


Approaches to controlling, preventing and eliminating H5N1 HP avian influenza in endemic countries

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Material used for this presentation

- **FAO. 2011. Approaches to controlling, preventing and eliminating H5N1 Highly Pathogenic Avian Influenza in endemic countries. Animal Production and Health Paper. No. 171. Rome**
- OFFLU contribution on interventions in animals to the WHO Influenza Research Agenda, Nov 2011
- Vincent Martin. Social Networks Analysis and other material on China
- David Swayne. OFFLU study on ‘’H5N1 HPAI Vaccination: Opportunities and Challenges’’
- Material from FAO ECTAD Egypt

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FAO ANIMAL PRODUCTION AND HEALTH

paper

APPROACHES TO CONTROLLING, PREVENTING AND ELIMINATING H5N1 HIGHLY PATHOGENIC AVIAN INFLUENZA IN ENDEMIC COUNTRIES







Content

- **A few lessons learnt:**
  - Agro-ecological factors
  - Role of live poultry markets and trading
  - Role of various sectors
- **Control and preventive measures:**
  - Stamping out
  - Vaccination
  - Monitoring and surveillance
  - Understanding and modifying the poultry sector
- **Constraints to virus control, prevention and elimination**
- **Innovative approaches**

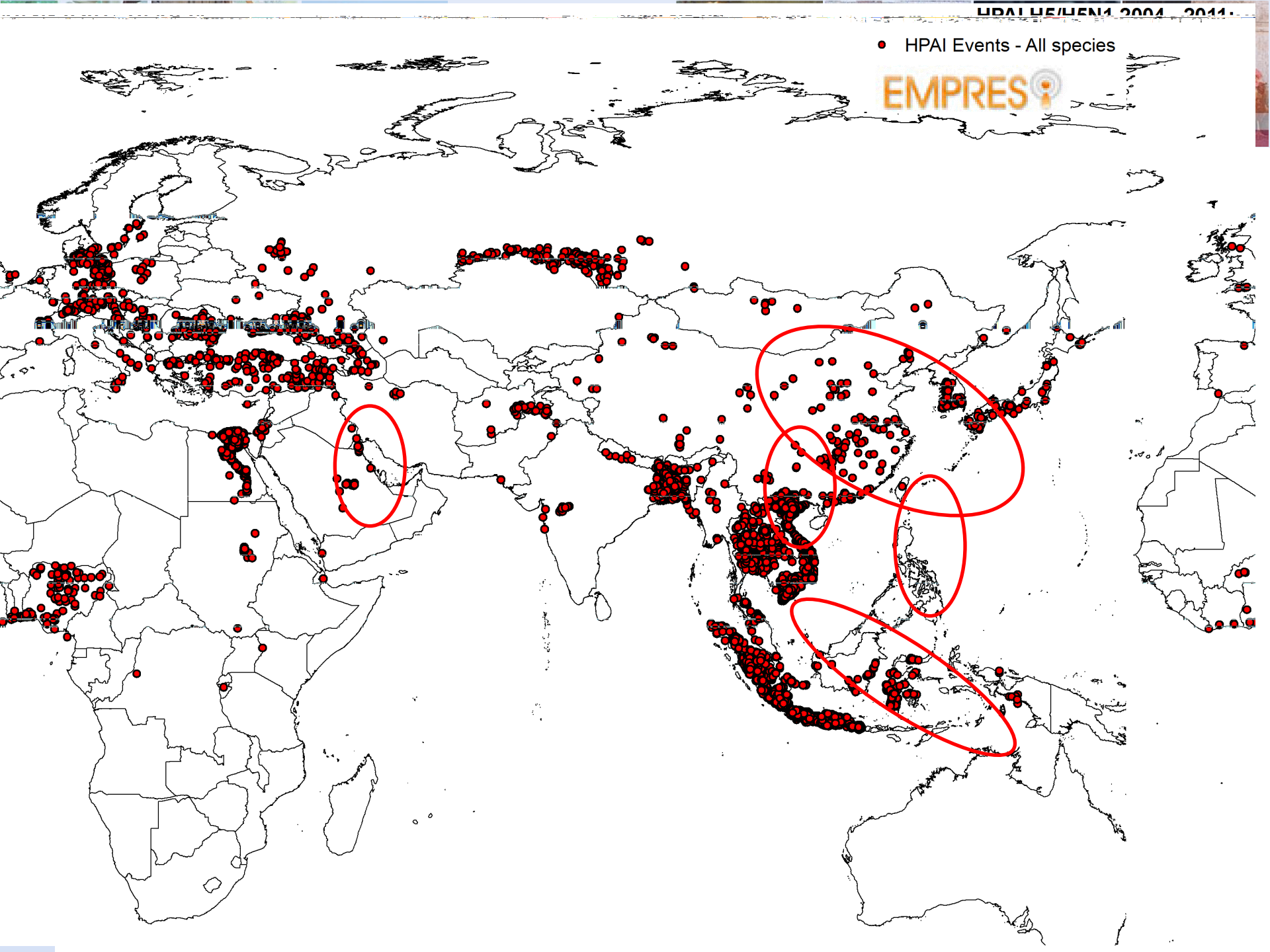






Information generated

- Huge amount of information generated the last 6 years through scientific publications, grey literature (consultants', media reports, etc) and GRIPAVI…
- Many measures/approaches taken. Not always easy to assess the impact of each measure.
- Interventions will vary from country to country; however, there are many common factors
- Eradication of H5N1 HPAI in endemic countries is not expected to happen before 5-10 years for various reasons including challenges of measures to be applied


HPAI Events - All species
EMPRES

A few lessons learnt

- Agro-ecological factors
- Role of live poultry markets and trading
- Role of different sectors


EcoHealth
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Original Contribution

Persistence of Highly Pathogenic Avian Influenza H5N1 Virus Defined by Agro-Ecological Niche

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Agro-ecological factors

- Multivariate analysis of a set of 14 agricultural, environmental, climatic, and socio-economic factors
- A combination of six variables discriminates the areas with human cases and persistence: **agricultural population density, duck density, duck by chicken density, chicken density, the product of agricultural population density and chicken output/input ratio, and purchasing power per capita**
- 5 agro-ecological clusters, or niches, representing varying degrees of disease persistence.







Role of live poultry markets and trading

- In all endemic countries, systems of rearing, transporting and marketing poultry: poorly regulated, low levels of biosecurity, high-volume production and trade (including live poultry); these systems have contributed to the spread and persistence of H5N1 HPAI
- Markets chains are complex, often involve collectors, unhygienic live poultry markets, transport vehicles and cages poorly cleaned.
- Some poultry markets have been closed/renovated, rebuilt; others continue to pose a threat


Role of respective sectors

- Well-managed farms can remain free from infection
- Very large ‘backyard’ poultry population: can also be part of the cycle, esp. when there is sale and movement
- Wild birds: are not the focus for prevention/control of HPAI, although contacts between wild/domestic birds should be avoided
- Ducks: carriers; farmers have little incentive to prevent infections in ducks; active surveillance needed. Role of different duck sectors still being studied.


Control and preventive measures:

- Stamping out
- Vaccination
- Monitoring and surveillance
- Understanding and modifying the poultry sector







Stamping out

- In case of early detection and response
- If movements can also be controlled
- Where vaccination is not applied (eg. India, Bangladesh)
- Wide area culling can be avoided if good surveillance systems are in place to detect new cases/stop poultry movements
- Modified culling: only destruction of clinically affected flocks and those epidemiologically linked







Vaccination

- Vaccination can only be viewed as a way to reduce clinical disease to maintain livelihoods, reduce environmental contamination, reduce transmission and reduce human infections, but not eradication
- National H5N1 HPAI vaccination campaigns for all poultry are not sustainable and have low potential for effective HPAI control
- As outbreak matures, vaccination must be risk-based, with resources focused on highest risk populations and reservoirs
- Proper application in the field
- Several vector vaccines showing potential for vaccination of young chicks and ducks







Vaccination: future direction

- How to move from massive to targeted, towards risk-based, and based on which criteria? (experience sharing with Vietnam and GETS project)
- Define an exit strategy
  - What would be the element of an exit strategy?
  - Timeframe?


- **Gathering Evidence for a Transitional Strategy (GETS) for HPAI H5N1 Vaccination in Viet Nam**


GETS Project Recommendations

- Progressively withdraw vaccination from poultry that do not act as silent carriers as these will show clinical signs of disease (chickens). Use other control methods such as outbreak investigation and culling in these poultry.
- Intensify vaccination in poultry that act as silent carriers (ducks and especially mobile duck layer flocks)
- Implement complementary risk management practices
  - Public awareness (mass media)
  - Animal Health & Public Health Officer joint training
  - Biosecurity training (across market chain)
  - Improved surveillance (market surveys, mobile duck flock monitoring)







Monitoring and surveillance

- Purposes to be clearly defined
- Goal: to provide info for improving the control and prevention
- Information to be integrated and analyzed
- Further insights into the complex dynamics of virus spread
- Major gaps in surveillance networks
- Because of mobility and rapid turnover of poultry: always gaps in surveillance; Disease incidence to be measured in a suitable period/geographical area to assess the risk of new outbreaks
- Establishment of disease-free zones possible


Understanding and modifying the poultry sector

- Production and market chain studies
- Drastic changes in marketing practices
- Take into account the behavior of the traders and producers who supply those markets
- Understand the drivers of trade, legal and illegal
- Poultry, even at high density, reared in proper manner (biosecurity and tight movements control) with measures in place to prevent the virus from entering farms = not an indicator of risk
- FAO does not recommend that all poultry be reared under industrialized conditions; models suitable for small farmers
- Structural changes linked to level of development







Measures applied to markets

- Access to only vaccinated poultry
- Minimize live poultry trade
- Live markets outside the city center
- Slaughtering practices
- Market hygiene (cleaning-disinf)
- Scoring system
- No overnight stay
- No poultry exit (unless slaughtered)
- Tracing of source of poultry
- Mixed species avoided


Constraints to virus control, prevention and elimination







Three major constraints to virus control, prevention and elimination

1. the structure of the poultry sector,
2. quality of veterinary and animal productions services,
3. the commitment to the control and elimination of the virus at all levels

The exact contributions of each of these is not known and probably differs between countries







Three major constraints to virus control, prevention and elimination

1. the structure of the poultry sector

- Changes, covering both production and marketing systems, are being made in endemic countries. But will not eliminate all high risk practices/prevent all cases of infection
- Increased proportion of poultry reared under industrial conditions, improved biosecurity measures, chilled carcasses from centralized slaughtering plants, improvements of live bird markets
- Commitment from all stakeholders (farmers, transporters, poultry traders, consumers) for changes







Three major constraints to virus control, prevention and elimination

2. quality of veterinary and animal productions services

- Poor quality veterinary services generally have insensitive disease reporting systems and surveillance programs
- Top-down approach to be avoided
- Transparency for good reporting
- Drivers of value chain not well understood
- Little or no compensation provided
- Border controls weak
- Field staff have limited incentives to undertake field investigations


Three major constraints to virus control, prevention and elimination

3. the commitment to the control and elimination of the virus at all levels

- Eg duck farmers
- Low-cost biosecurity measures not applied
- Government services: commitment needed not only for containment but for elimination
- Consumers: belief that live poultry is healthier

→ big commitment needed to eliminate H5N1


Innovative approaches







Innovative approaches (1)

- Risk modeling; risk assessment frameworks
- Public-Private Partnership
- Better knowledge of production sectors through Social Network Analysis
- Holistic health services for smallholders poultry owners







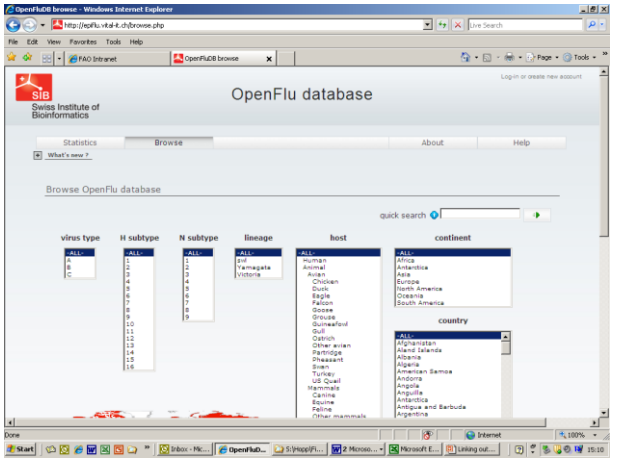
Innovative approaches (2)

- Field Epidemiology Training Programme for Veterinarians (FETPV)
- Increased focus on socio-eco, socio-cultural, institutional and political aspects in surveys and strategies
- Early studies demonstrate some potential for AI ‘resistant’ chicken, but much more work to do
- Combining epi, viro and bioinformatics


Genetic module in the FAO Global Animal Health database

Sequence ID number

Virus information

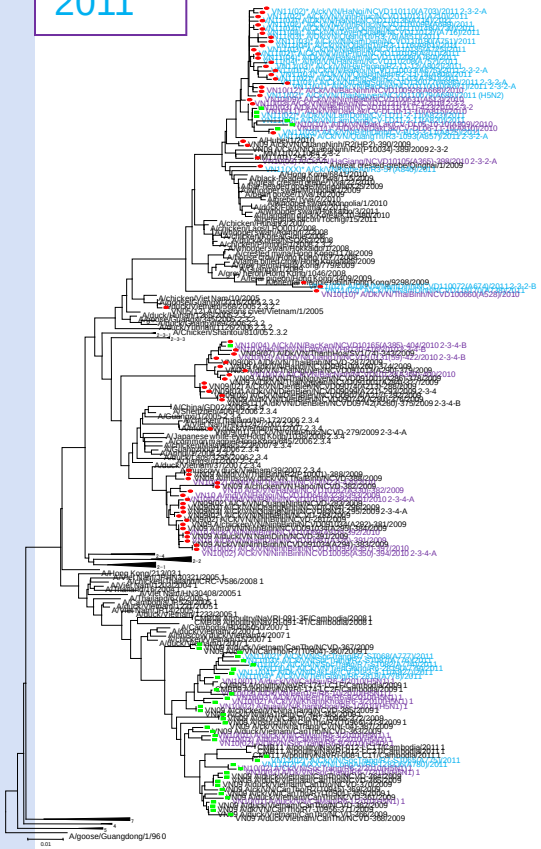


EMPRES-i

OpenFluDB

Shift of HA Clade from 2-3-4 to 2-3-2 in the North Vietnam observed during 2009-2011 (Ken Inui, FAO)

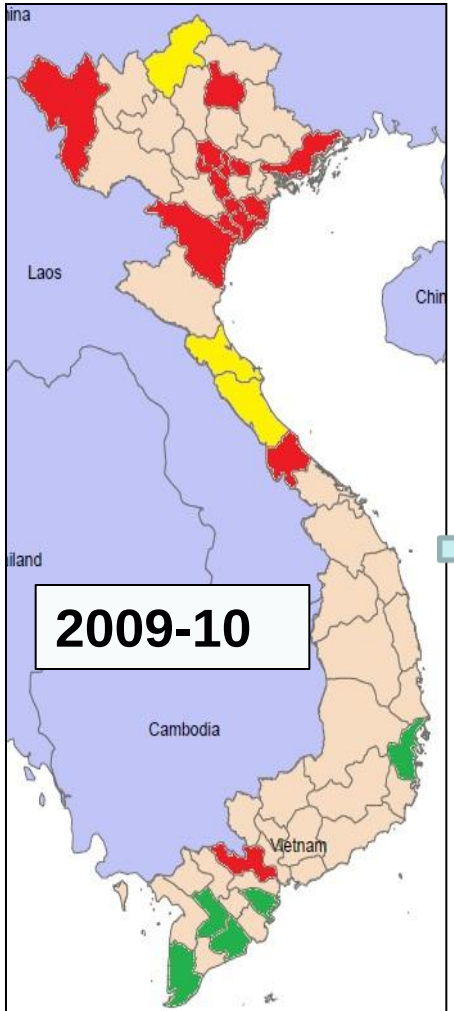
2009
2010
2011

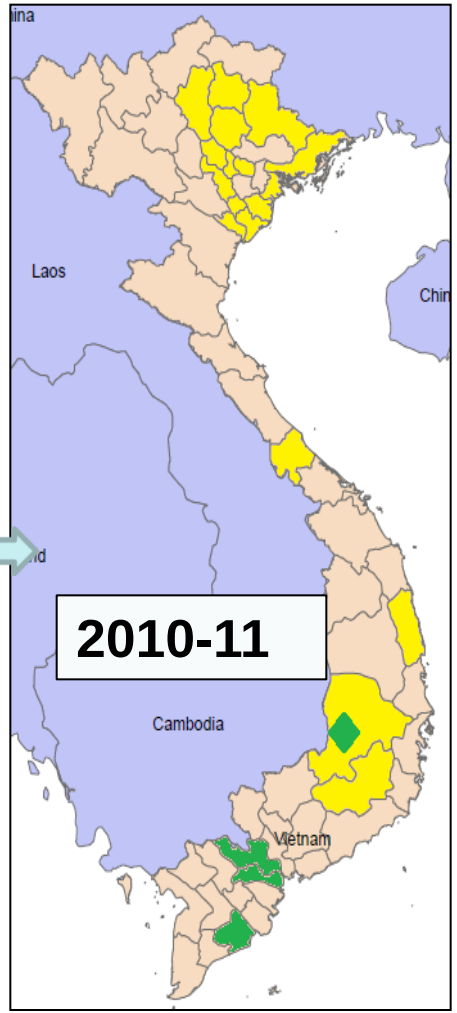


2-3-2

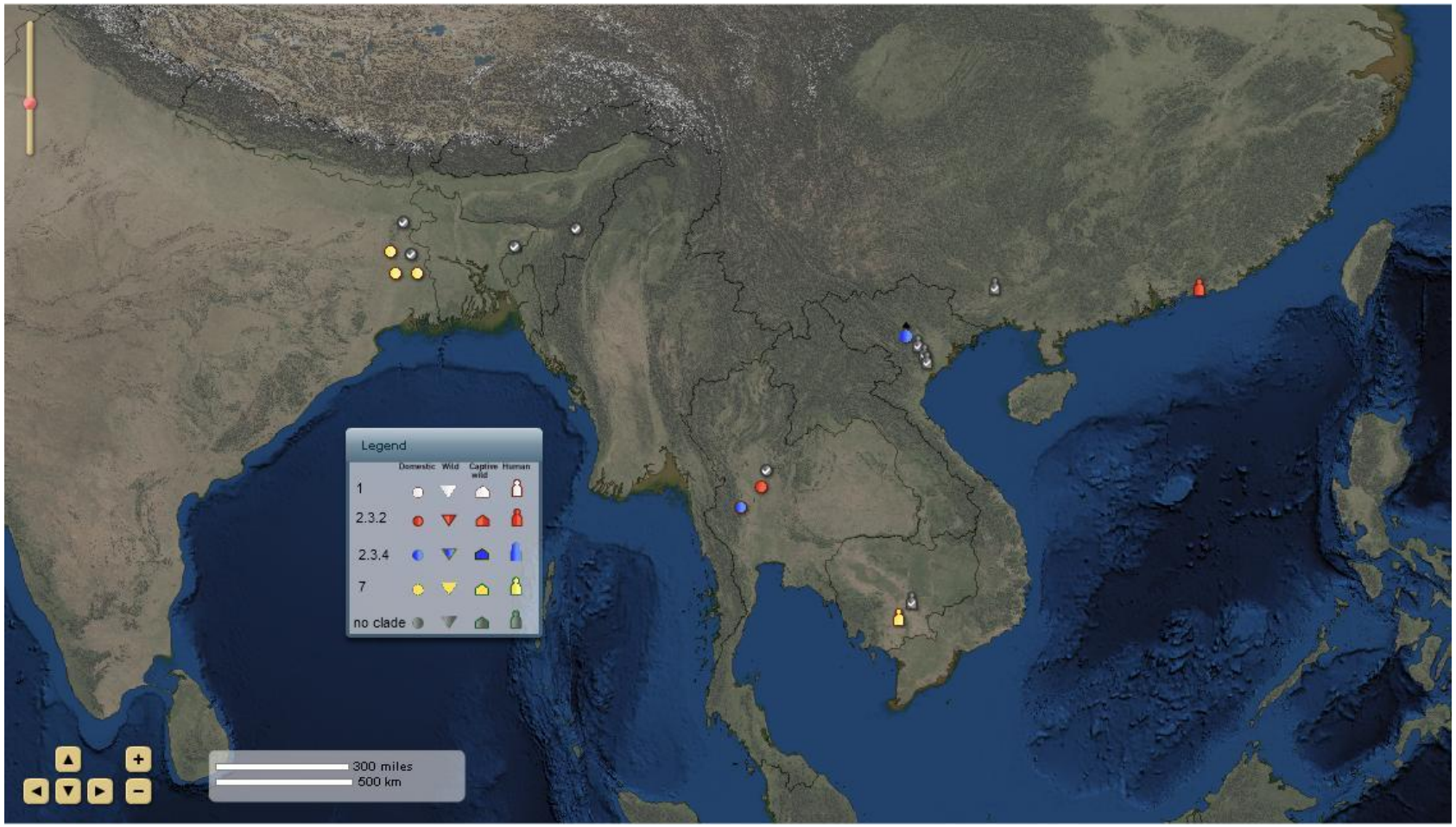
2-3-4

1

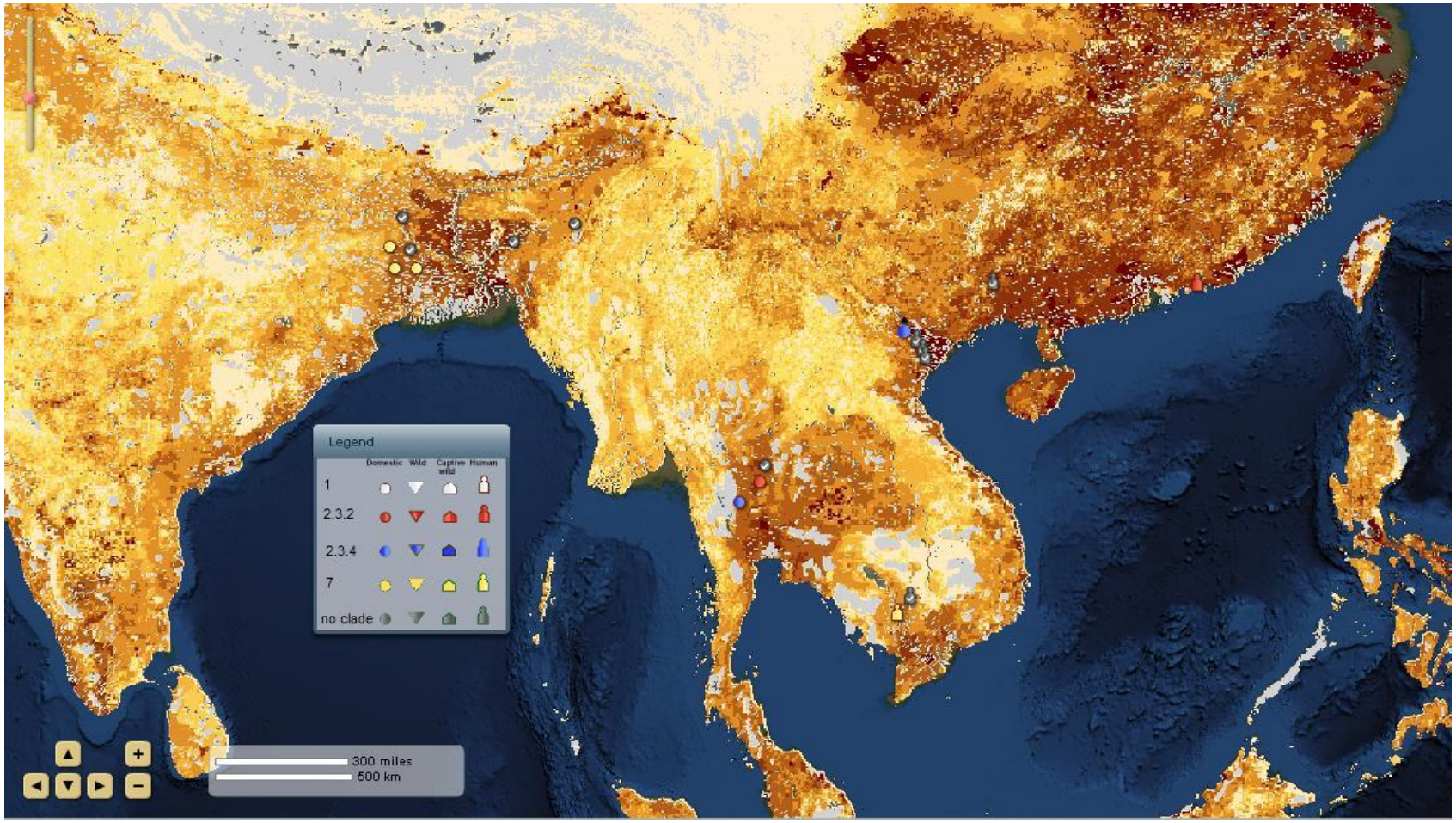





Mapping clade information



Adding layers…









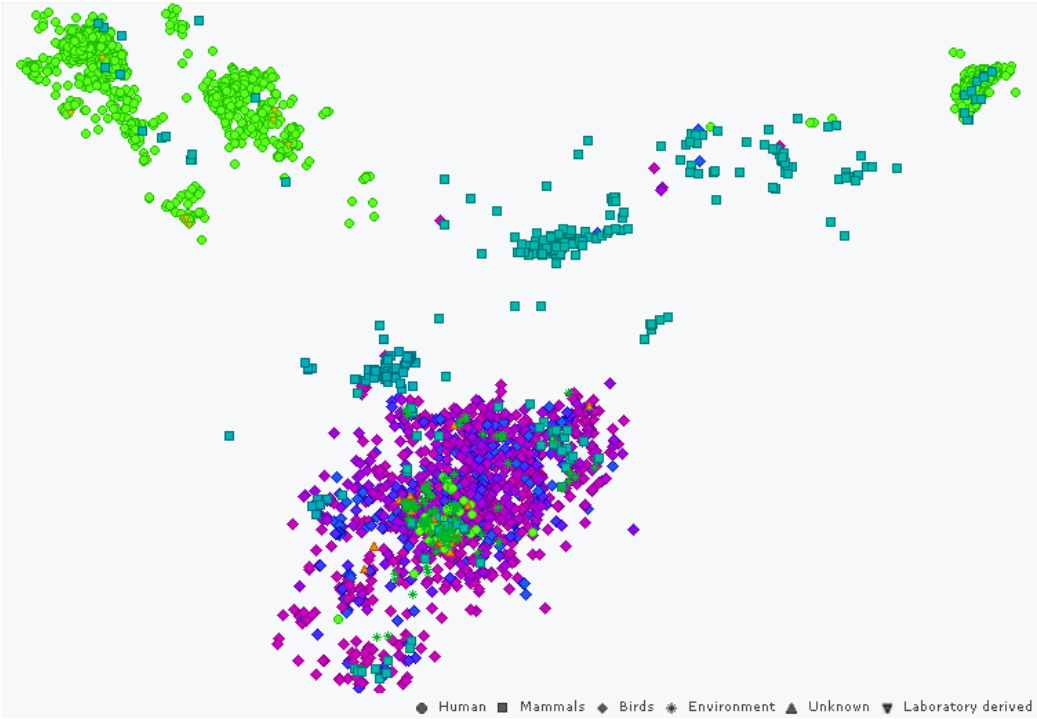
Computed annotations:
molecular markers (OpenFlu)

Segment	Type (subtype)	Number of isolates	Position (H3 and N2 numbering)	Wild	Mutant	Antiviral resistance				High pathogenicity	Hum. adapt.
						Neuraminidase inhibitors			Adam.		
						Ose.	Zan.	Per.			
NA	A(N2), B	12	119	E	V	X					
NA	A(N2), B	1	119	E	A	X	X				
NA	A(N2), B	3	119	E	G		X				
NA	A(N2), B	7	119	E	D		X	X			
NA	A(N1)	415	274	H	Y	X		X			
NA	A(N1,N2)	0	294	N	S	X					
NA	A(N2), B	2	292	R	K	X	X	X			
NA	B	0	152	R	K	X	X	X			
NA	B	3	198	D	N/E	X	X				
NA	B	1	222	I	T	X	X				
NA	A(N2)	6	222	I	V	X	X				
M2	A	20	26	L	F				X		
M2	A	130	27	V	A				X		
M2	A	8	30	A	T				X		
M2	A	1433	31	S	N				X		
M2	A	0	34	G	E				X		
HA	A	2030	HA cleavage site		≥5 R or K					+++	
NP	A	92	319	N	K						++
PB2	A	3181	627	E	K						++
PB2	A	177	701	D	N						++
NS1	A	97	92	D	E					+ (M)	+
NS1	A	1240	80–84	XXXXX	–					+ (M)	+
PB1-F2	A	1416	66	N	S					++	


Mapping molecular markers

Possible tools and applications: to be explored/developed

eg Sequence Similarities Maps, to globally monitor the trends in the evolution of virus populations



Snapshot of the eight segments map of human seasonal H1N1, seasonal H3N2, H1N1 pandemic lineage and H5N1 viruses (Swiss Institute of Bioinformatics)







Conclusions

- Most endemic countries have made progress in understanding, controlling and preventing H5N1 HPAI but the gains represent only small steps towards eliminating the virus
- Only progressive control: timelines with milestones to reduce endemicity and develop defined disease-free compartments or zones







Conclusions (con't)

- Long-term interventions needed in: capacity building; improving understanding of infection and transmission dynamics; developing appropriate biosecurity and hygiene measures for farms and markets; improving early detection, diagnosis and response to the disease; strengthen and sustain disease control related systems of veterinary services from central level to the field
- Support national and regional surveillance and laboratory networking; Promote the idea of influenza as a public good; Facilitate sharing of information and biologic materials

Thank you for your attention…