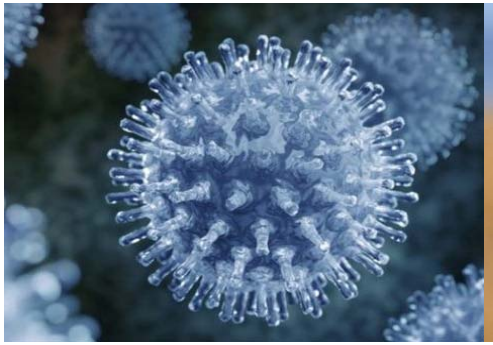
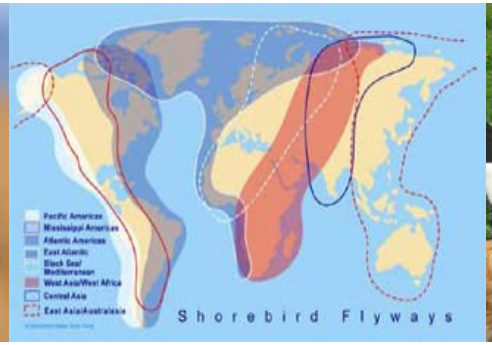
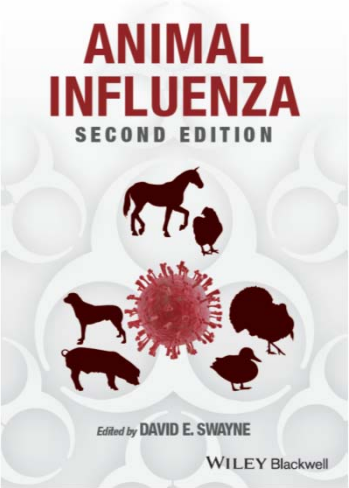




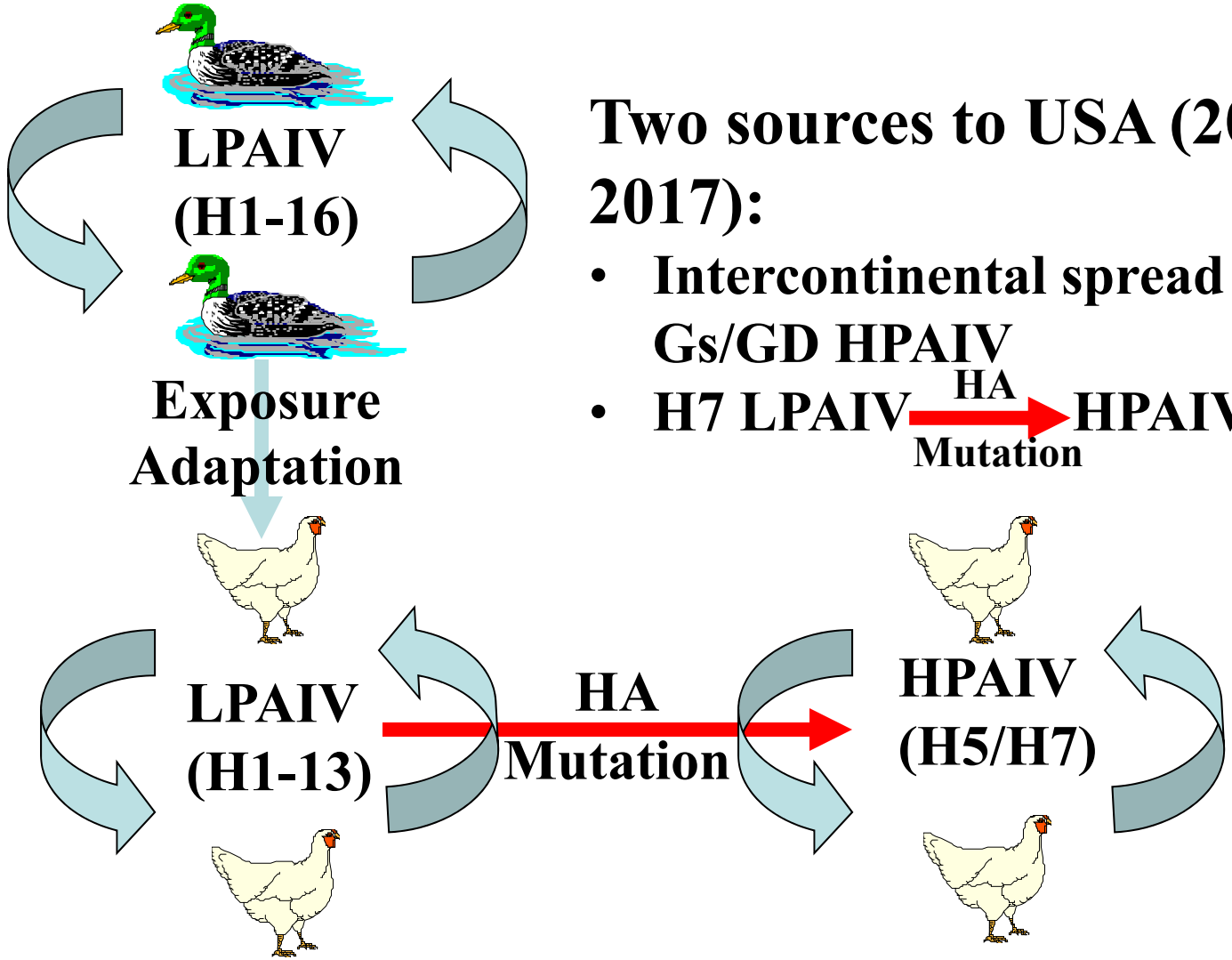
The USA experience - strategies for the prevention and control of AI in North America after the recent outbreaks of HPAI

David E. Swayne and Fidelis Hegngi

Exotic and Emerging Avian Viral Diseases Research Unit, Southeast Poultry Research Laboratory, U.S. National Poultry Research Center, Agricultural Research Service, U.S. Department of Agriculture, Athens, Georgia, Veterinary Services, Animal and Plant health Inspection Services, U.S. Department of Agriculture, Riverdale, Maryland



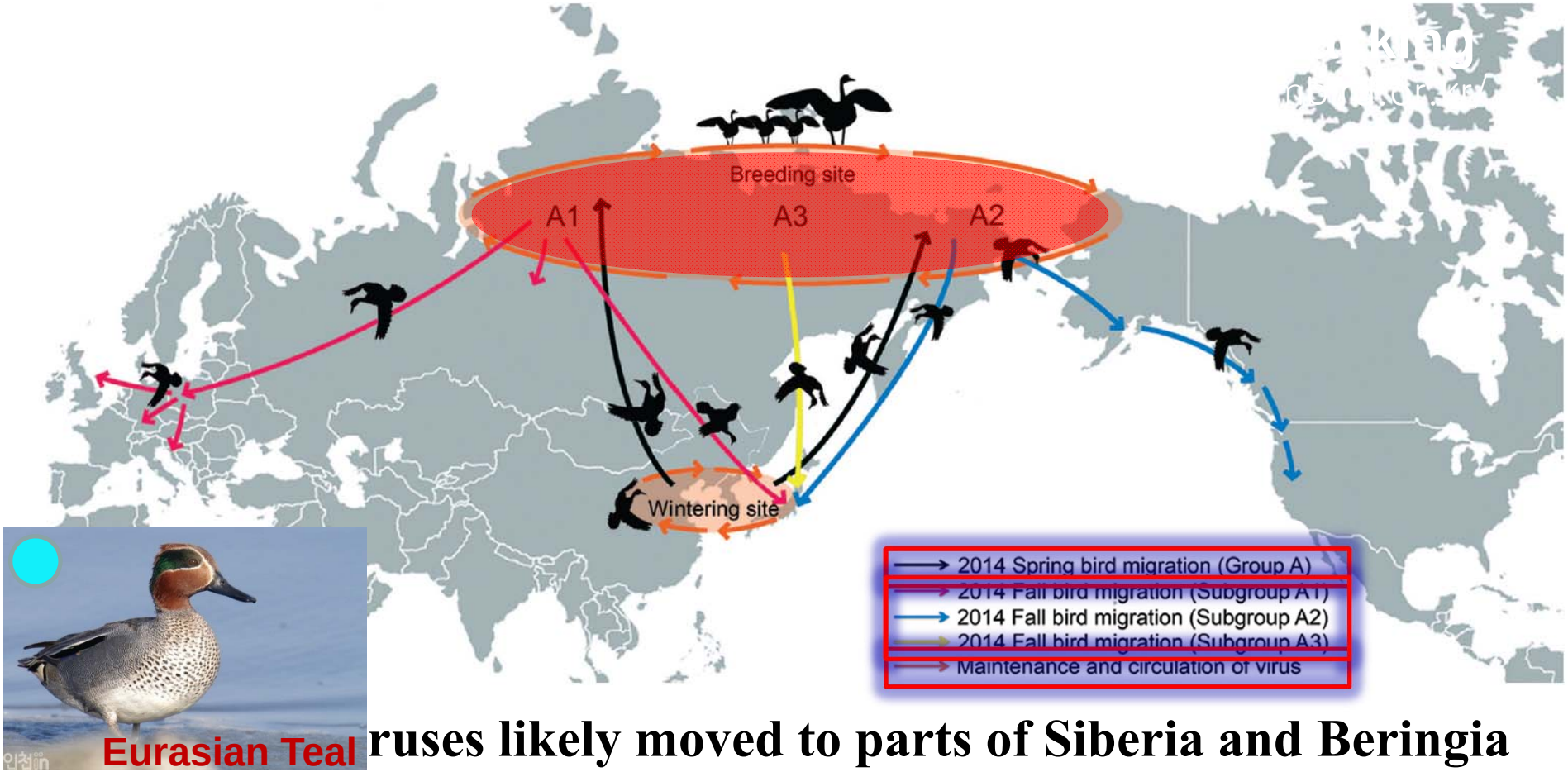
Avian Influenza Virus Ecology/Epidemiology



Two sources to USA (2014-2017):

- **Intercontinental spread of H5N8 Gs/GD HPAIV**
- **H7 LPAIV $\xrightarrow[\text{Mutation}]{\text{HA}}$ HPAIV**

Spread of H5N8 to USA in 2014

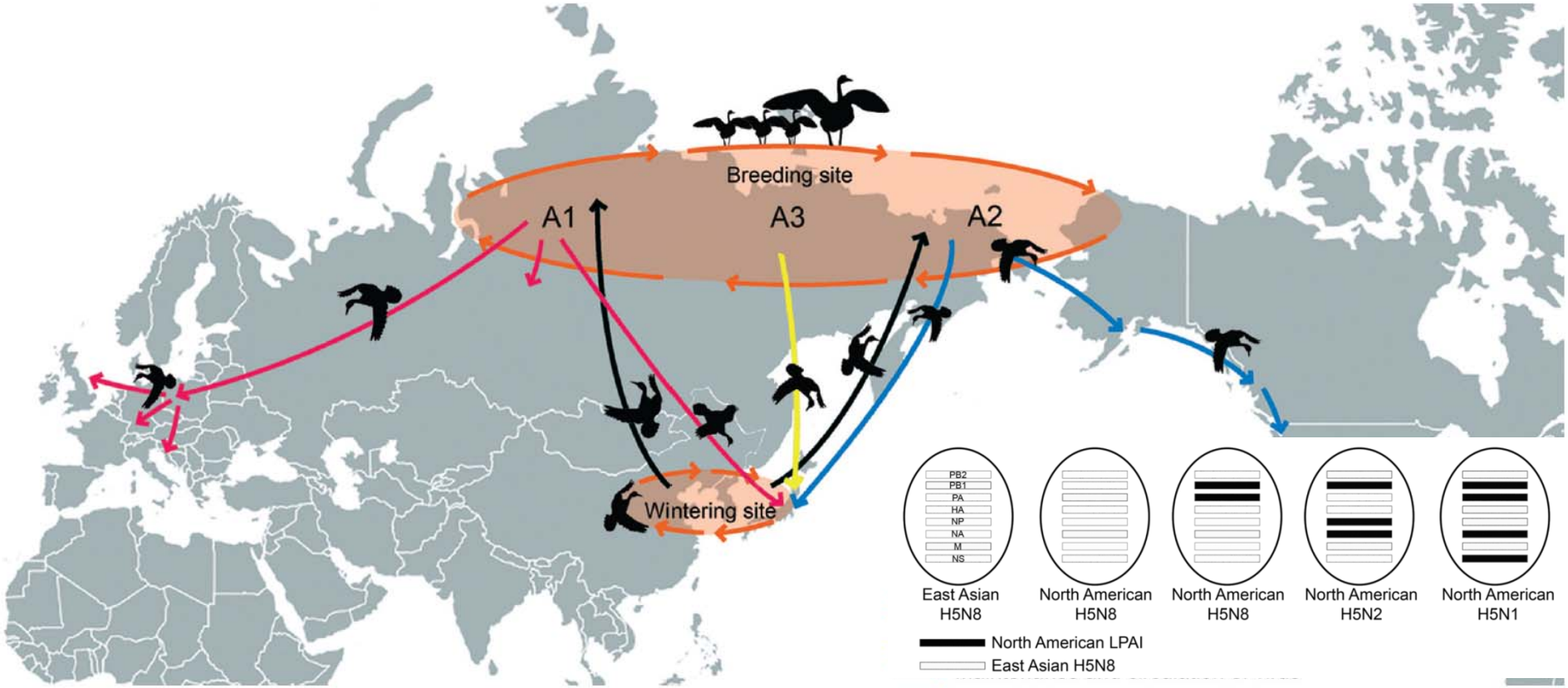


ruses likely moved to parts of Siberia and Beringia

- **Evolved into subgroups during the breeding season**
- **Subsequently spread along different flyways during autumn into Europe, East Asia and North America**

Dong-Hun Lee et al., 2015. J Virol 89:6521–6524.

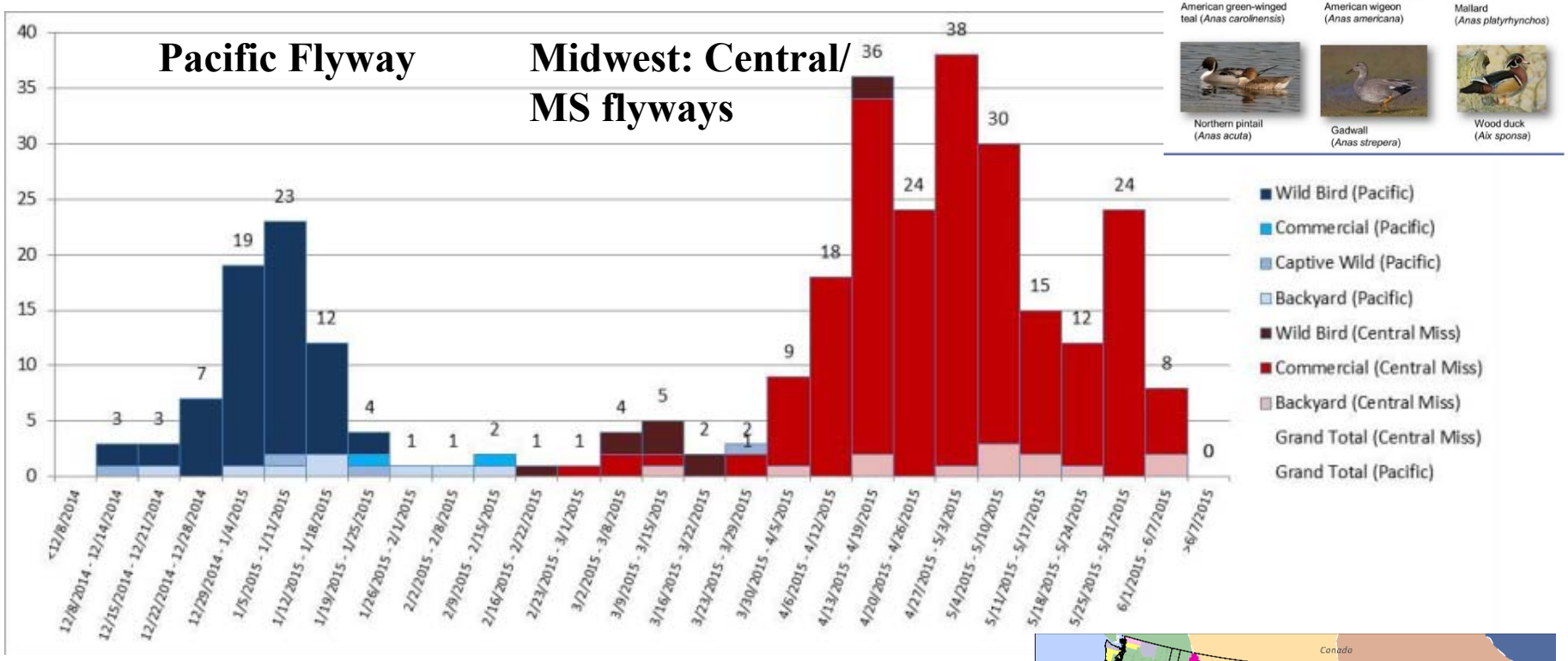
Spread of H5N8 to USA in 2014



Reassortment events with LPAIV lead to the divergence of H5 viruses into distinct subtypes, including reassortant H5N1, H5N2 and H5N8 in North America

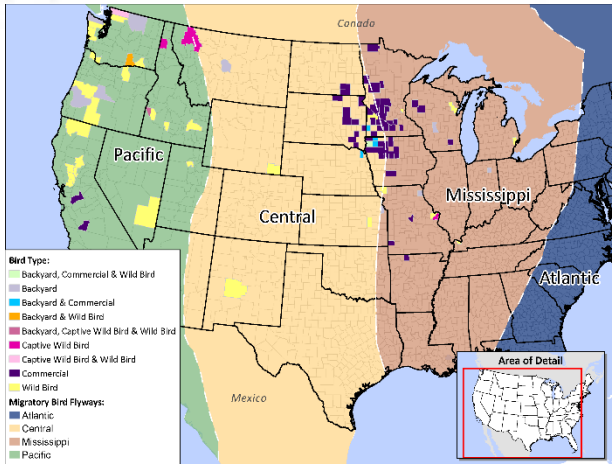
Dong-Hun Lee et al., 2016. Emerging infectious diseases 22 (7), 1283.

12/8/2014 to 6/17/2015 – H5 HPAIV in wild bird, backyard poultry and commercial poultry



301 detections (4 captive wild bird; 21 backyard; 211 commercial flocks, 65 wild birds)

- **21 states affected; 15 states with wild bird cases**
- **~ 50.5 million commercial birds: Layer chickens (~ 43 million) > turkeys (~ 7.5 million)**

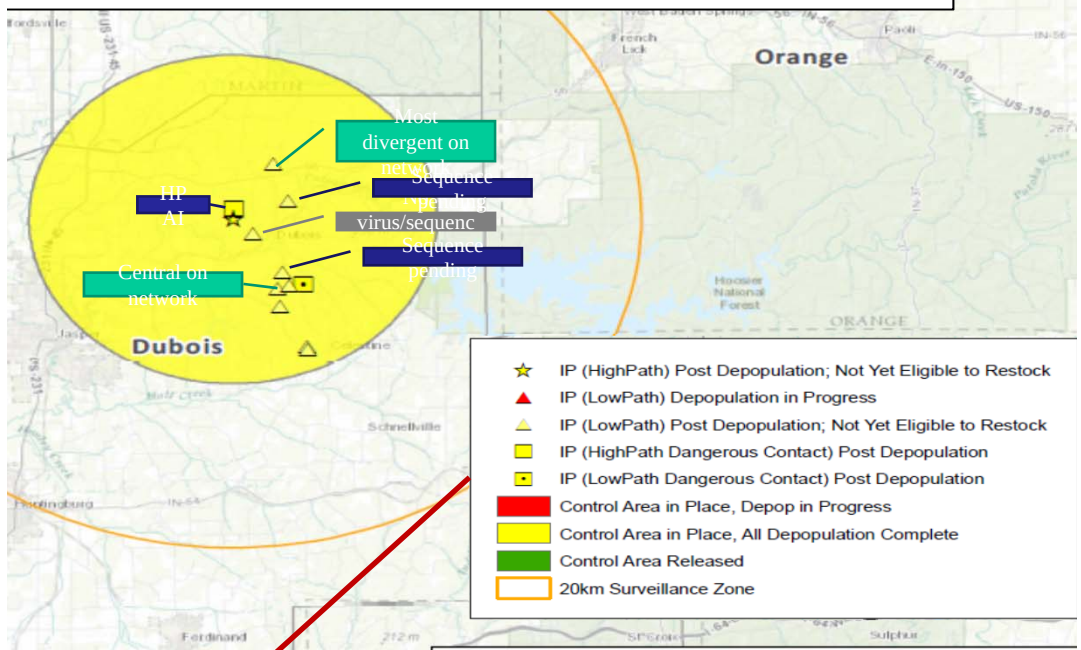


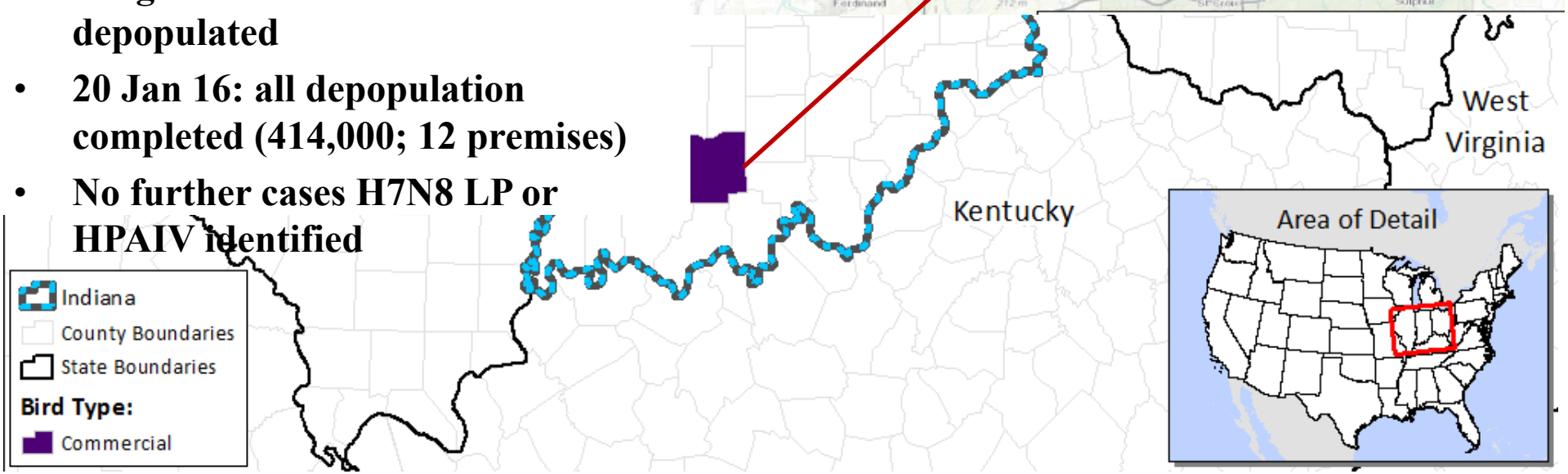
USA Control Program and Costs

- **Cost of H5Nx HPAI Outbreak (2014-2015):**
  - **Direct cost $1.6b; economy wide $3.3b**
  - **Federal taxpayer - $850m (~$200m indemnity, ~$650m response cost)**
- **Emergency H5 vaccine bank (500m doses)**
  - **Vaccines must be licensed by USDA**
  - **New rule: "cassette" concept for non-replicating influenza vaccines with approval via truncated licensing process**
  - **Requires an emergency declaration by USDA before use in the field – USA has not used vaccine in HPAI control**
  - **Approved Vaccines (DIVA compatible):**
    - **rHVT-H5: recombinant herpesvirus turkey with H5 (clade 2.2) insert**
    - **RNP-H5: RNA particle vaccine with H5 insert (clade 2.3.4.4)**
    - **rgH5N1: H5N1 reverse genetics whole AIV, inactivated (clade 2.3.4.4)**

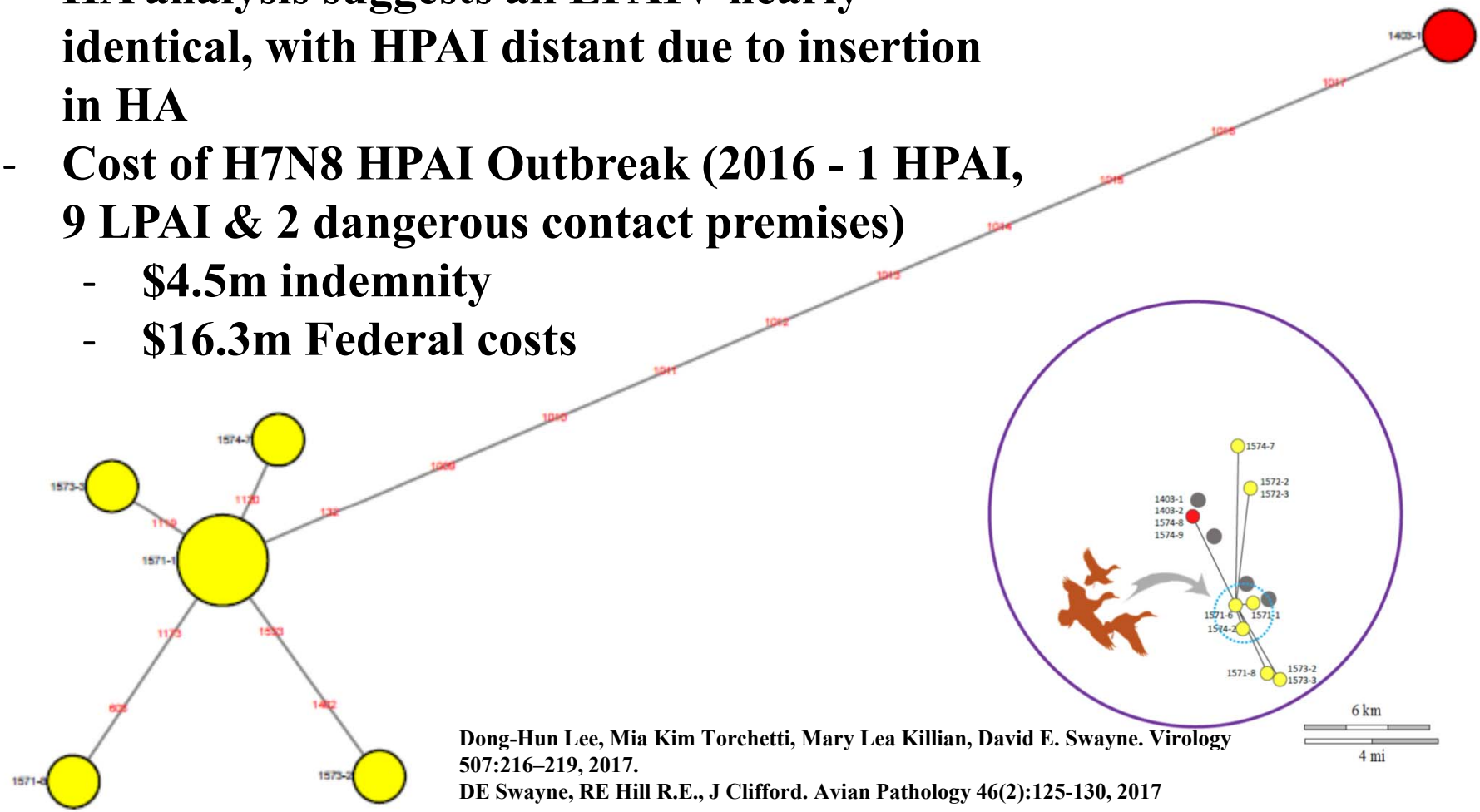
ɔn and Stamping-out: ɪna, Turkeys (2016)

- 10 Jan 16: meat turkeys w/↓ water consumption & pulmonary edema in dead birds within 1 of 5 barns
- 13 Jan 16: 100 dead birds (1.3%); 14 Jan, 800 dead birds (10.5%)
- 14 Jan 16: +ACIA and preliminary +H7 rRT-PCR
- 15 Jan 16: +H7N8 North American HPAIV, depopulation initiated
- 16 Jan 16: Depopulation completed; 10km zone 65 comm. premises surveillance identified H7N8 LPAIV on 9 premises; 2 dangerous contacts also depopulated
- 20 Jan 16: all depopulation completed (414,000; 12 premises)
- No further cases H7N8 LP or HPAIV identified





- **Eight H7N8 viruses highly similar and supports a single introduction followed by lateral/secondary spread**
- **HPAIV, IVPI = 2.84, PENPK<u>KRK</u>TR/GLF**
- **LPAIV, IVPI = 0.00, PENPKTR/GLF**
- **HA analysis suggests all LPAIV nearly identical, with HPAI distant due to insertion in HA**
- **Cost of H7N8 HPAI Outbreak (2016 - 1 HPAI, 9 LPAI & 2 dangerous contact premises)**
  - **$4.5m indemnity**
  - **$16.3m Federal costs**



Dong-Hun Lee, Mia Kim Torchetti, Mary Lea Killian, David E. Swayne. Virology 507:216–219, 2017.
DE Swayne, RE Hill R.E., J Clifford. Avian Pathology 46(2):125-130, 2017

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2017 HPAI Detections

- On **March 4, 2017** APHIS **confirmed H7N9 HPAI** in a **commercial broiler breeder flock** in Lincoln County, Tennessee
- First commercial HPAI detection since January 2016
- The H7N9 HPAI is of North American wild bird lineage and not related to Asian H7N9 HPAI viruses
- On **March 15, 2017** APHIS confirmed **a second** H7N9 HPAI in a commercial broiler breeder flock in Lincoln County, Tennessee
- This second HPAI detection was within the Control Area (10 km) of the First HPAI case
- APHIS worked with State and industry for quick response
- Both HPAI infected flocks were depopulated and disposal has been completed on both HPAI premises
- Virus elimination activities (C&D) completed May 13, 2017
- There have been no further detections of HPAI in the United States since March 15, 2017

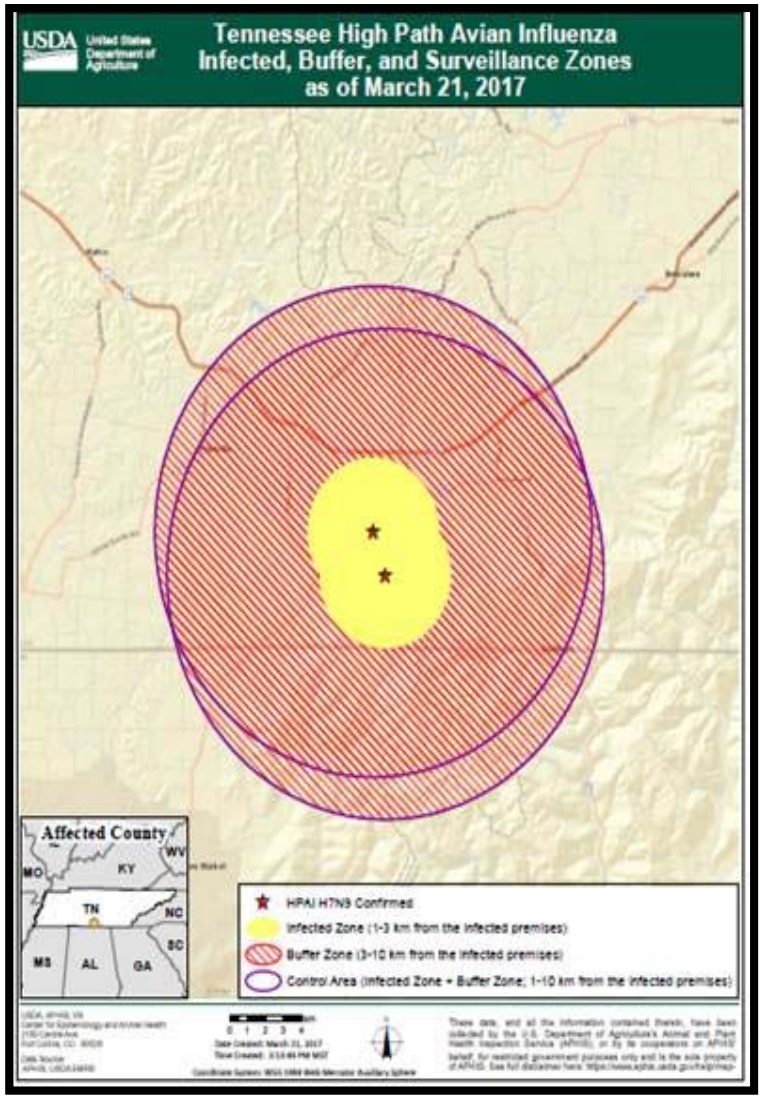
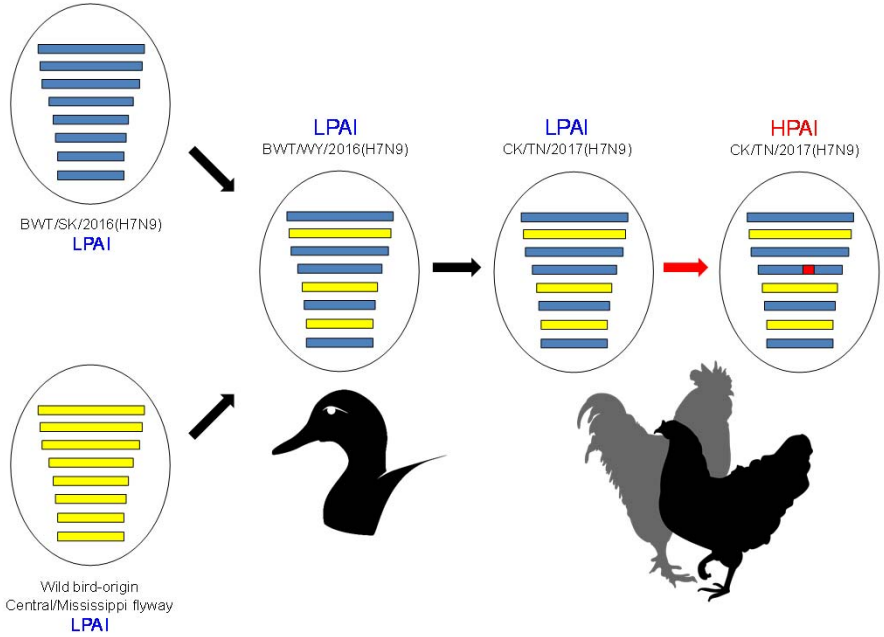


Photo credit – https://www.bigdutchman.com/en/poultry

2017 HPAI and LPAI Detections

- **H7N9 LPAI virus and/or antibody detections in Tennessee, Alabama, Georgia and Kentucky poultry**
- **Reassortment of wild bird LPAIV genes and transmission to poultry**



Dong-Hun Lee, Mia K. Torchetti, Mary Lea Killian, Yohannes Berhane, David E. Swayne. Emerging Infectious Diseases 23(11):1860-1863, 2017

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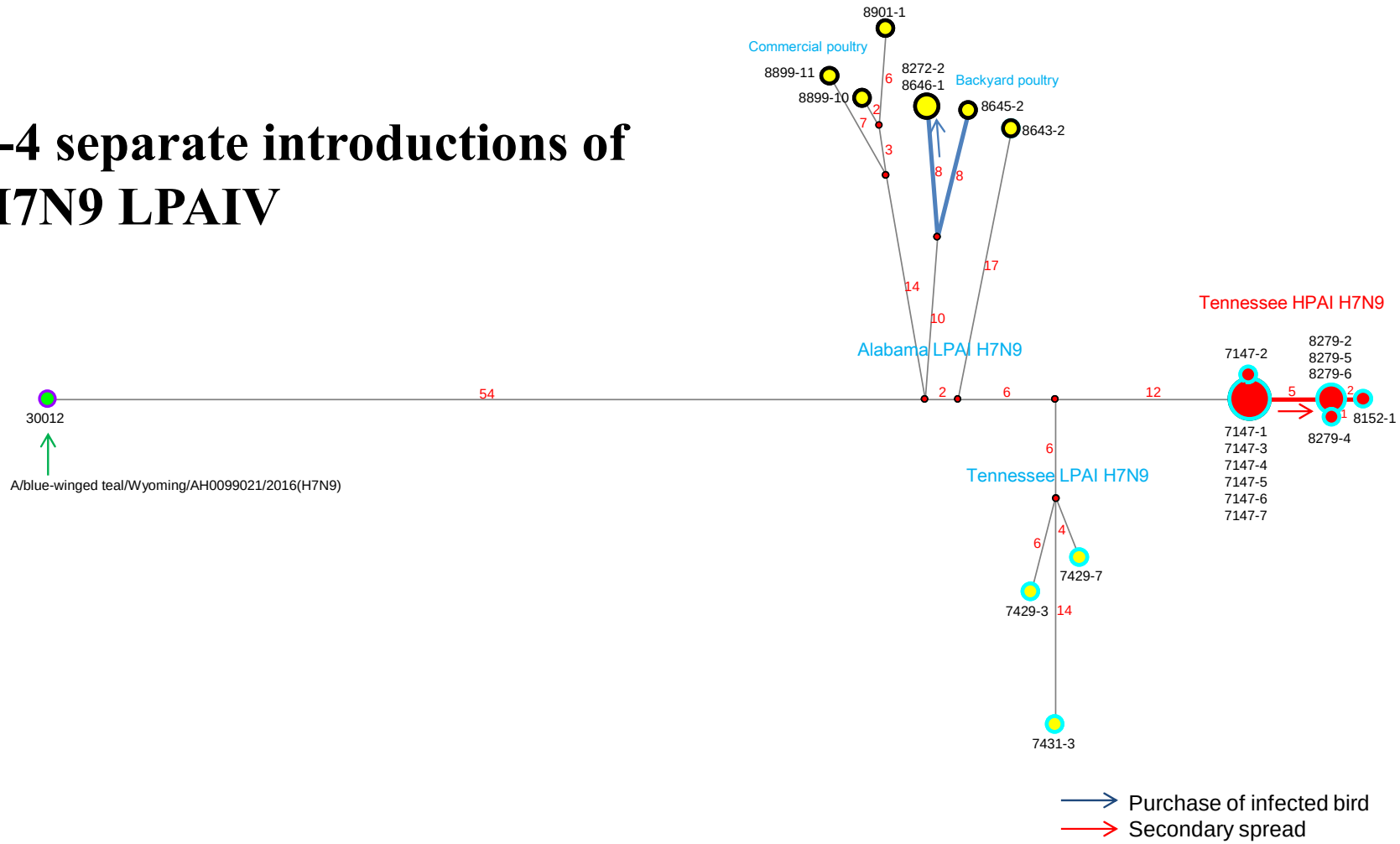
2017 HPAI and LPAI Detections

3-4 separate introductions of H7N9 LPAIV



Dong-Hun Lee, Mia K. Torchetti, Mary Lea Killian, Yohannes Berhane, David E. Swayne. Emerging Infectious Diseases 23(11): 1860-1863, 2017

Summary of U.S. HPAI Response Process

Figure 16. A Guide to Help You Understand the Response Process

USDA
United States Department of Agriculture

Highly Pathogenic Avian Influenza
A Guide To Help You Understand the Response Process

1 2 3 4 5 6 7 8 9 10

Detect
You see unusual signs of illness or sudden deaths in your flock. You report it to your private or State veterinarian. Samples are taken and tested. You find out your flock is positive for HPAI.

Quarantine
USDA and State personnel come to your farm. We assign you a caseworker, who will be your main point of contact onsite, answer your questions, and guide you through the needed paperwork. We will also place your operation under quarantine, meaning only authorized workers are allowed in and out, and movement restrictions for poultry, poultry products, and equipment go into effect. We contact neighboring poultry farms and start testing their birds to see if they've been affected, too.

Appraise
We work with you to create a flock inventory. This lists how many birds you have, what species they are, their age, and other key details that will help us give you 100 percent of fair market value for your birds.

Depopulate
Infected flocks are depopulated as quickly as possible—ideally within 24 hours of the first HPAI detection—to get rid of the virus.

Compensate
You receive your first indemnity payment early on in the response process. We also pay you a standard amount for virus elimination activities (cleanup work).

Manage Disposal
USDA will help you dispose of the dead birds safely. Disposal methods include composting, burial, incineration, rendering, or landfilling. The options you'll have depend on several things: what type of farm you have, the specific conditions there, State and local laws, and what you prefer.

Eliminate Virus
The next step is to wipe out all traces of the virus at your property. To kill the virus, thoroughly clean and disinfect the barn, equipment, and all affected areas of your farm. You can do this work yourself or hire contractors to handle it.

Test
As soon as you're ready, let your caseworker know you're finished with cleanup. Your site must then stay empty for at least 21 days. During this time, we'll return to collect and test environmental samples. We need to confirm that your property is completely virus-free.

Restock
Once USDA and the State both approve, you can restock your facilities and start production again. State officials will release your farm from quarantine after all required testing and waiting periods are done.

Maintain Biosecurity
After restocking, you'll need to continue maintaining the highest biosecurity standards to keep the virus from coming back. For biosecurity tips, go to www.aphis.usda.gov/publications and download the factsheet "Prevent Avian Influenza at Your Farm."

How Long Does the Process Take?
Ideally, this entire process could be completed in as soon as 60–120 days. However, the timeframe varies depending on many things (for example, flock size, depopulation and disposal methods used, test results, farm's location). We're committed to restoring production as fast as we can while also protecting poultry health.

Questions?
Talk with your caseworker or the State or Federal officials responding to the disease event in your area.

For general information and contacts, visit:
www.usda.gov/avian_influenza.html
www.aphis.usda.gov/fadprep

Animal and Plant Health Inspection Service • APHIS 91-029-026 • Issued September 2015

United States HPAI Response: Detect

Surveillance and Diagnostics

- The challenges related to diagnostics for HPAI are greater than they may be for other diseases because the disease is so virulent.
- Diagnostic infrastructure was straining to keep up with the demand for results.
- Enhanced diagnostic laboratory preparedness
  - **56** National Animal Health Laboratory Network (NAHLN) labs reviewed and updated staffing plans, surge capacity plans, and barcoding and shipping protocols.

- **Initiate depopulation based on:**
  - **A presumptive positive H5 or H7 virus detection (RRT-PCR): pool 11 swabs per vial and 2 vials**
  - **A flock that meets the AI case definition in field**
  - **Agreement of State and Federal officials**

United States – HPAI Response: Detect

Surveillance and Diagnostics

- **Case Definition – Mortality Threshold and NALHN RRT-PCR+**
- Commercial flocks within the control area that exceed the mortality thresholds listed below are investigated and sampled as rapidly as possible for avian influenza:
  - **Commercial broilers:** mortality exceeding 3.5 birds/1,000 per day
  - **Commercial layers:** mortality exceeding 3x the normal daily mortality per day (normal=0.13 birds/1,000 per day for layers from 2 to 50 weeks, and 0.43 birds/1,000 per day for layers over 50 weeks); OR 5 percent drop in egg production for 3 consecutive days
  - **Commercial turkeys:** mortality exceeding 2 birds/1,000 per day
  - **Broiler breeders:** mortality exceeding 2 birds/1,000 per day
  - **Layer breeders:** mortality exceeding 3x the normal daily mortality per day (normal: 0.2 birds/1,000 per day up to 50 weeks, and 0.37 birds/1,000 per day after 50 weeks)
  - **Turkey breeders:** mortality exceeding 2 birds/1,000 per day; OR a decrease in egg production of 15 percent occurring over a 2-day period
  - **Small-volume high-value commercial poultry flocks and other commercial flocks not listed here:** any sudden and significant mortality event or sudden drop in egg production should be investigated.

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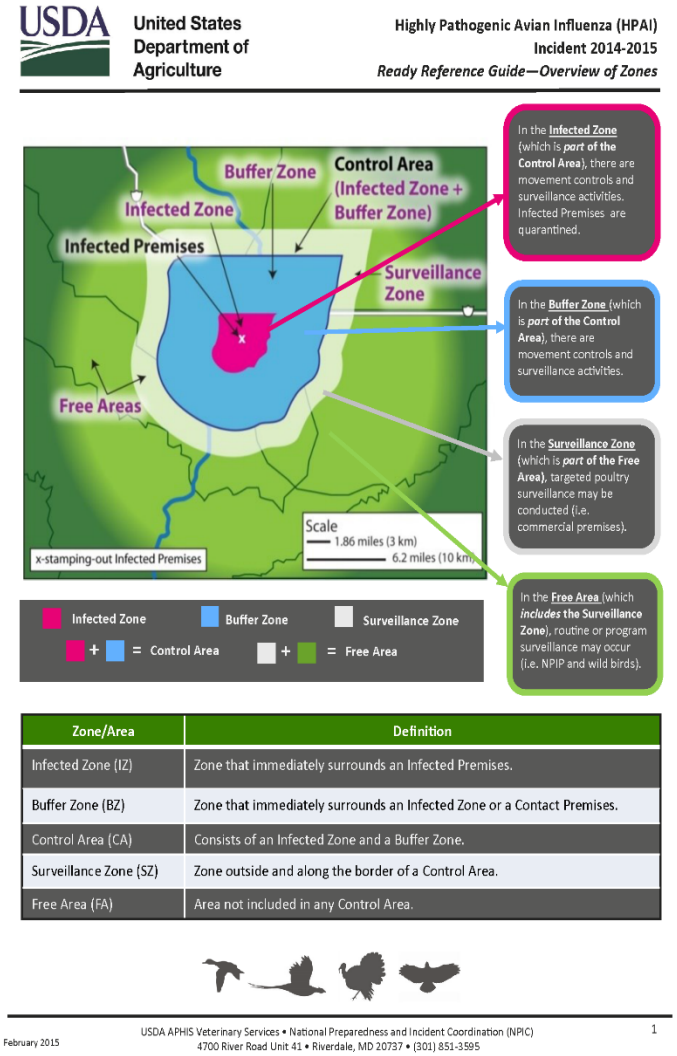
United States HPAI Response: Quarantine

Implement Effective Quarantine and Movement Control Measures:

- The quarantine is initiated based on non-negative/presumptive positive results from the National Animal Health Laboratory Network (NAHLN) labs
- Quarantine each IPs with movement controls in the 10-km control area
- **Infected Zone(IZ):** The 3 km radius of the infected premises will be considered the infected zone
- **Buffer Zone (BZ):** The area between 3 km and 10 km of the infected premises will be considered the buffer zone
- **Control Area (CA):** 3-km infected zone + buffer zone
- **Surveillance Zone (SZ):** The zone at least 10 km wide outside the border of the Control Area, extending 20 km from IP



Zone/Area	Definition
Infected Zone (IZ)	Zone that immediately surrounds an Infected Premises.
Buffer Zone (BZ)	Zone that immediately surrounds an Infected Zone or a Contact Premises.
Control Area (CA)	Consists of an Infected Zone and a Buffer Zone.
Surveillance Zone (SZ)	Zone outside and along the border of a Control Area.
Free Area (FA)	Area not included in any Control Area.

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United States HPAI Response: Appraise/Compensate

9 CFR Part 53 - Authority to Pay Indemnity

- Federal law gives APHIS the authority to depopulate affected poultry flocks to contain or stop the spread of Foreign Animal Diseases (FAD) if they are found in U.S. poultry populations such as: Virulent Newcastle disease (vND) and Highly pathogenic avian influenza (HPAI), or any other communicable disease of poultry that, in the opinion of the Secretary of Agriculture, constitutes an emergency and threatens the U.S. poultry population.

- To encourage early reporting of disease issues, farmers are paid for depopulated animals, which helps stop the outbreak and support impacted farmers at the same time.

- When depopulation occurs, APHIS will give the producer an indemnity payment equal to **the fair market value** of the animal.

Appraisal/Indemnity/Compensation

APHIS is authorized to pay 100 percent of eligible costs:

- Poultry or other animals infected or exposed
- Conveyances and materials
- Destruction of Eggs
- Depopulation
- Disposal
- Cleaning & Disinfection (C&D)
- Enhanced surveillance

United States – HPAI Response: Depopulate

Mass Depopulation vs. Euthanasia

Mass Depopulation

- Is a method by which large numbers of animals must be destroyed quickly and efficiently with as much consideration given to the welfare of animals as practicable, given extenuating circumstances:
  - Animal Health Emergency (AHE)
  - Catastrophic infectious disease
  - Mass intoxication
  - Natural disaster
- Goal: Depopulation in 24 hrs after diagnosis for AHE

Euthanasia

- Involves transitioning an animal to death as painlessly and stress-free as possible.
- Usually-Non-emergency
- Often for reasons other than disease control
- Typically low number of animals

- **In addition, the emotional and psychological impact on animal owners, caretakers, their families, and other personnel should be minimized**

United States HPAI Response: Disposal

Disposal Options:

- In-house composting
- Outdoor, on-site composting
- Off-site composting
- Burial
- Landfill
- Incineration
- Rendering

Photo- credit: Dr. Melissa Mace – WI DATCP

Photo credit: Ms. Lori Miller – PE/APHIS

United States Department of Agriculture

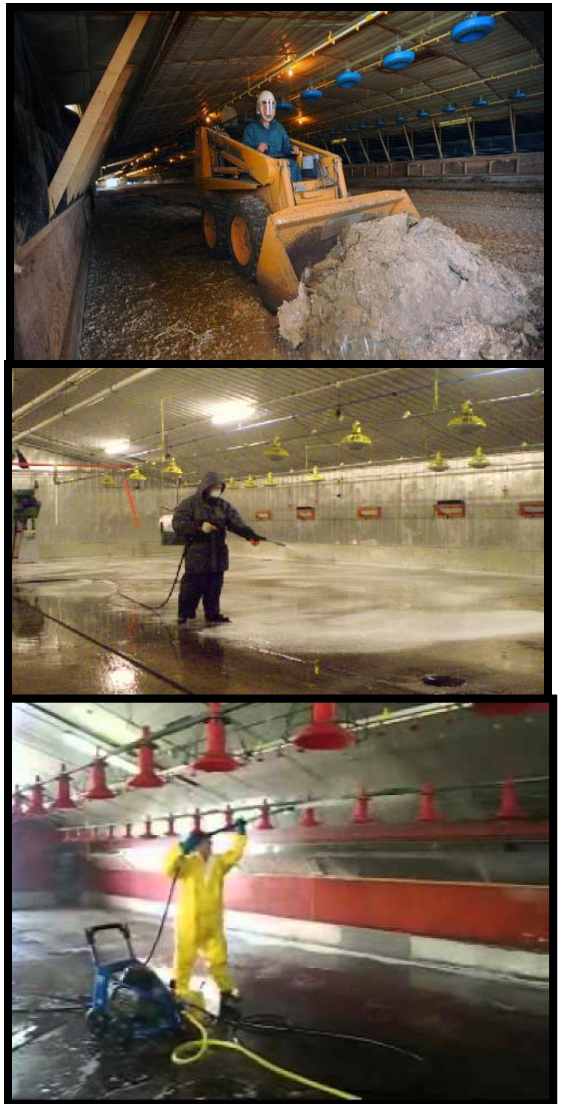
United States HPAI Response: Eliminate Virus

Virus Elimination - Cleaning and Disinfection

- HPAI Infected Premises must be both **CLEANED** and **DISINFECTED** (C&D)
- C&D practices during an outbreak **should focus on virus elimination** in a cost-effective manner

NOTE: A premises may require a *combination* of methods, but at *least* one choice must be selected from Step 1 and Step 2. The cleaning and disinfection options selected and implemented *must* be included as part of the approved cleaning and disinfection plan and approved by State Animal Health Officials and APHIS for reimbursement.

- For premises that cannot be cleaned and disinfected:
  - **Fallowing for 120 days or period recommended by Incident Command**
- Heating barns/houses that have been dry cleaned is often the most efficient way to disinfect poultry houses and destroy HPAI virus

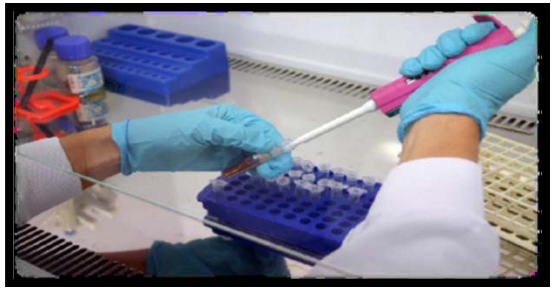


United States HPAI Response

Environmental Testing

- Environmental sampling inside the houses/barns occurs *after* the compost pile is complete and removed from inside the barns.

- Houses/barns are cleaned and disinfected.



- All environmental samples must test negative prior to restocking.

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United States HPAI Response - Restocking

Figure 1. Timeline for Disposal & Premises Restocking:
IN-HOUSE COMPOSTING

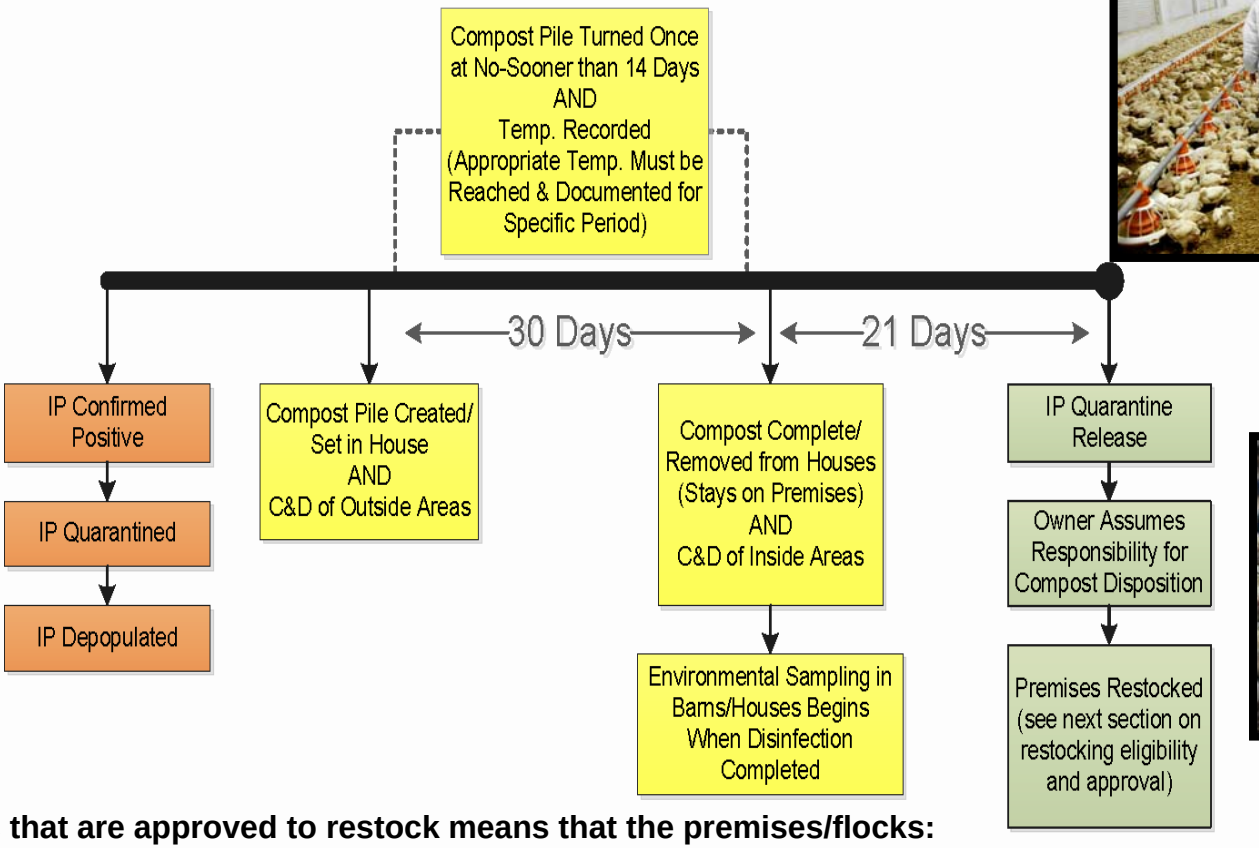

Photo credit: WattAgnet

- **Premises that are approved to restock means that the premises/flocks:**
  - Are 21 days post completion of C&D/virus elimination,
  - Finished with environmental sampling with no signs of HPAI in control area,
  - Have met all requirements per the USDA Flock Plan, State Quarantine Notice/Hold Order, and USDA Cooperative Compliance Agreement, and
  - Are approved by State and APHIS officials, in writing, to restock.

HPAI and Biosecurity

- We have developed a biosecurity self-assessment, and reference materials for producers

- Based on the flock size as stated in the 9 CFR 53.10 and NPIP Program Standards. The following minimum management practices and principles are designed to prevent the introduction and spread of infectious diseases:
  - Biosecurity Responsibility
  - Training
  - Line of Separation (LOS)
  - Perimeter Buffer Area (PBA)
  - Personnel
  - Wild Birds, Rodents and Insects
  - Equipment and Vehicles
  - Mortality Disposal
  - Manure and Litter Management
  - Replacement Poultry
  - Water Supplies
  - Feed and Replacement Litter
  - Reporting of Elevated Morbidity and Mortality
  - Auditing

United States HPAI Response: Conclusions

- **Critical Activities and Tools for Containment, Control, and Eradication:**
  - Enhanced Surveillance
  - Rapid diagnosis (Sample Collection, Surge Capacity, and Reporting of Confirmed Positive Premises)
  - Swift imposition of effective quarantine and movement controls
  - Health and Safety and PPE
  - Appraisal/Indemnity/Compensation
  - Mass depopulation and Humane euthanasia, potentially including preemptive culling
  - Effective and appropriate disposal procedures
  - Virus Elimination/Cleaning Disinfection of facilities & equipment procedures
  - Test to confirm virus is eliminated in the environment
  - Repopulation/Restocking
  - Logistics and Mobilization of Resources - National Veterinary Stock Pile
  - Epidemiological investigation and tracing
  - Biosecurity measures
  - Public Awareness, Education and Outreach Campaign/Communication

Grazie Mólto!