

Emerging and Exotic Diseases of Food Animals Threaten Global Food Security

**Clinician Outreach and
Communication Activity (COCA)
Webinar
May 28, 2015**

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Objectives

At the conclusion of this session, the participant will be able to:

- ❑ Review recent examples of emerging diseases of food animals
- ❑ Discuss reasons for emergence and dissemination of diseases of food animals
- ❑ Describe challenges for control of zoonotic and non-zoonotic food animal diseases
- ❑ Suggest infrastructure changes needed to improve prevention and control of food animal diseases

TODAY'S PRESENTER



James A. Roth, PhD, DVM, DACVM

Clarence Hartley Covault Distinguished Professor – Iowa State University
Director, Center for Food Security and Public Health
Executive Director, Institute for International Cooperation in Animal Biologics

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The findings and conclusions in this presentation are those of the author(s) and do not necessarily represent the views of the Centers for Disease Control and Prevention/the Agency for Toxic Substances and Disease Registry

Newly Emergent Zoonotic Diseases Since 1980

| 2015 and beyond?? | |
|-------------------|--|
| 2010 | 2013 Avian Influenza (H7N9), China |
| | 2012 Middle East Respiratory Syndrome (MERS), Arabian Peninsula |
| | 2011 Influenza A (H3N2) Variant Virus, United States |
| 2000 | 2009 Pandemic Influenza A (H1N1), globally |
| | 2005 Avian Influenza H5N1, Europe and Africa |
| | 2004 Avian Influenza (H5N1), East Asia, Asia, Eurasia |
| | 2003 Monkeypox, United States Severe Acute Respiratory Syndrome (SARS), spreads globally Bovine Spongiform Encephalopathy, United States |
| | 2002 Severe Acute Respiratory Syndrome (SARS), China |
| 1990 | 1999 West Nile virus, United States |
| | 1998 Nipah Virus, Malaysia |
| | 1997 Avian Influenza (H5N1) in humans, Hong Kong |
| | 1996 Variant Creutzfeldt-Jakob Disease (vCJD), United Kingdom |
| | 1994 Hendra virus, Australia |
| | 1993 Hantavirus (Sin Nombre virus), Four Corners, United States |
| 1980 | 1989 Ebola-Reston virus – monkeys imported from Philippines to United States |
| | 1986 Bovine Spongiform Encephalopathy (mad cow disease) – United Kingdom |
| | 1983 <i>Bartonella henselae</i> (causative agent for cat scratch disease) |
| | 1982 <i>E. coli</i> O157:H7 Lyme disease (<i>Borrelia burgdorferi</i>) etiologic agent discovered |
| | 1981 Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome (HIV/AIDS), United States |

EMERGING DISEASES AFFECTING VARIOUS ANIMAL SPECIES

Aquaculture



Viral hemorrhagic septicemia
Infectious salmon anemia
White spot disease (shrimp)

Dogs



Canine influenza
Nipah virus infection
Rift Valley fever
Leishmaniasis

Horses



West Nile encephalitis
Hendra virus infection

Poultry



High pathogenicity avian influenza
Newcastle disease

Swine



Porcine reproductive and respiratory syndrome virus
Porcine circovirus associated disease
Foot and mouth disease
African swine fever
Classical swine fever
Swine influenza
Nipah virus infection
Menangle virus infection
Reston Ebolavirus infection
Porcine Enteric Corona Viruses

Cats



High pathogenicity avian influenza (H5N1)
Plague (*Y. pestis*)
Rift Valley fever

Ruminants



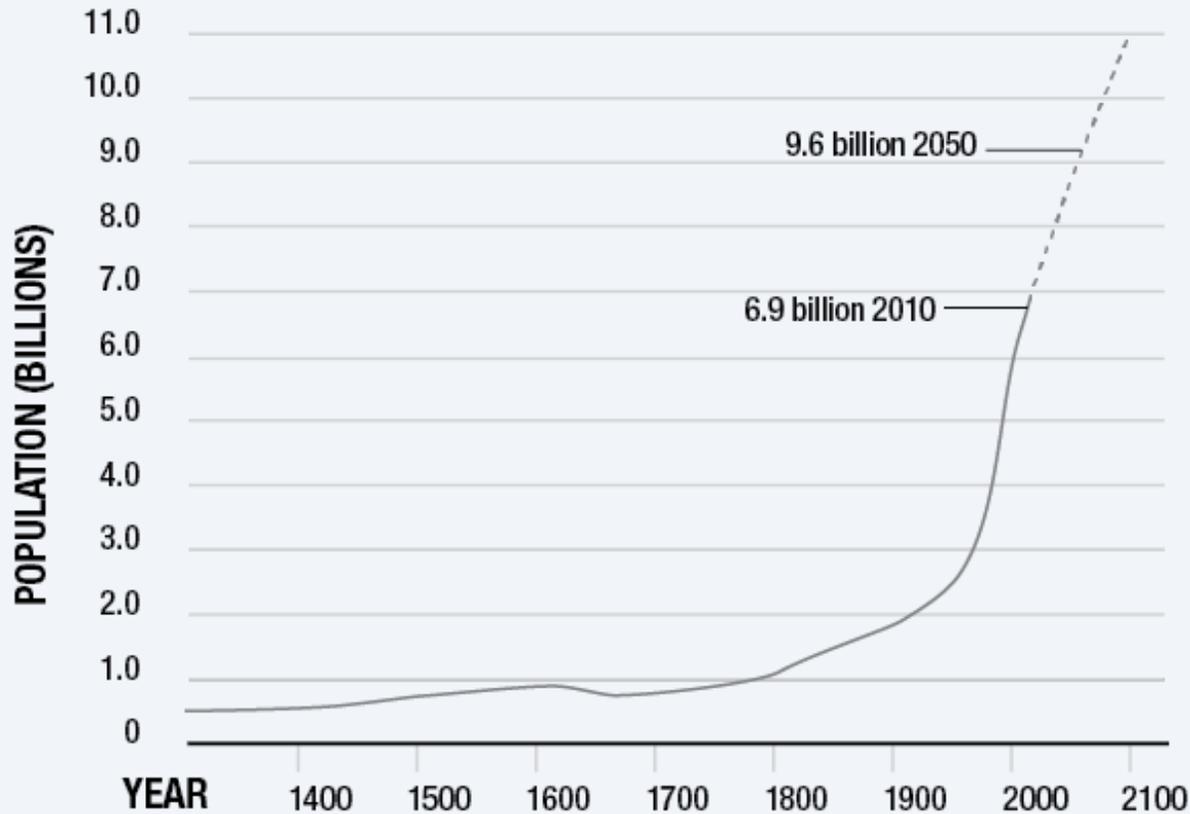
Foot and mouth disease
Rift Valley fever
Brucellosis
Prion diseases
BSE, CWD, Scrapie
Bluetongue
Tuberculosis, bovine
Schmallenberg

Factors contributing to continuing emergence/re-emergence of diseases

- Overpopulation
- Intensive animal agriculture
- Increased “backyard” animal production
- Wildlife/domestic animal/human interactions
 - Interspecies transfer of pathogens
- Environmental degradation
- Climate change
- Globalization

Growing Population

PEOPLE OF THE WORLD



GROWING POPULATION

Between 1960 and 2010, the world population more than doubled, growing by 3.9 billion people. While actual growth is predicted to slow between 2010 and 2050, another 2.6 billion people are expected to be added to the world's population. FAO estimates that 868 million people were undernourished in 2012.

In 2009, 49% of the population lived in cities.
By 2050, 70% of the population is projected to live in cities.

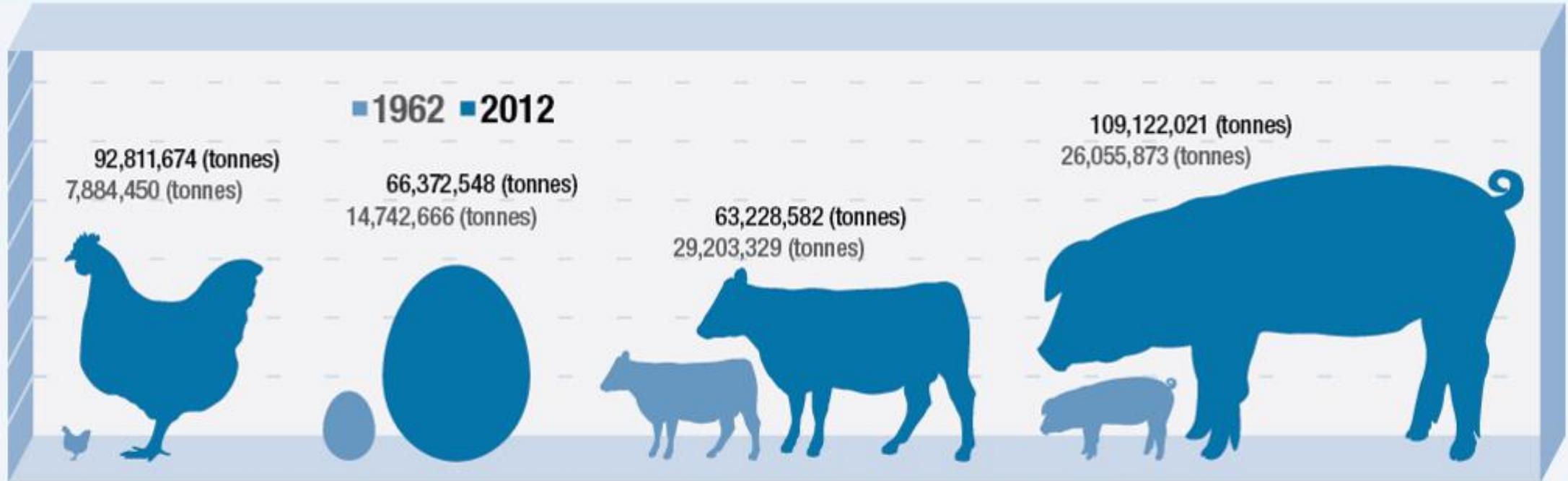
Crowded urban environments, especially those without adequate infrastructure, can enhance disease epidemics such as influenza.

Source: United Nations Department of Economic and Social Affairs Division

WORLD MEAT AND EGG PRODUCTION 1962 TO 2012

ESTIMATED PRODUCTION

Tonnes = metric ton = 1,000 kilograms



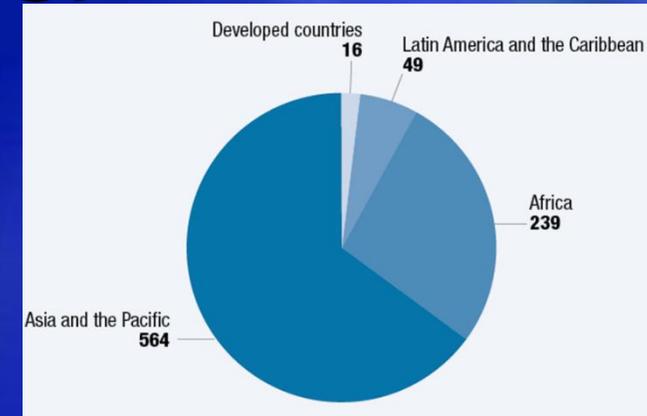
Increased Food Animal Production

Veterinarians must play a major role in finding the balance between the needs for efficient food production, conservation of the environment, and animal welfare.

Source: FAO STAT faostat3.fao.org

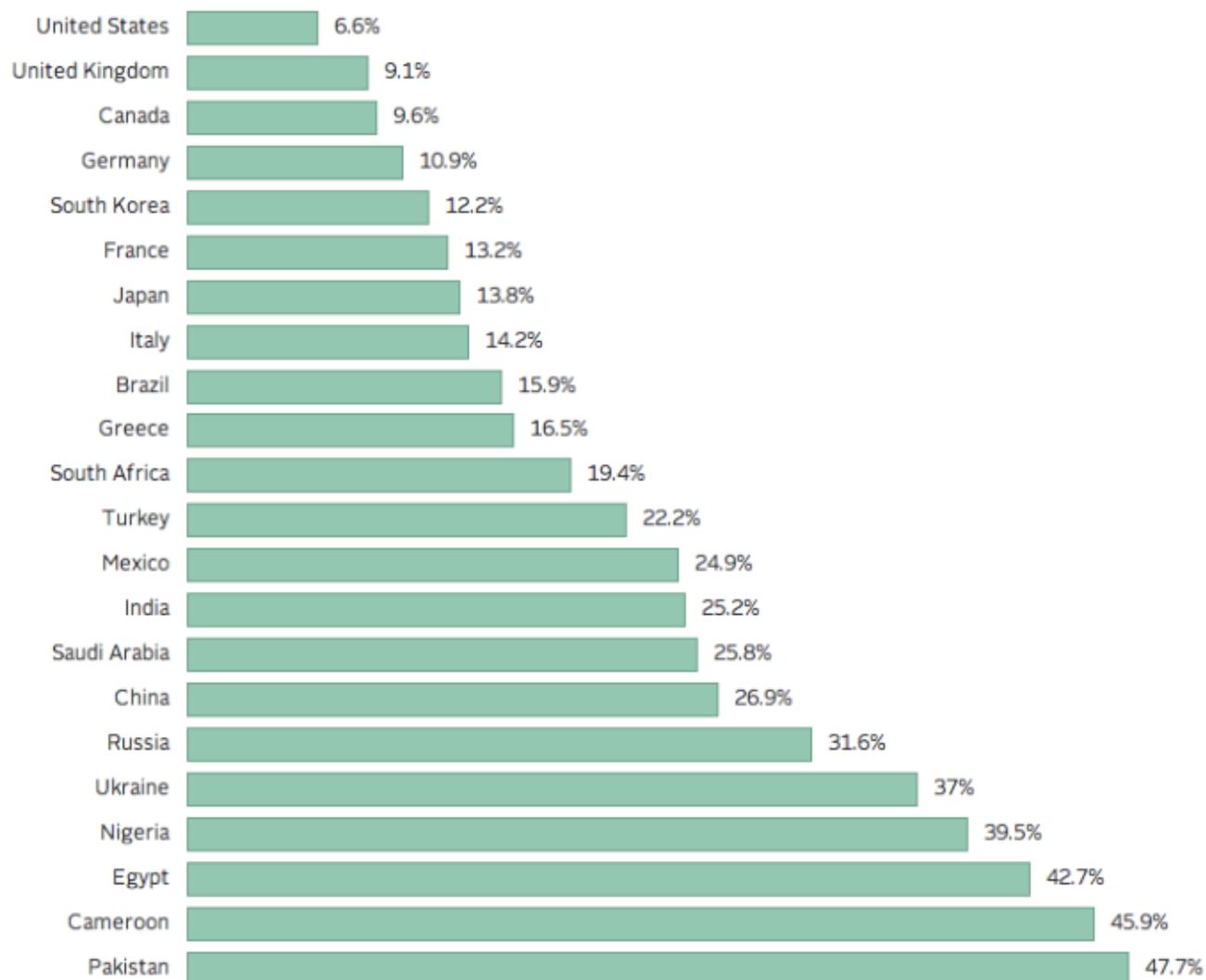
World Hunger

- 2012: 868 million undernourished people
- 49.1 million people in the United States live in “Food-insecure households”
 - Includes 16.7 million children
 - 14.4% of all adults
- FAO: food production needs to increase 70% from 2005/07 to 2050
 - to feed projected 9.1 billion people



How much countries spend on food

Selected countries, 2012, as % of household expenditures



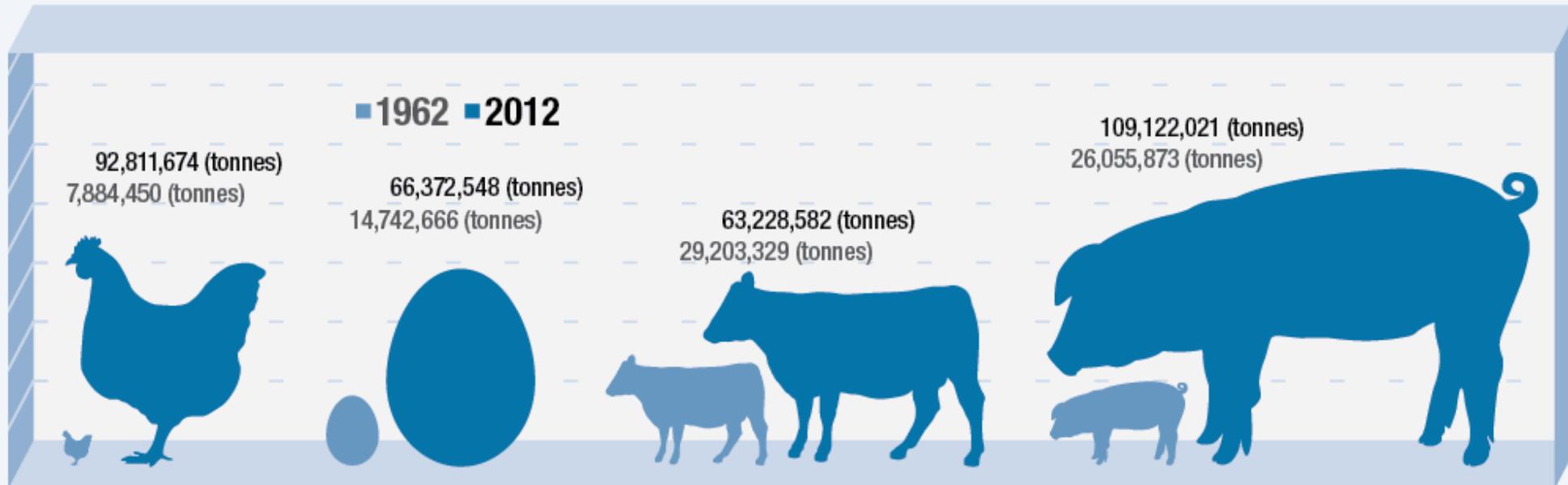
Source: USDA, Economic Research Service.



FAO: Food Production Needs to Increase 70% from 2005/07 to 2050

WORLD MEAT AND EGG PRODUCTION 1962 TO 2012

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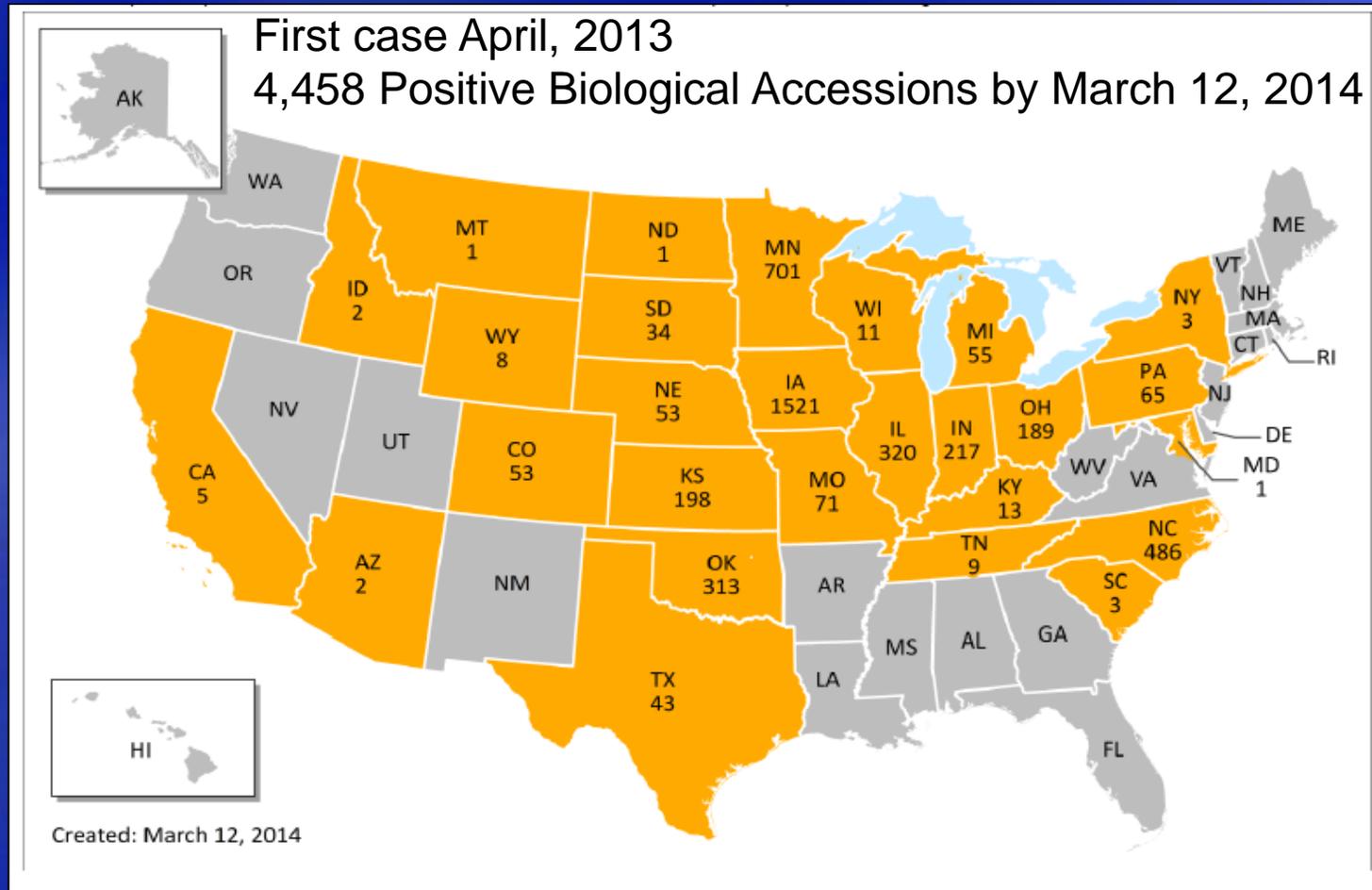
Swine



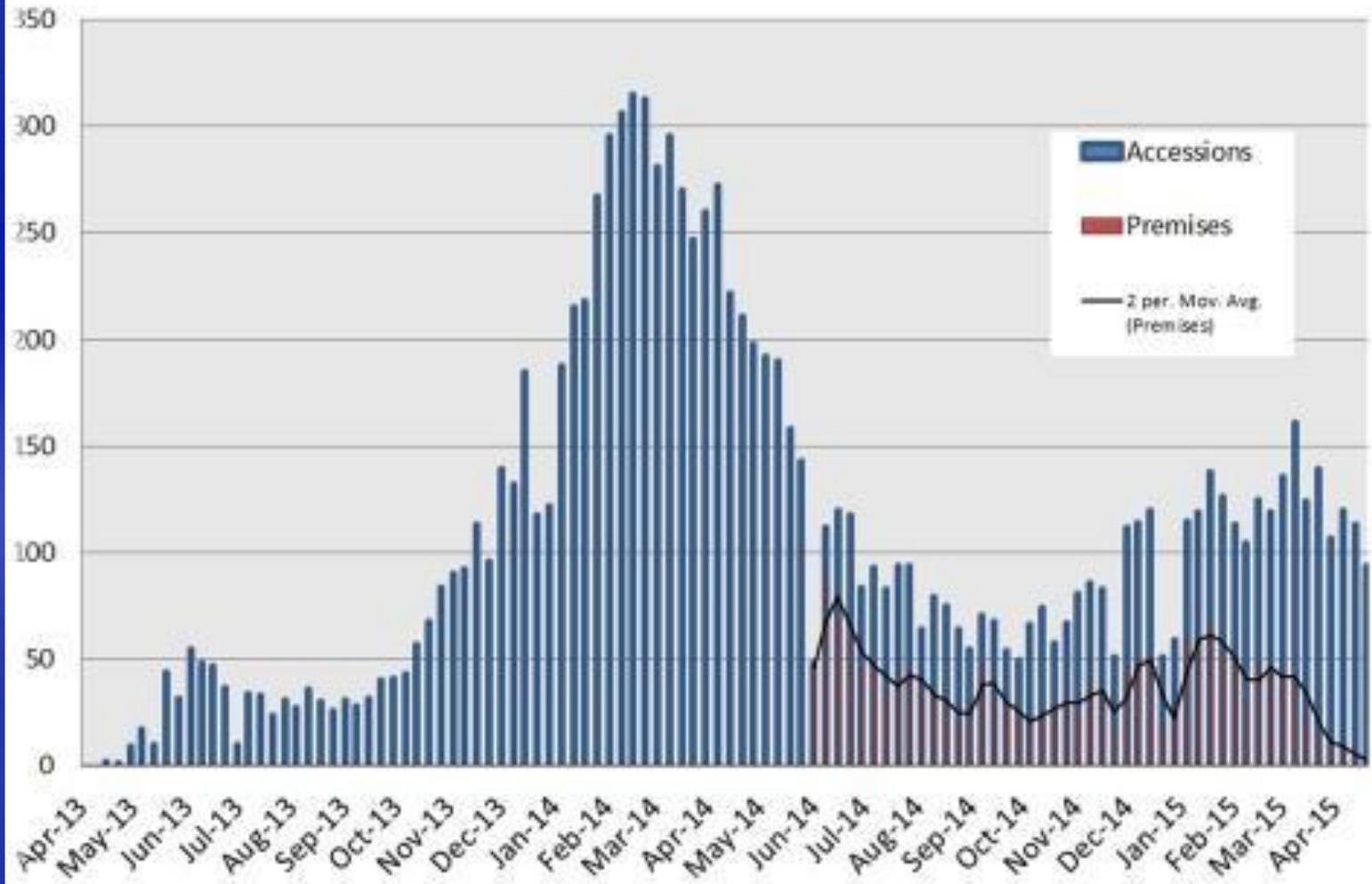
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Porcine Epidemic Diarrhea Virus (PEDV) Positive Biological Accessions (estimated to have killed 8 million piglets)



New PEDv Case Reports by Week



<https://www.aasv.org/>

Nipah Virus Outbreak

- 1998-1999, Malaysia
 - Respiratory and neurologic syndrome in swine
 - Encephalitis in humans
 - More than 250 cases
 - More than 100 deaths
 - Initially mistaken for Japanese encephalitis
 - Discovered new Paramyxovirus

Reservoir

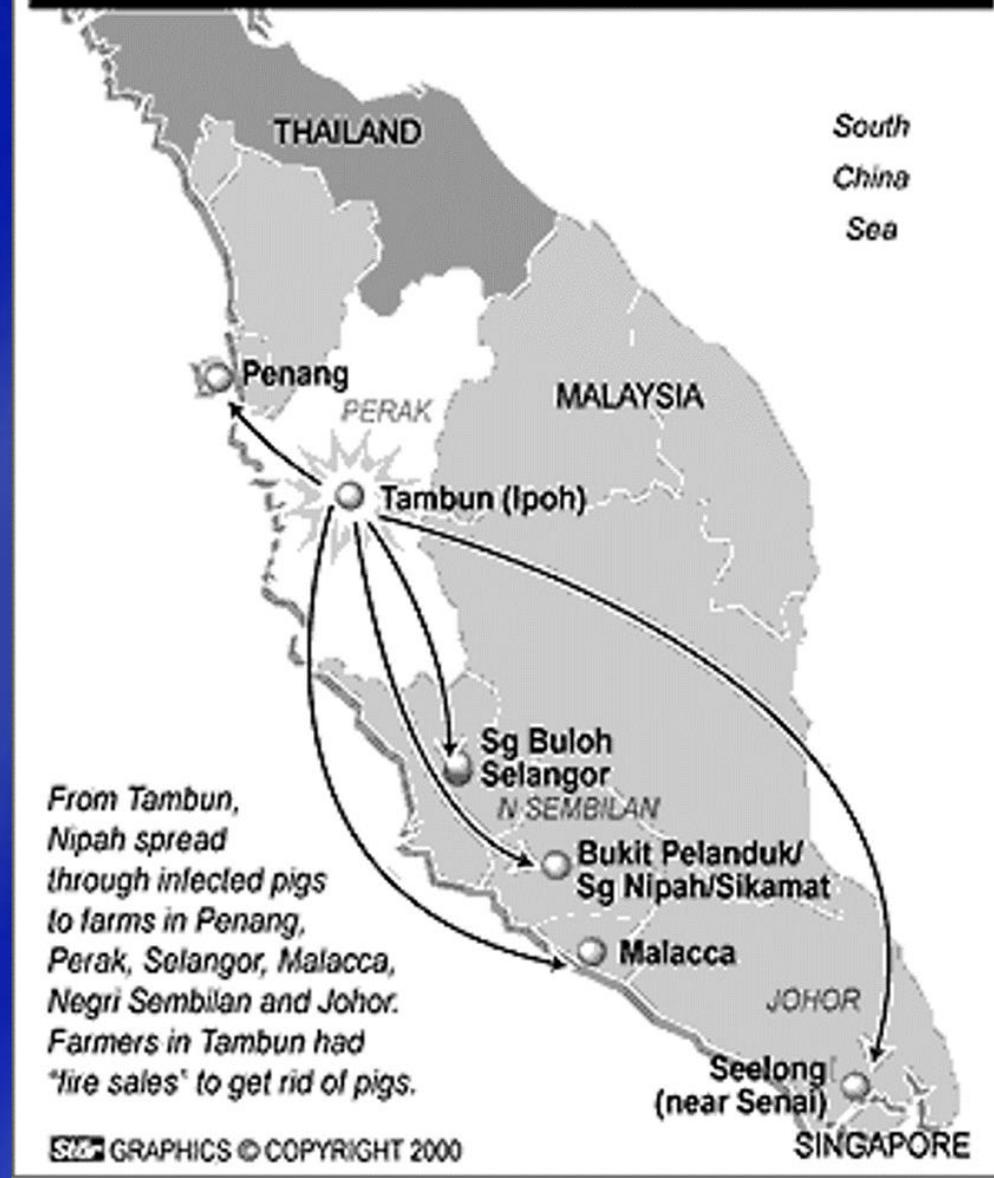
- Flying foxes (fruit bats)
 - Carry the virus
 - Are not affected
 - Virus found in
 - Urine
 - Partially eaten fruit
 - Migratory





Photo courtesy of
James Roth, Iowa
State University

HOW NIPAH SPREAD IN PENINSULAR MALAYSIA



Nipah Field Investigations- Malaysia

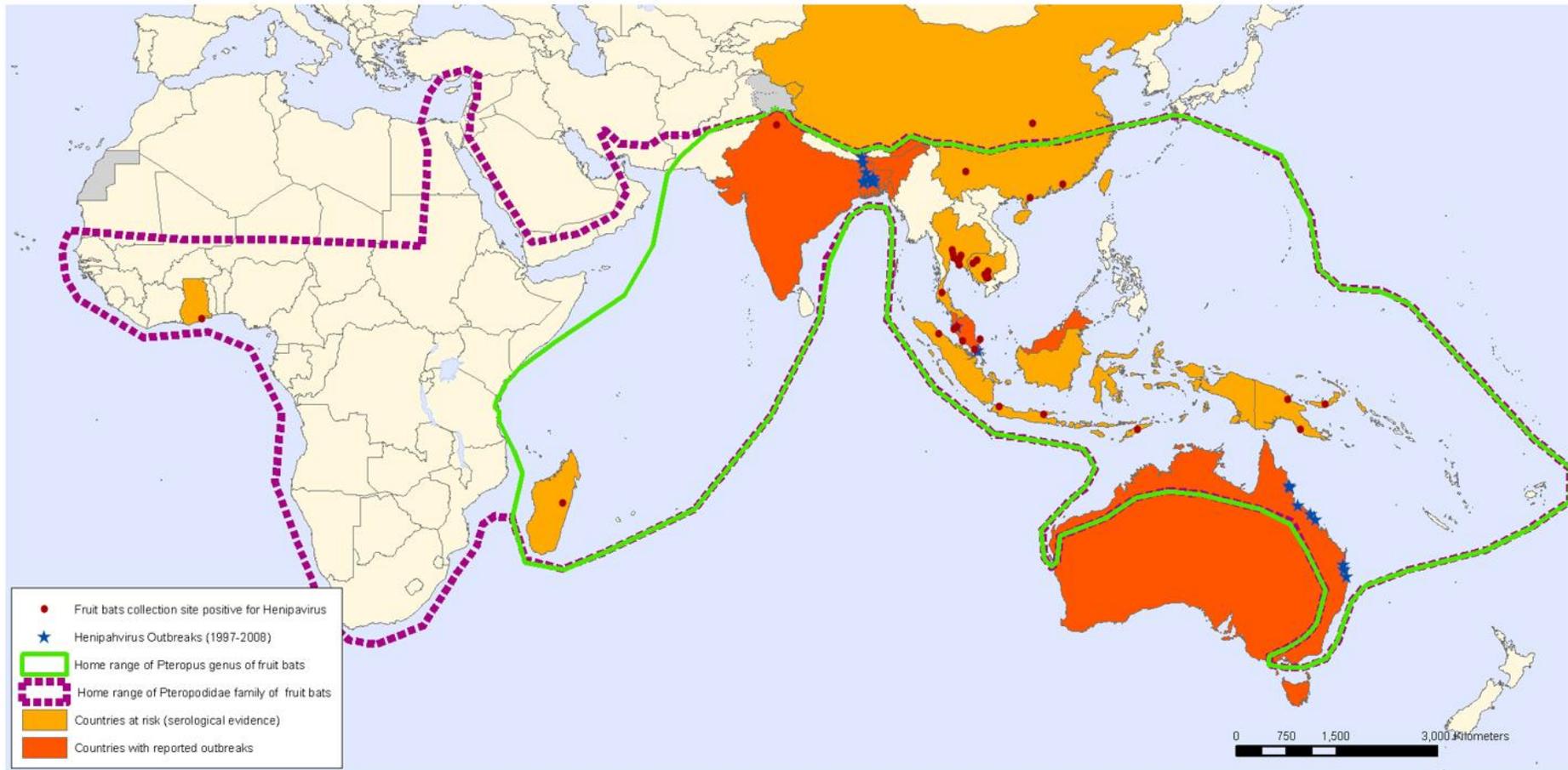


Nipah Virus

- Virus isolated in March 1999
- Quick national response with international assistance
- 1.1 million pigs culled (out of 2.4 million total)
- No new cases in Malaysia since 1999



Geographic distribution of Henipavirus outbreaks and fruit bats of Pteropodidae Family



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: Global Alert and Response Department
World Health Organization
Map Production: Public Health Information
and Geographic Information Systems (GIS)
World Health Organization



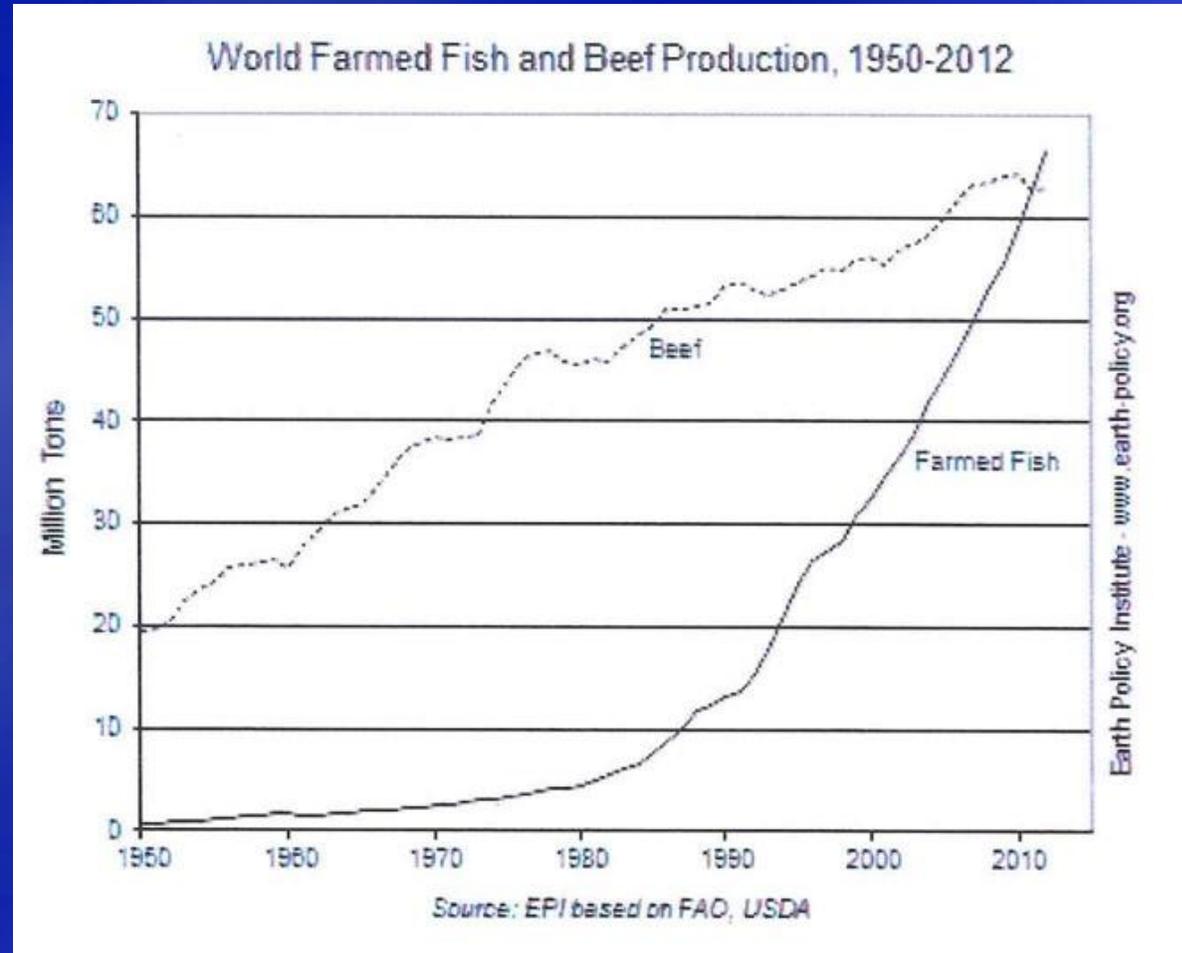
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Impact of Nipah Outbreak in SE Asia?

- Malaysia
 - 2.4 million pigs
- Cambodia
 - 21 million pigs
- Viet Nam
 - 27.3 million pigs
- Thailand
 - 9.7 million pigs
- Myanmar
 - 9.8 million pigs



World Farmed Fish and Beef Production, 1950 - 2012



Intensive Aquaculture

- Fastest-growing area of animal protein production
 - 47-50% of global aquatic food supply
 - China: 90% of aquatic animal food
 - 1950s: <1 million tons
 - 2012: >65 million tons
- Finfish, crustaceans, mollusks
- Can reduce pressure on wild fishery stocks
 - Can deplete wild fish used as feed for farmed fish
- Contagious diseases with high stocking densities
 - Can spread to wild fish
 - Sea lice, infectious salmon anemia (Chile), shrimp white spot disease (Asia)



Poultry



High pathogenicity avian influenza
Newcastle disease



H5N1 Avian Influenza

- 2004/5 – H5N1 emerged in Asia, killed millions of poultry and is zoonotic
- Concern that H5N1 would spread through migrating waterfowl from flyways in Europe/Asia to the Western hemisphere
- Extensive surveillance programs established in U.S.
- No detections of this strain of H5N1 in Western hemisphere
- New strains of H5 avian influenza detected in Canada and US fall 2014
 - **Not zoonotic**

Highly Pathogenic H5N2 Avian Influenza in Iowa

| | |
|------------------------------------|------------|
| Total Poultry Affected (5/18/2015) | 25,680,221 |
| Layer | 23,089,996 |
| Pullet | 1,603,896 |
| Turkey | 966,766 |
| Hatchery | 18,791 |
| Backyard Chickens | 747 |
| Backyard Ducks | 25 |

<http://www.iowaagriculture.gov/AvianInfluenza.asp>

Ruminants



Foot and mouth disease
Rift Valley fever
Brucellosis
Prion diseases
 BSE, CWD, Scrapie
Bluetongue
Tuberculosis, bovine
Schmallenberg



Foot and Mouth Disease (FMD): The MOST Contagious Disease of Animals

- Affects cloven hoofed animals
- FMD is the major animal disease preventing international trade of animals and animal products
- Mortality may be low but morbidity is high
- High mortality associated with some strains and some control measures
- **Not a public health or food safety concern**

UK



Korea



Japan



Egypt



FMD Lesions



Cow tongue

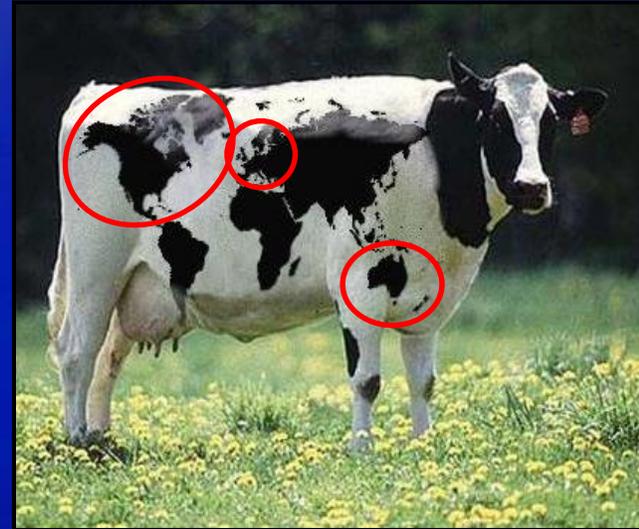


Pig foot

Global Prevalence of FMDv

World Organization for Animal Health (OIE) has

- 178 member countries:
 - 96 countries are endemic (“have it”) and have never been free of FMD
 - 66 countries free of FMD
 - 11 countries have free zones either with or without vaccination
 - 5 countries were free and recently suffered from a re-emergence of FMD



The United States has had Nine Outbreaks of FMD

1870, 1880 and 1884: Due to importation of infected animals. Since the development of a Federal system of inspection and quarantine of imported livestock, no outbreak has been attributed to admission of live animals.

1902, 1908, 1914, 1924 (two separate outbreaks) and 1929

All outbreaks were controlled by stop movement and stamping out

We must plan and be prepared to respond in new ways



“US livestock industries have
changed dramatically since 1929 ”

Factors Requiring a Change in the Planned Response to FMD

- Very large herd sizes
- Extensive movement of animals
- Public resistance to stamping out
- Environmental concerns with carcass disposal
- Changes in OIE policies related to FMD free with vaccination status

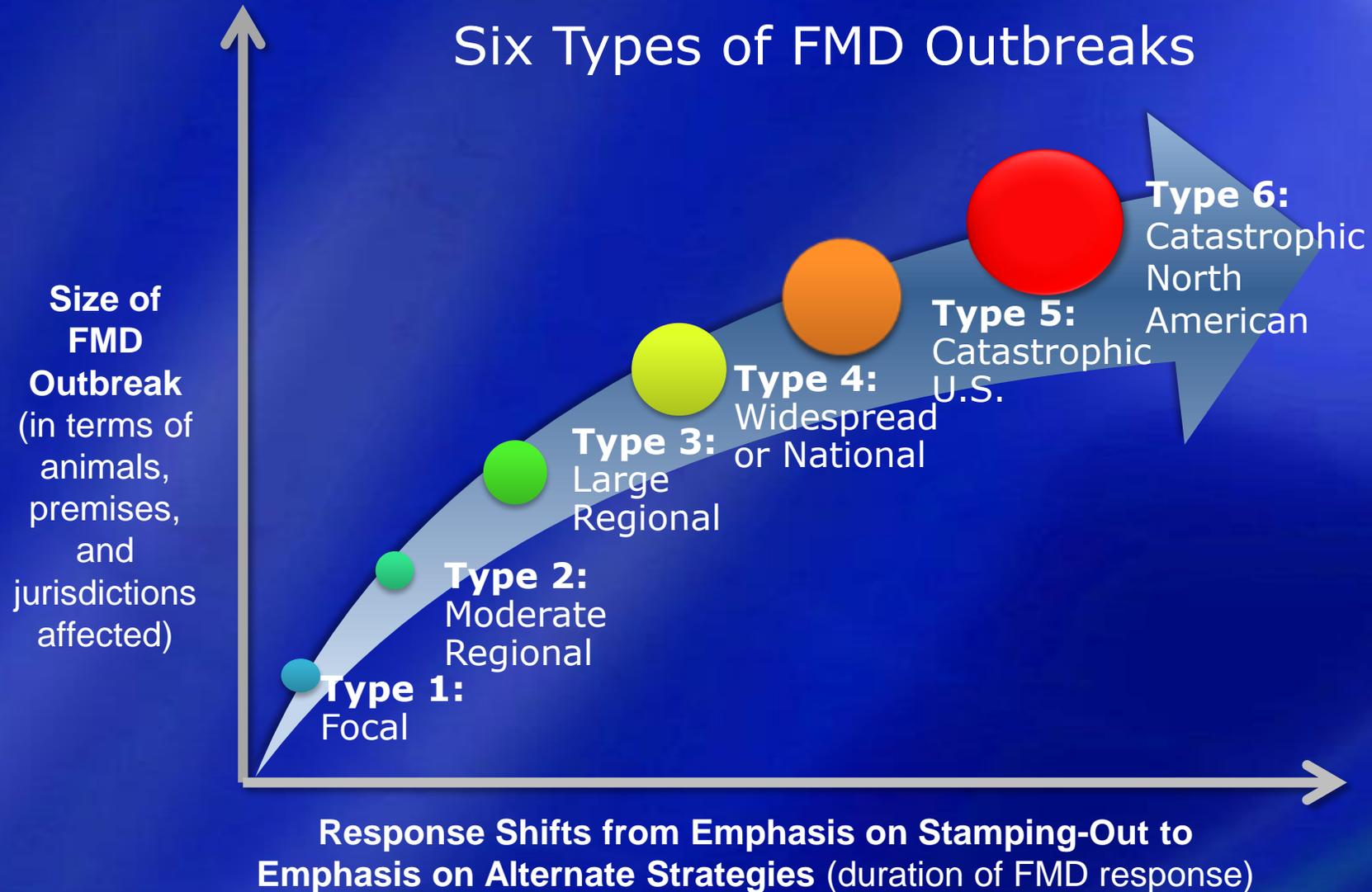
Tools for Control of FMD

- Biosecurity
- Stop Movement
- Stamping Out
 - Slaughter of all clinically affected and in-contact susceptible animals (within 24 hours or as soon as possible)
- Trace back/Trace forward
 - 28 days prior to outbreak
- Rapid Diagnostics
- Vaccination
 - Vaccinate to kill/slaughter; Vaccinate to live

Tools for Control of FMD in a Large Outbreak

- ~~Biosecurity~~
- ~~Stop Movement~~
- ~~Stamping Out~~
 - ~~Slaughter of all clinically affected and in-contact susceptible animals (within 24 hours or as soon as possible)~~
- ~~Trace back/Trace forward~~
 - ~~28 days prior to outbreak~~
- ~~Rapid Diagnostics~~
- ~~Vaccination~~
 - ~~Vaccinate to kill/slaughter; Vaccinate to live~~

FMD Detection in the U.S.: Types of an FMD Outbreak



Prospects for the Emergence of New Diseases

- Emergence of new human and animal diseases is inevitable
- Human dependence on livestock, poultry and aquatic animals for food and livelihood
 - Limits policy options
- Protecting human and animal health and food production is essential

Dr. Norman Borlaug

Father of the Green Revolution

- 1940's: developed disease-resistant, high-yield wheat
 - 1970 Nobel Peace Prize
 - Established World Food Prize
- This technology along with mechanized agriculture, fertilizers, irrigation
 - Increased crop yields and prevented famine in India and China



Norman Borlaug

Nobel Peace Prize, 1970

- “The green revolution has won a temporary success in man’s war against hunger which could provide sufficient food for humankind through the end of the 20th century.”
- “Unless the frightening power of human reproduction is curbed, the success of the Green Revolution will only be ephemeral.”

Norman Borlaug

Nobel Peace Prize, 1970

- “Agricultural scientists have a moral obligation to warn the political, educational, and religious leaders about the magnitude and seriousness of the arable land, food, and population problems that lie ahead.”

Essential Elements to Avoid and Manage Biological Crises

One medicine, one world, one health approach to diseases

International collaboration

- Lead by international organizations
- Funded by developed world

Strengthen public health infrastructure and veterinary services in all nations

Government agency, private sector and university collaboration

Accelerate the application of modern science to improve diagnostics, vaccines, and anti-virals

- Increase funding
- Streamline regulatory hurdles

Population control

Questions or Comments?

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