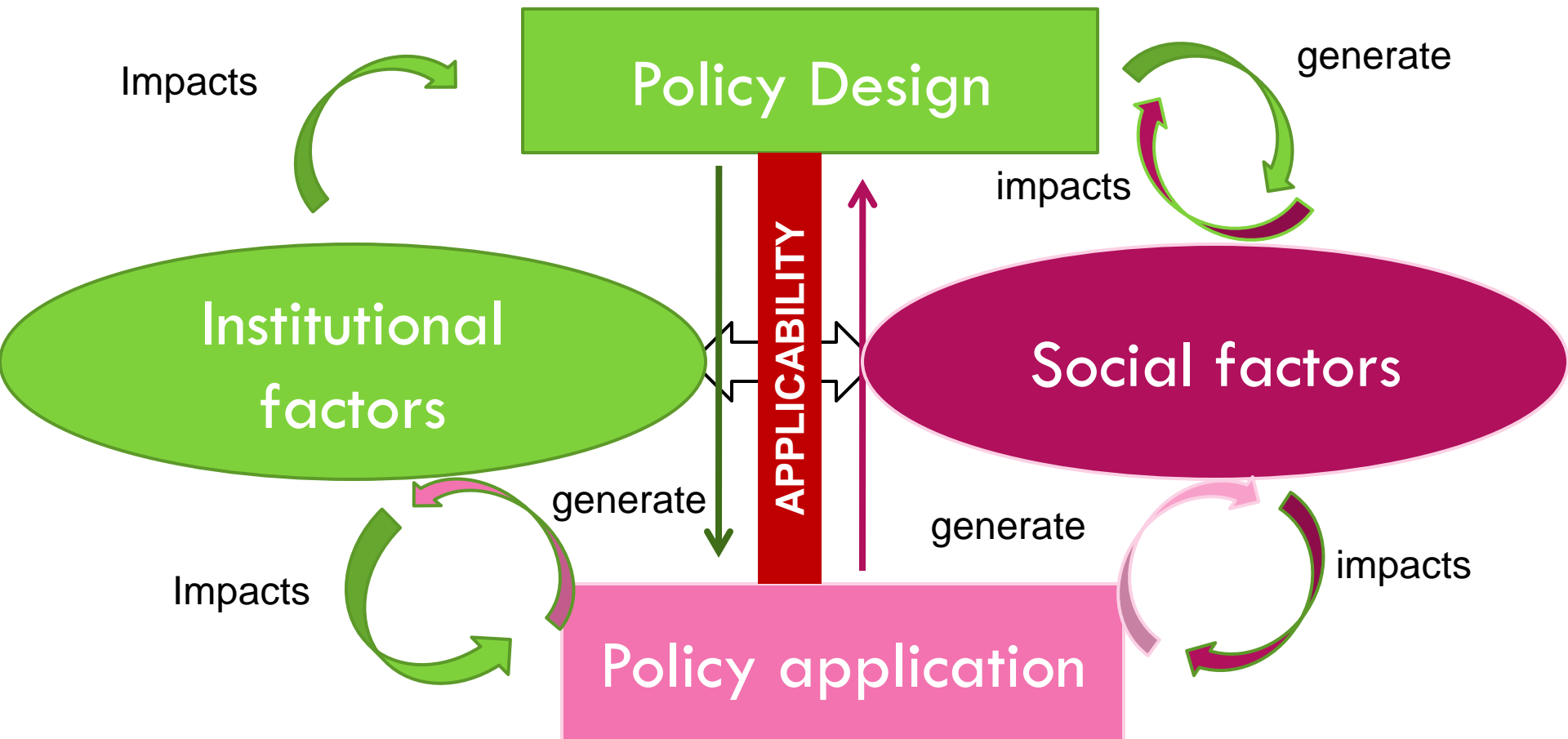
# Impact on Surveillance in VIETNAM

- Changes in epidemiology of the disease  
(lower mortality ratio; longer duration of infection; limited spread)
- No changes in case definition: high level of mortality in short period of time (*Desvaux & Figuié 2011*)
- **Lower Se** of surveillance system

## **Undetected and unreported H5N1 HPAI viral circulation**

- 
- **Adapt the case definition to the changes in disease epidemiology**
  - **Increase awareness of surveillance actors on new case definition**

# Conceptual framework (preliminary work)





# Perspectives/Research needs

- **Evaluation of prevention system performances**
  - Qualitative: network process
  - Quantitative: Se of surveillance system; efficacy of control strategies
- **Evaluation/quantification of local social factors**
- **Evaluation stakeholder networks & organisation**
  - Social impact
  - Bottom-up approach

# Acknowledgements

## EGYPT

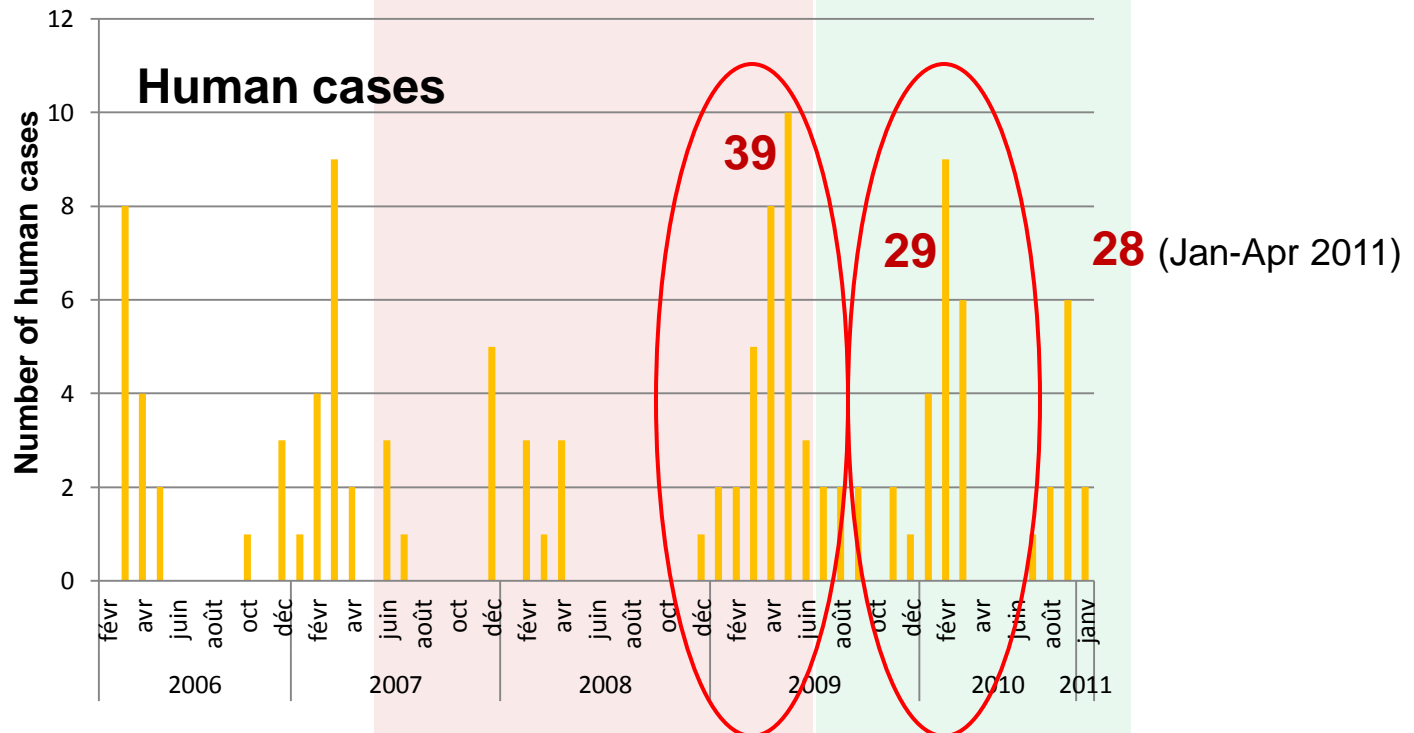
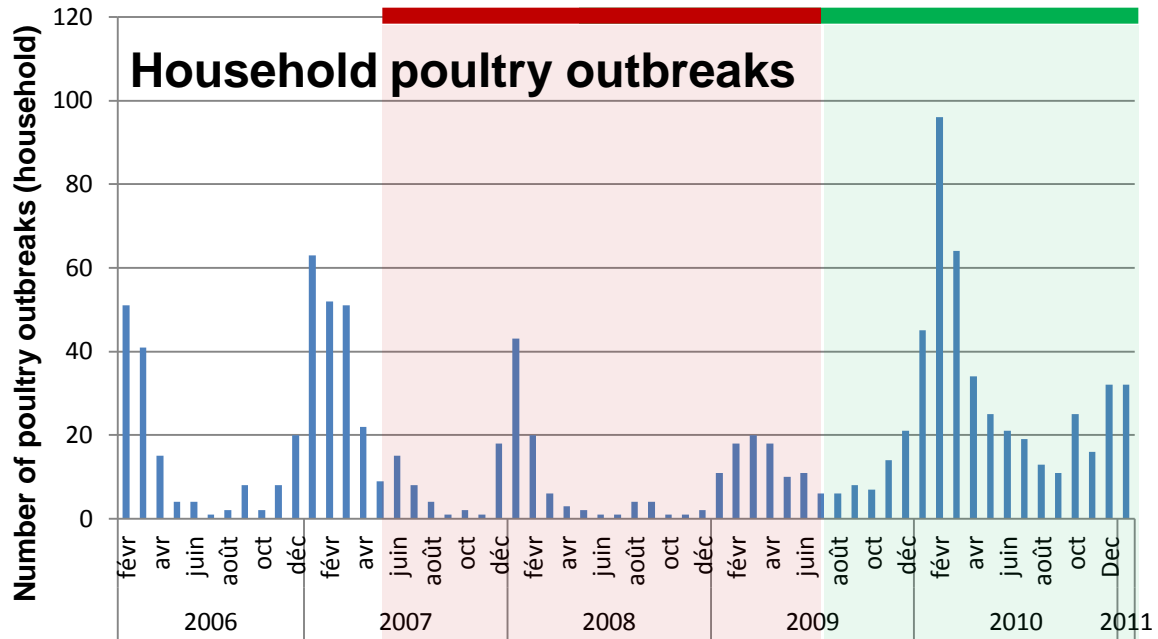
- GOVs: CVO; AIEMU team, Dr. Soheir Hassan
- NLQP: Dr. Mona Aly; Dr. Sheeren Galal; Dr. Mahamed Hassan; Dr. Walid Kilani
- CLEVB: Dr. Mansour Hashim; Dr. Lamiaa M Omar
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- Private stakeholders
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## VIETNAM

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- HKU: Malik Peiris and Connie Leung
- CIRRD, HAU: Vu Dinh Ton
- DAH: Do Huu Dung, Nguyen Ngoc Tien, Phan Quang Minh, Nguyen Thi Diep
- Sub-DAH Thai Binh Province
- FAO: John Weaver, Ken Inui, Juan Carrique Mas
- NZAID: Birgit Schauer

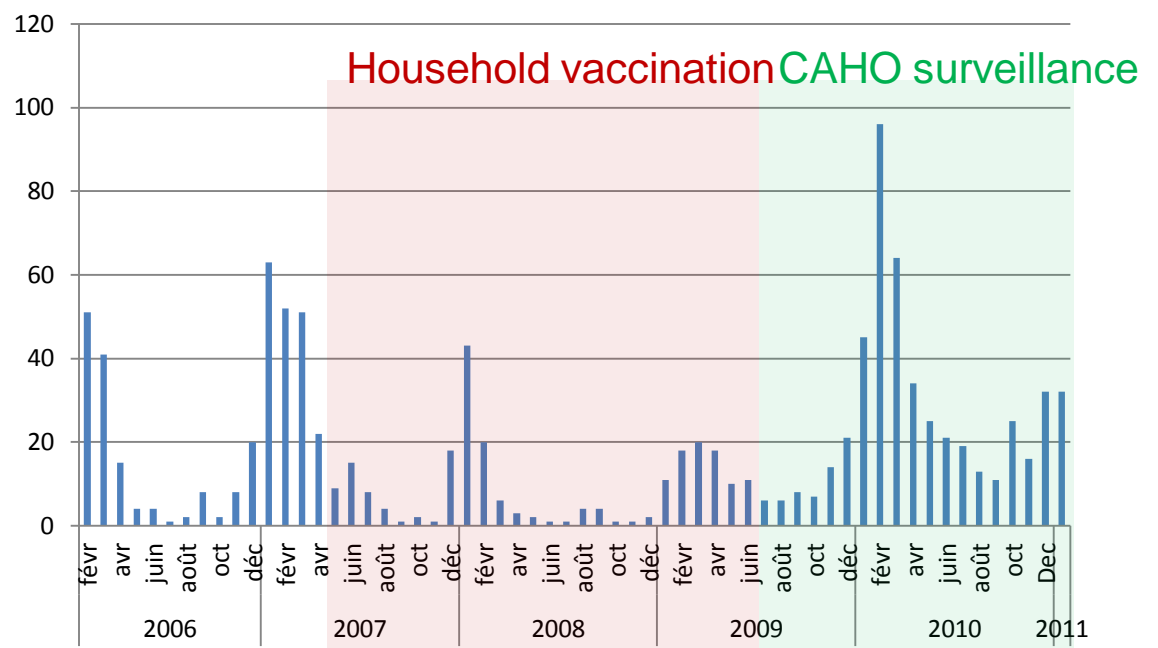
**Thanks for your attention**

Household vaccination CAHO surveillance



# EGYPT

Number of poultry outbreaks (household)



Human cases EGY

18

25

8

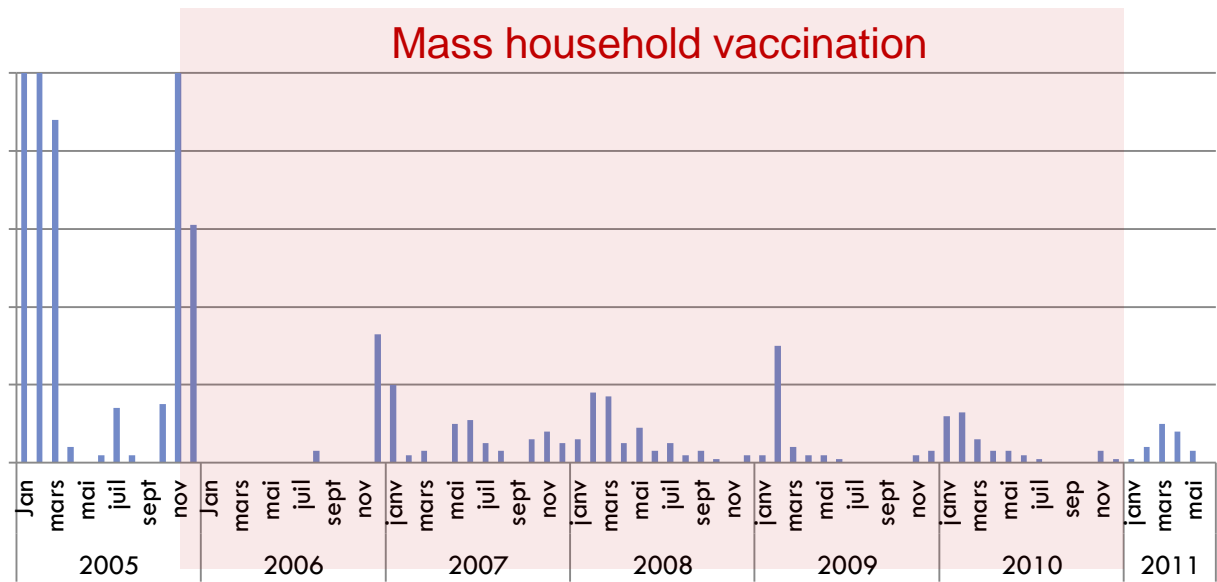
39

29

28

# VIETNAM

Number of poultry outbreaks



Human cases VIET

61

0

8

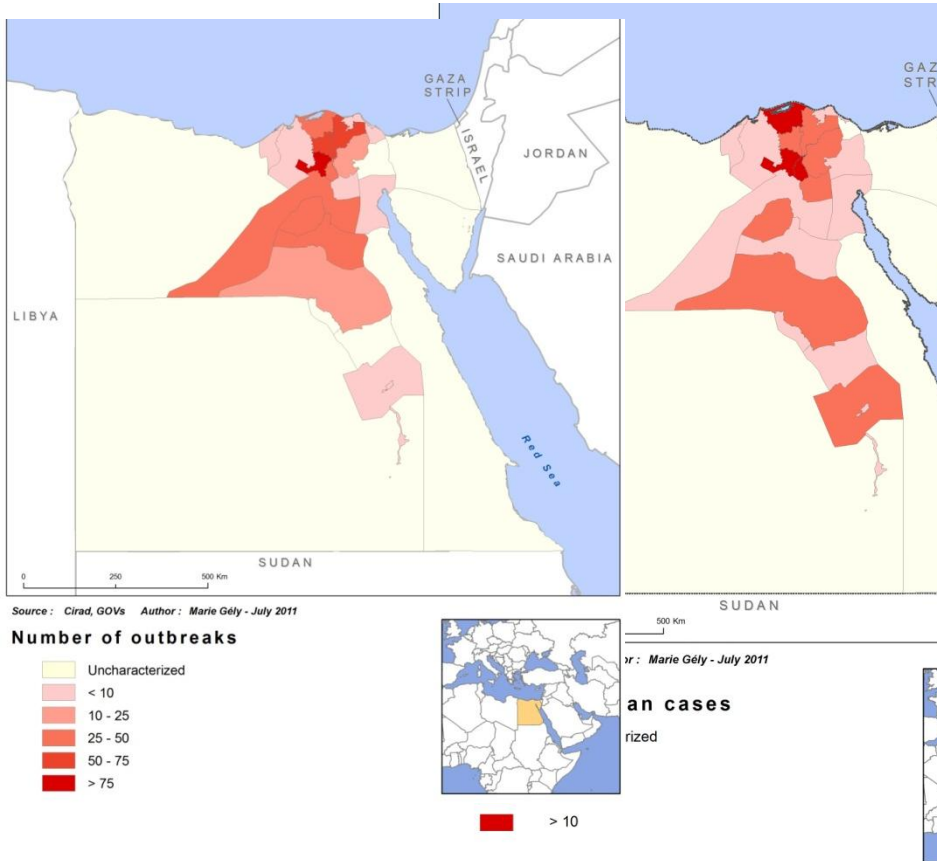
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# HPAI Epidemiological Contexts

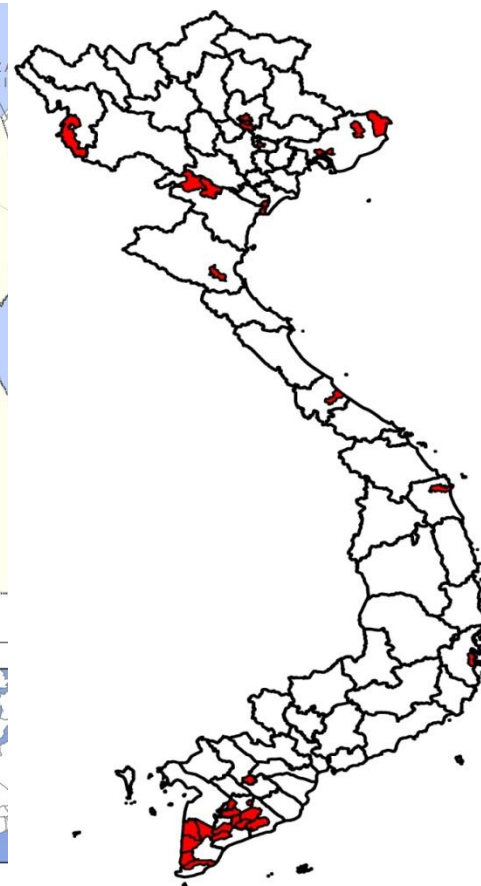


**Poultry outbreaks**

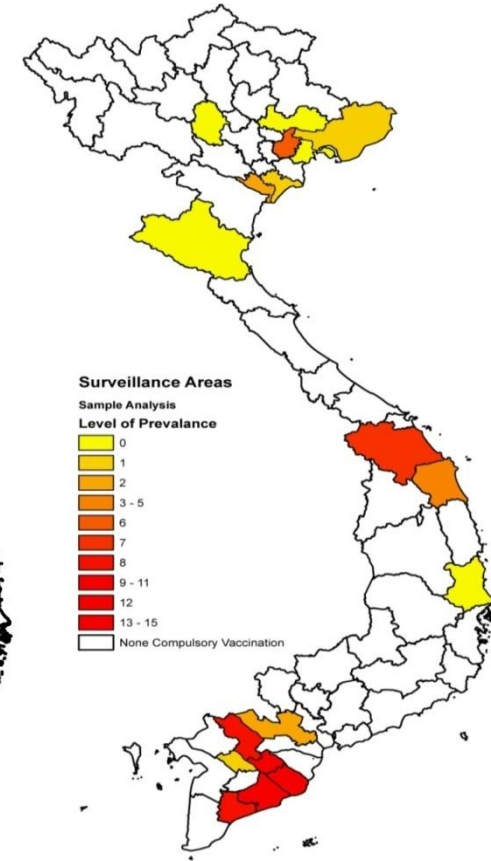
**2011 (June) > 350**

**Human cases**

**2011 (June) = 28**



**Poultry outbreaks  
Nov 2009**



**Viral circulation  
2008**

# Post-monitoring of AI vaccination in commercial farms

- Good monitoring in sector 1-2 farms: private labs
- No centralization of data at NLQP
  
- Active surveillance (viral circulation in vaccinated farms)
  - 2007: 3610 farms (14%), 35 + (prevalence=0.1%)
  - 2008: 8682 farms (35%), 27 + (prevalence=0.31%)
  - 2010 Pre-slaughtering: 5000 farms (0.3 % positive)
  
- HI monitoring
  - 2009-2010 active surveillance: 426 farms (15% Sector 3)
  - Post-vaccination monitoring central level (NLQP):  
200 farms/year, 70% sector 3 farms (volunteer)  
93-97% HI positive (2/3 H5N1 vaccine)
  - **<1% of Sector 3 broiler farms**
  - **Sector 3 farms not vaccinated: 4/5 positive for H5 Ab**



Commercial poultry farms

# Vaccination efficacy Vietnam(2)

## Technical constraints

- Short term immunity (1 month pv= 50% protection; *Desvaux et al*)
- Implementation?:
  - intra flock sero-conversion levels <50% (*Desvaux et al 2011; Henning et al 2010*)
  - Intra-farm vaccine coverage level: 45-55% (GRIPAVI)

## Production constraints

- Population turnover (new birds/flocks in between campaigns)
- Layers (20-40%) versus Broilers (<20%)

## Geographical differences

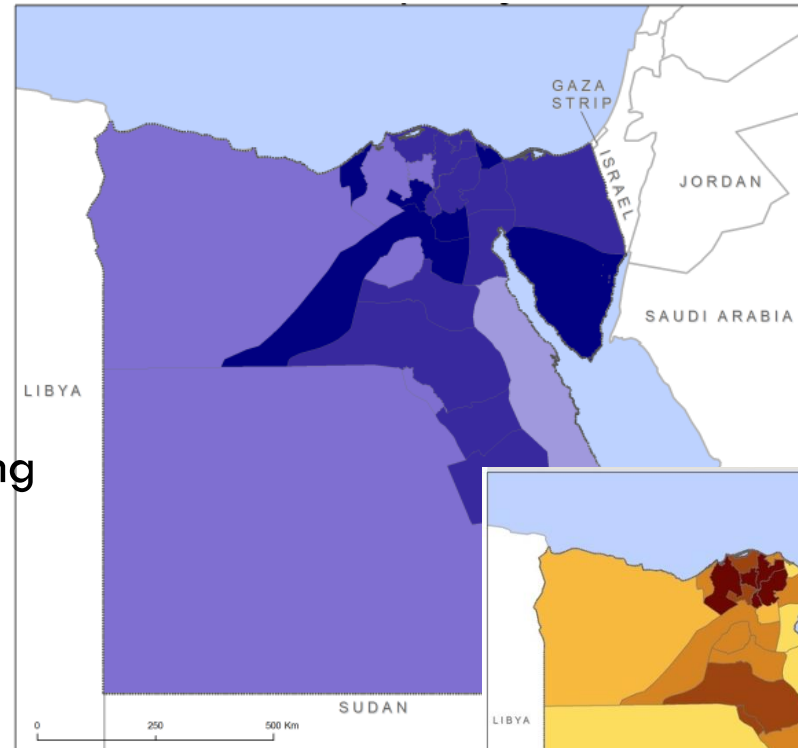
- Implementation; Post-vacc monitoring: differences between provinces (VAHIP; GRIPAVI)
- Overall immunity: no evidence of differences between Provinces / Region

## Limited efficacy in ducks?

- No evidence of differences in seroconversion according to species

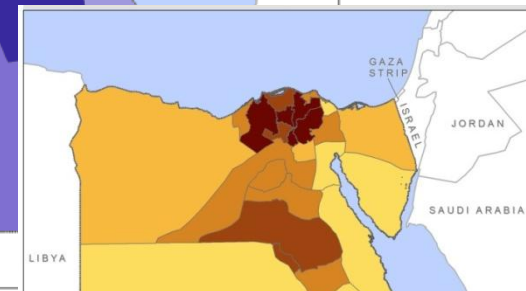
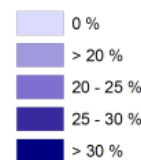
# Vaccination efficacy EGYPT

- Vaccine coverage
  - Large farms 50-80% (<2% birds)
  - Small farms <30% (60% birds)
  - Household <10-30% (40% birds)
  
- Very limited post vaccination monitoring
  - Immunity levels large farms (private)
  - No immunity monitoring in Household poultry
  - Viral circulation: pre-slaughtering surveillance for broilers
  - Limited Active surveillance in household poultry & farms



Source : Cirad Author : Marie Gély

Percentage of the vaccination



Source : Cirad, GOVs

Total farms





# Vaccination effectiveness EGYPT: Household poultry (1)

- Before/after end of household (HH) vaccination study
  - HH vaccination:** May 2007-June 2009 (Before=during)
  - No HH vaccination:** June 2009-Dec 2010 (After)

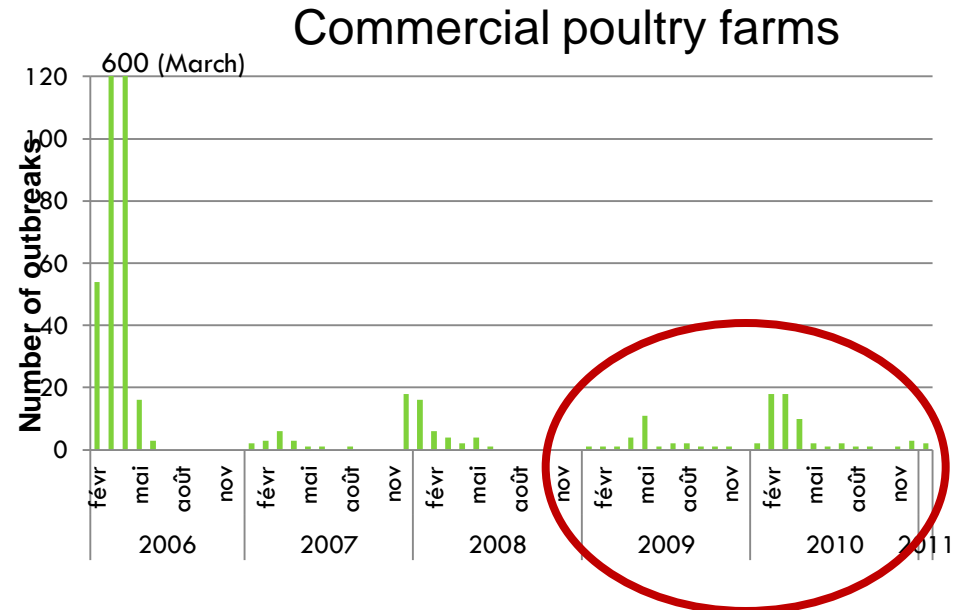
# Vaccination effectiveness EGYPT: Household poultry (2)

- Before/after end of household (HH) vaccination study  
HH vaccination: May 2007-June 2009 (Before=during)  
No HH vaccination: June 2009-Dec 2010 (After)
- Active surveillance<sup>1</sup>:
  - 2007: 30% (n=246/816)
  - 2008: 5.2% (n=89/1723)
- Live bird market surveillance<sup>2,3</sup>:  
Jan-Apr 2009 (during) =**12.4%** (71/573)  
All 2009 (including after)=**11.4%** (108/944)

<sup>1</sup>Hafez et al. 2010 Poultry Science <sup>2</sup>Abdelwhab et al. 2010 Avian Diseases; <sup>3</sup> Abdelwhab and Hafez. 2011. *Epidemiology and Infection*

# Vaccination effectiveness in EGYPT: Commercial farms

- 80-100% AI vaccination coverage in Sectors 1-2
- 25% coverage Sector 3
- **Effective until 2009**
  - 50% Parent flock losses in 2010
  - Lower protection from challenge studies CLEVB data
  - H5N1 vs H5N2 not clear in the field
- **Evidence of sub-optimal immunity:**
  - virus circulation in vaccinated farms (Hafez et al. 2010)
  - High viral mutation rate (Cattoli et al. 2011)
- **Limited Surveillance**
- Gap of Sector 3 (representativeness?)

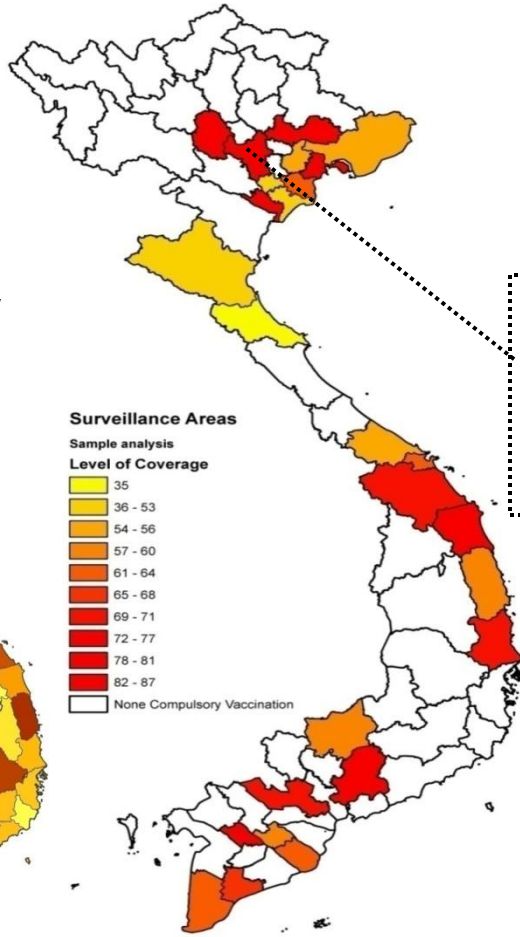


# Vaccination efficacy VIETNAM

Immunity coverage in tested flocks 3 wks post-vaccination

- Vaccine coverage
  - DAH, 3wks pv >70%
  - Desvaux et al 2011 = 40-70%
  - Henning et al 2009 ~50%

Poultry density



**Ha Tay 1 month pv**  
Coverage = 80%  
Vacc Pop Immunity =20-80%  
Pop Immunity =13-30%

**Ha Tay 2-4 months pv**  
Coverage = 60-70%  
Vacc Pop Immunity =40-50%  
Pop Immunity =13-30%

- Overall immunity ~30%

Source: DAH, 2008

# Vaccination effectiveness VIETNAM

## □ Reaching control objectives?

- Limited number of human cases (0-7 cases/year since 2006)
- Reduction of viral load in the environment

