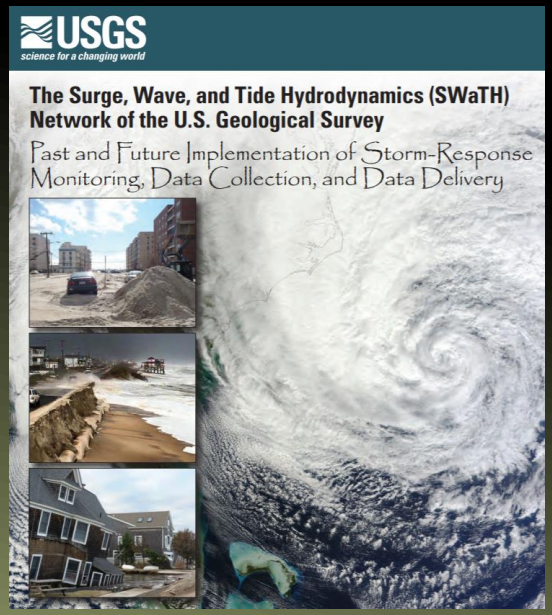
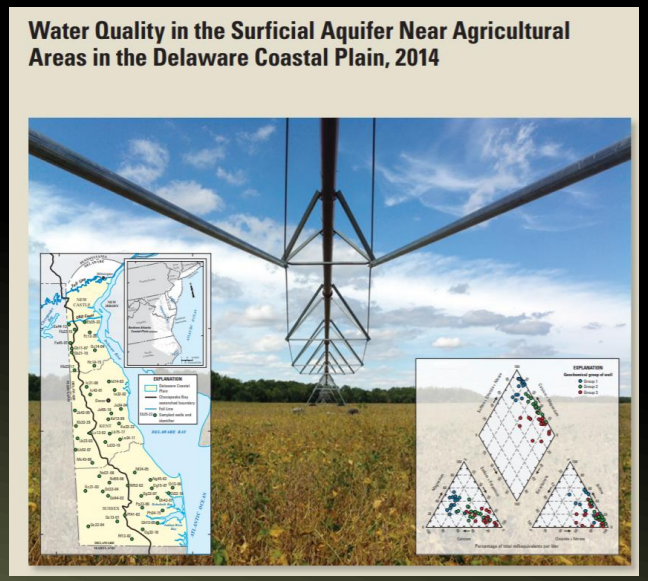
mrnardi@usgs.gov

Mark Nardi, Supervisory Geographer
MD-DE-DC Water Science Center, Dover DE

Geospatial Analysis
Soil Water Balance Modeling
Lidar Data
HEC River Modeling





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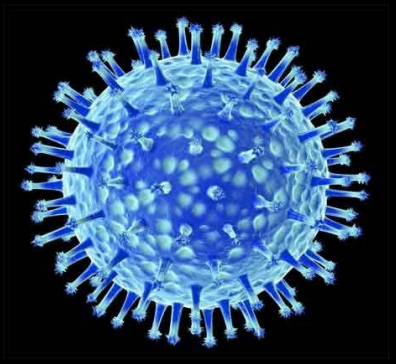
dprosser@usgs.gov

Diann Prosser, Research Wildlife Ecologist
Patuxent Wildlife Research Center, Laurel, Maryland

Waterbird and wetland ecology, spatial analysis

Integrating Field Studies and Spatial Modeling
-Wildlife Disease, AIV
-Restoration



Research-based science to inform surveillance, prevention, and preparedness efforts

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Interaction with the Agriculture Workgroup (why are we here today?)

- We work on multiple aspects of avian influenza science, globally, nationally, and regionally
- We would like to learn more from this network of members from very diverse backgrounds
- We would like to share our work and get feedback on
  - Usefulness of our work to folks in the room
  - Areas of interest for Delmarva region
- In order to answer questions at the wild-domestic interface for AIV, it takes interdisciplinary interaction. We are open to all levels of communication from feedback to potential collaboration
- We hope this can be an introduction to possible further communication

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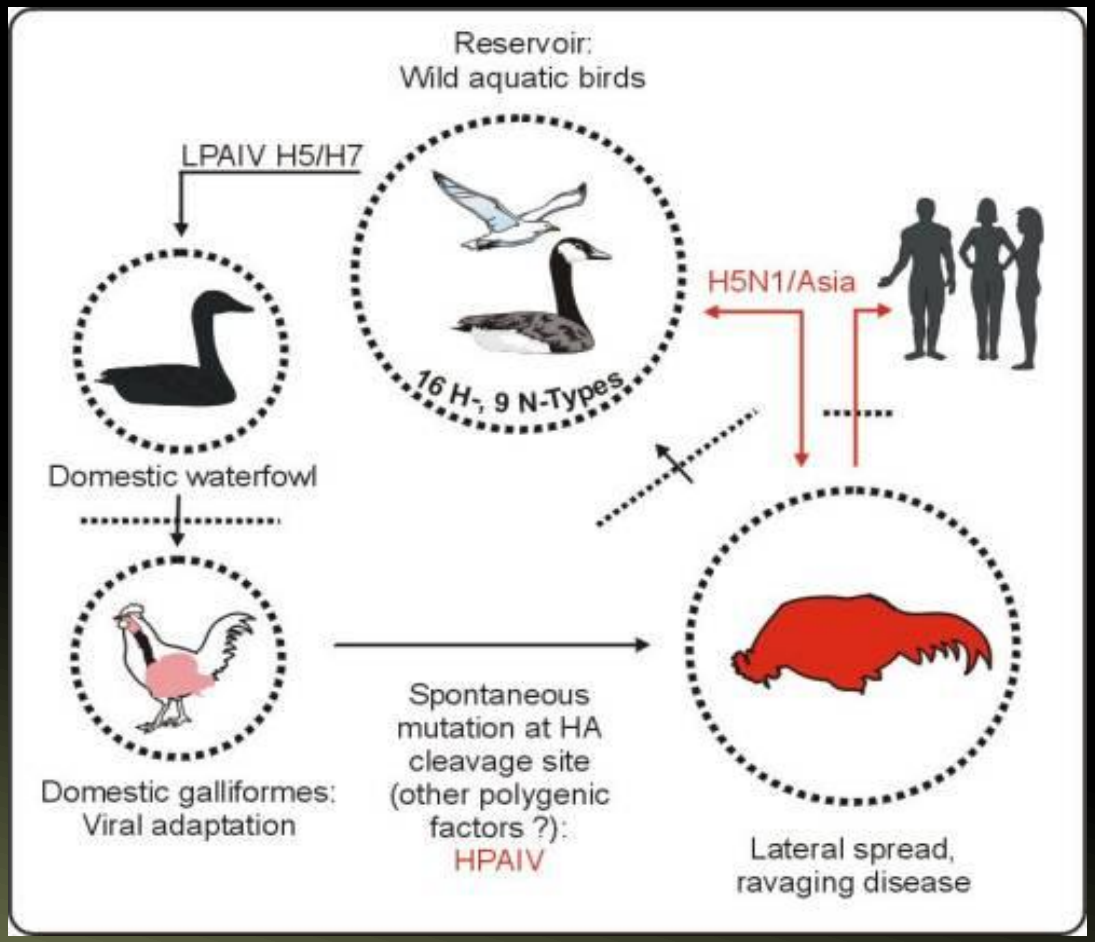
Wild birds are the reservoir for low-pathogenic AIVs
Importance of wild-domestic interface



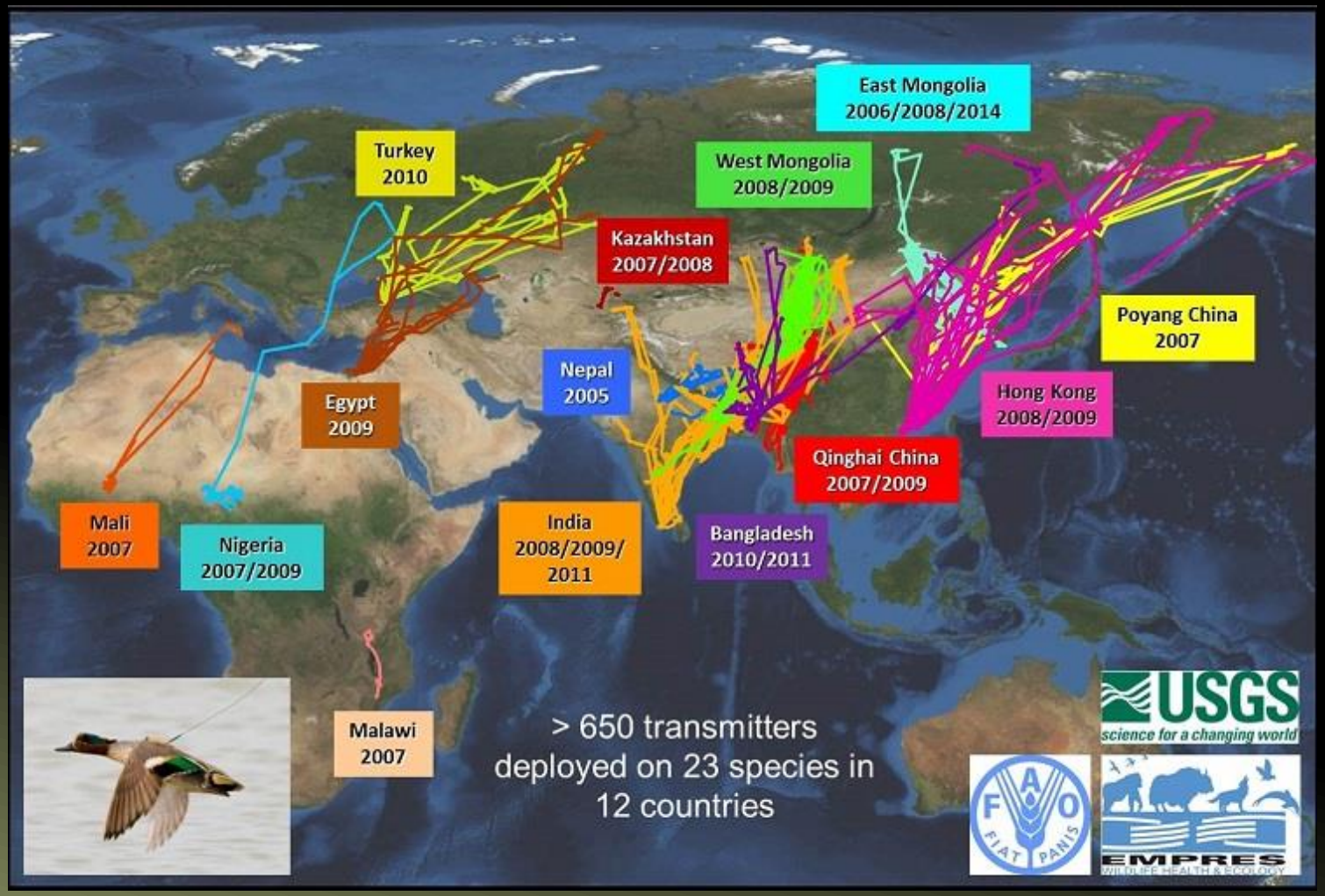
LPAI – causes mild to no disease in wild birds

HPAI – >90% mortality within 48h in chickens

- Fecal to oral transmission route
- Prior to H5N1, no spillback to wild birds

USGS science for a changing world

Prosser AIV work began in Asia – 2005 H5N1
At that time, there was little to no info on HPAI and wild birds
Needed to go where the virus was to study it



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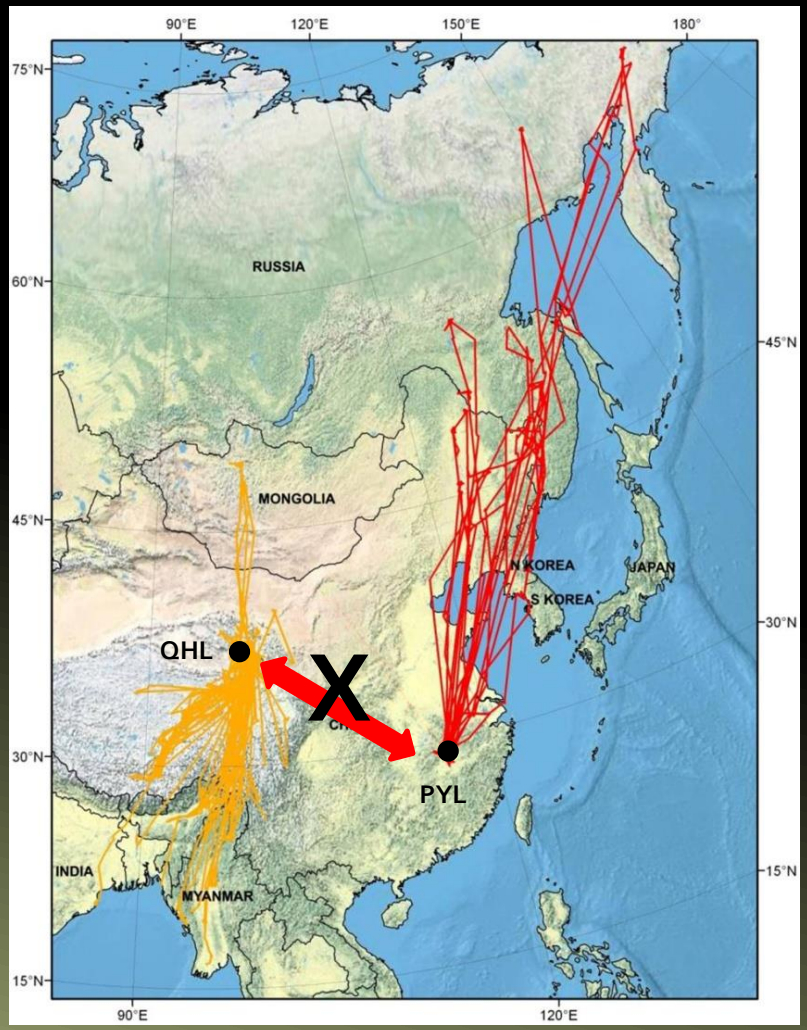
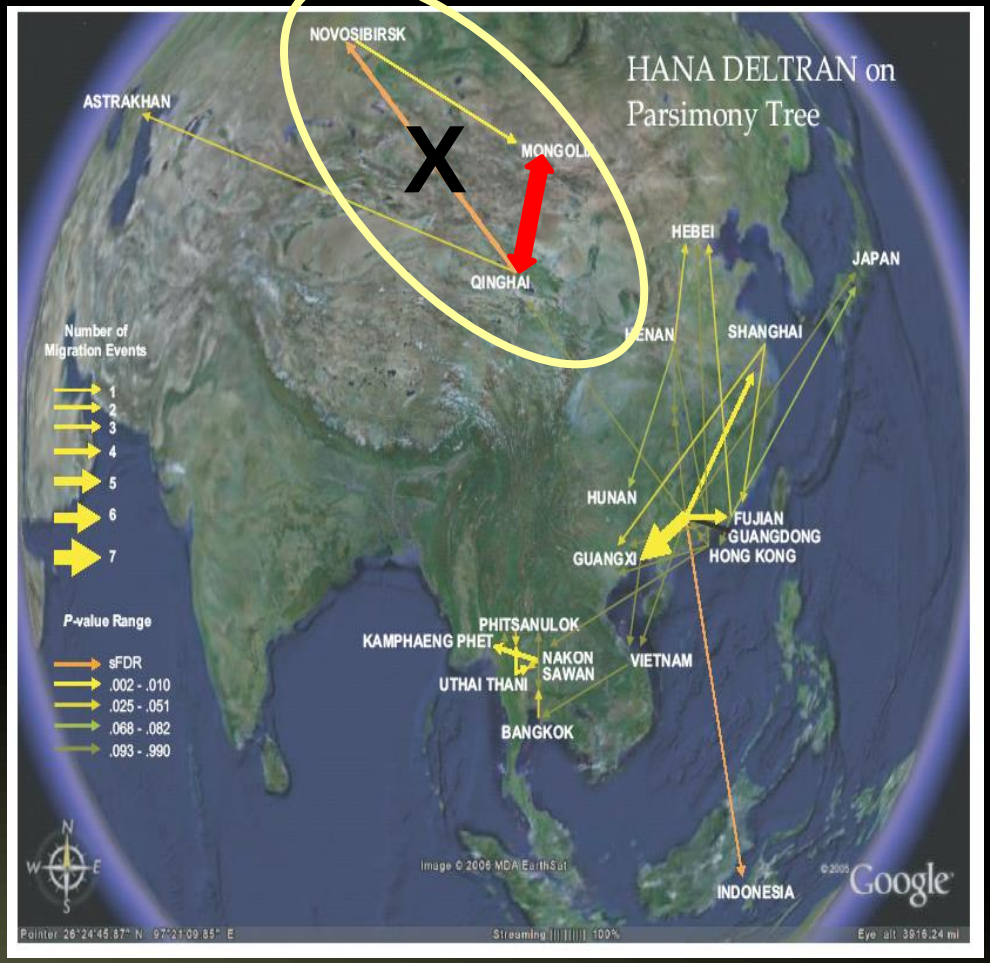
We have many products from our work in Asia, however,
Main lesson: Host Ecology is Important and often overlooked or understudied!

Chen et. al. 2006, PNAS
Hypothesized PLY to QHL via wild birds



Takekawa et al. 2010, *Avian Diseases*

Wallace et. al. 2006, PNAS
Hypothesized QHL to Russia to Mongolia, wild birds



Prosser et al. 2009, *Ibis*

USGS science for a changing world

China, 1km resolution spatio-temporal models identifying areas of higher risk of transmission for avian influenza viruses at wild to domestic interface

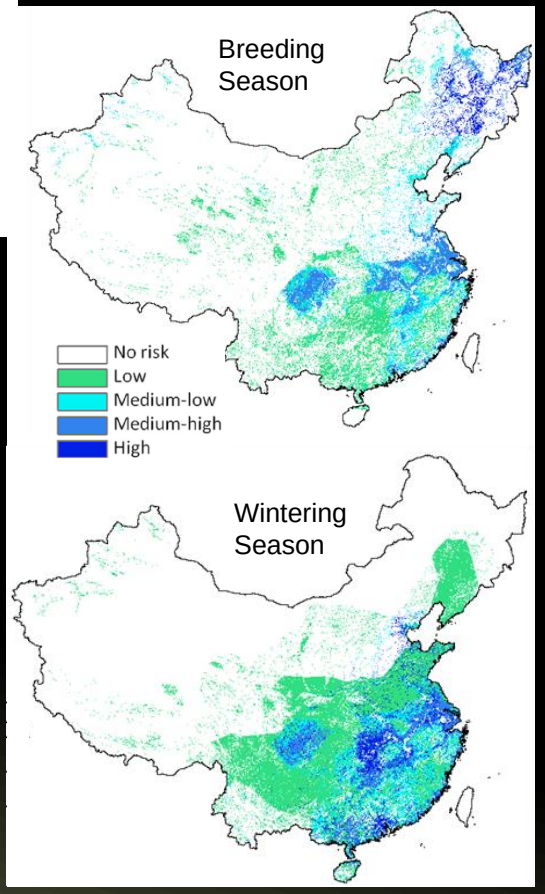
Why China? Epicenter of HPAI H5N1 and many novel viruses

frontiers in PUBLIC HEALTH

ORIGINAL RESEARCH ARTICLE
published: 30 August 2013
doi: 10.3389/fpubh.2013.00028

Mapping avian influenza transmission risk at the interface of domestic poultry and wild birds

Diann J. Prosser[1,2], Laura L. Hungerford[2,3], R. Michael Erwin[4], Mary Ann Ottinger[5], John Y. Takekawa[6] and Erle C. Ellis[7]*



Density Dependent, Environmental Transmission Models

Wild to poultry transmission

$$T_{WtoP} = ([W_{pr} * V_{wf}]) * ([P_{te} * B_{te}] + [P_{aq}]) * U)$$

Waterfowl distributions

Viral shedding

Poultry distributions

USGS

(Prosser et al. 2013, *Frontiers in Public Health*)

Currently working on Interface Risk models for USA. Partnering with USDA for poultry models.

USDA CEAH models for spread of HPAI in/ between commercial and backyard poultry flocks

USGS models for wild bird distribution; HPAI spread between wild birds and domestic populations; and environmental risk factors

Combined disease transmission risk models for the United States

USDA APHIS

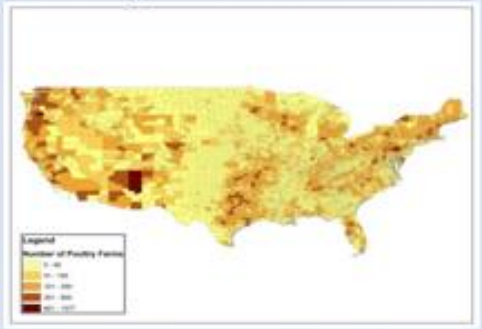
USGS

Wild-Domestic Interface Risk Modeling

Waterfowl Distribution Models

Identify distribution of waterfowl

Poultry Distribution Models



Identify locations of poultry production

Challenge Studies

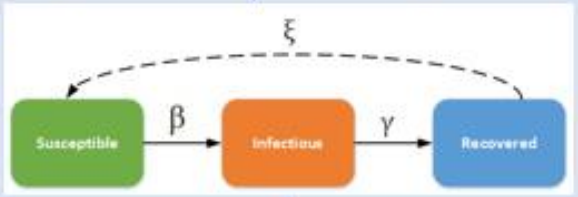
Identify asymptomatic period, shedding rate, and other clinical factors

Genetic Sequencing

Identify the origin of viral strains and how they change over time

Prevalence Surveillance

Identify viral strains and infection rate for critical flyways



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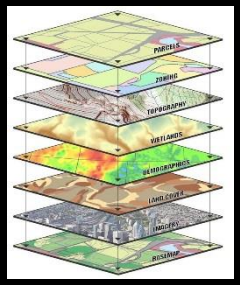
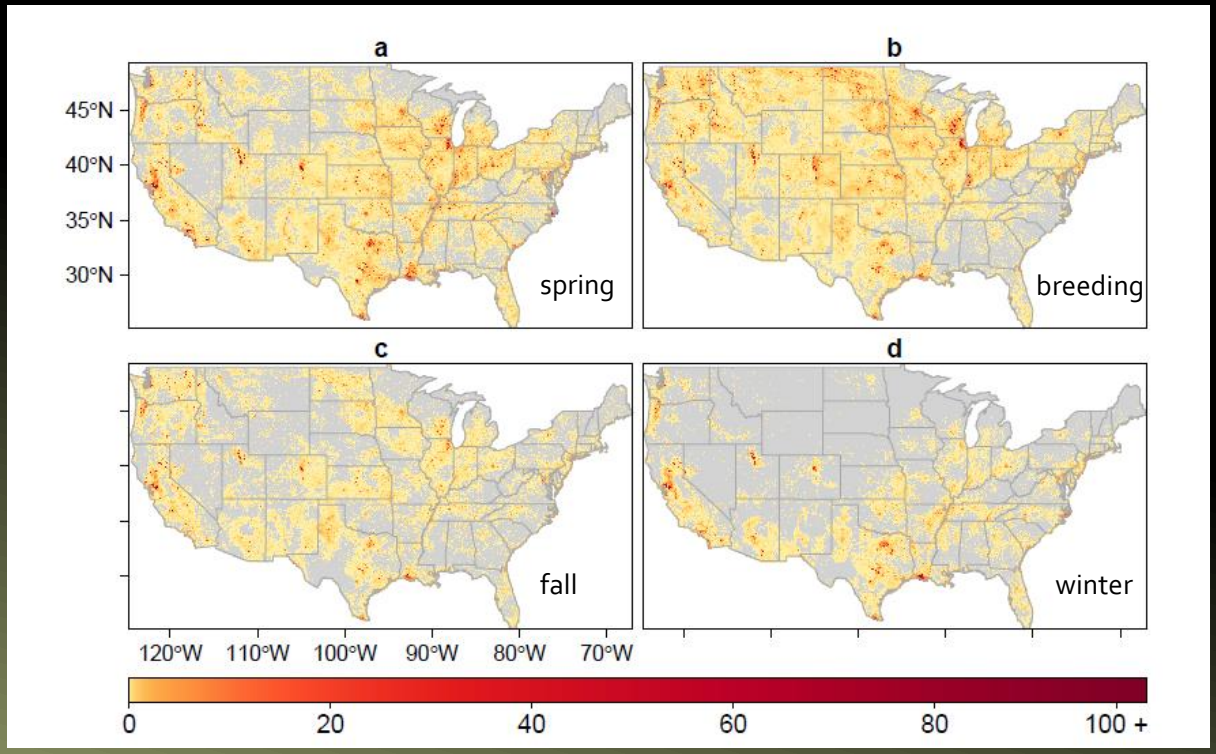
Spatiotemporal Waterfowl Inputs for Disease Risk Modeling, USA

Species Distribution Modeling (4 seasons)
11 dabbling duck species

Ebird Data, Advanced Computing
Heirarchical Bayesian modeling using INLA





Northern shoveler *(Anas clypeata)*

Diversity and Distributions, 2019

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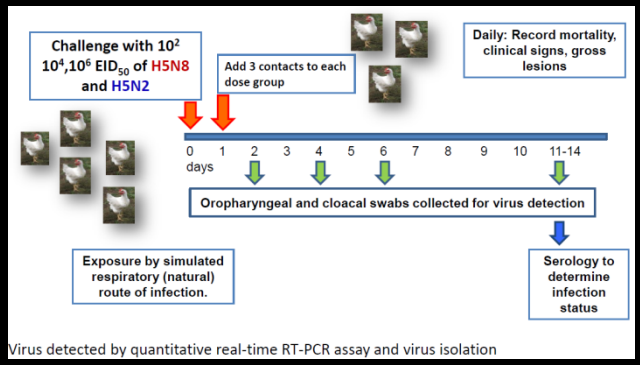
AIV challenge studies in understudied diving ducks

Partners: USDA Southeast Poultry Research Laboratory
USGS PWRC – Seaduck Colony

- Characterizing HPAI in two diving duck species
  - Susceptibility
  - Virus shed
  - Symptoms
  - Mortality

2017, 2018 Avian Diseases



2020 BMC Veterinary Research (in press)

Shed virus, zero to minimal clinical signs

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Environmental Persistence – Field and Lab study across NA

Partners: USGS WERC, University of Georgia-Southeast Cooperative Disease Study, USGS ASC and multiple partners

PROCEEDINGS B

royalsocietypublishing.org/journal/rspb

Research

Check for updates

Cite this article: Ramey AM *et al.* 2020 Influenza A viruses remain infectious for more than seven months in northern wetlands of North America. *Proc. R. Soc. B* 20201680.

Influenza A viruses remain infectious for more than seven months in northern wetlands of North America

Andrew M. Ramey[1], Andrew B. Reeves[1], Judith Z. Drexler[2], Joshua T. Ackerman[3], Susan De La Cruz[4], Andrew Lang[5], Christina Leyson[6,7], Paul Link[8], Diann J. Prosser[9], Gregory J. Robertson[10], Jordan Wight[5], Sungsu Youk[6,7], Erica Spackman[6,7], Mary Pantin-Jackwood[6,7], Rebecca L. Poulson[11,12] and David E. Stallknecht[11,12]

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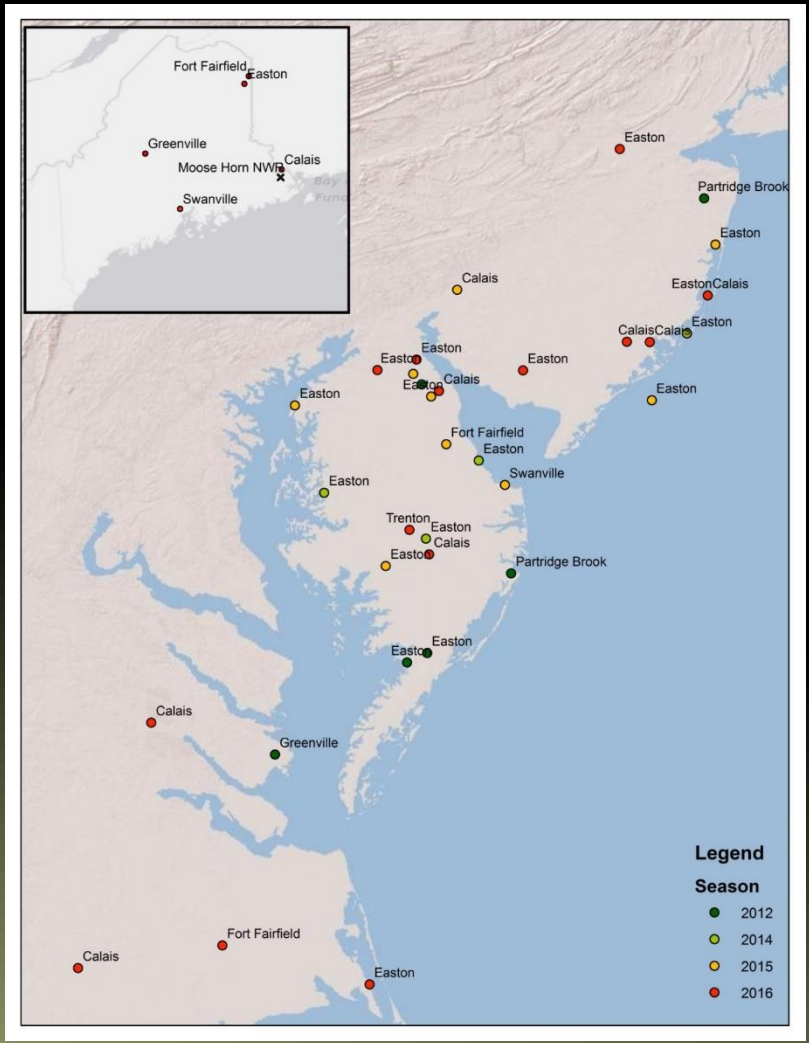
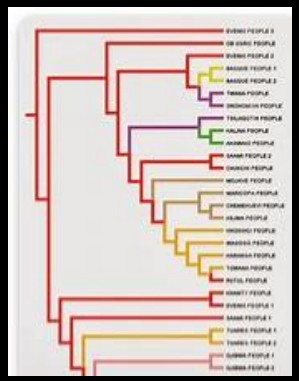
Avian Influenza in Waterfowl, the Atlantic Flyway

Partners: University of Georgia-Southeast Cooperative Disease Study, USGS ASC

BBL Encounters – connection to Maine AIV sampling sites





- Sampling waterfowl in Ches Bay (migration/wintering areas) and Maine
- Investigating banding data for connections
- Investigating subtypes and genetics for virus connectivity

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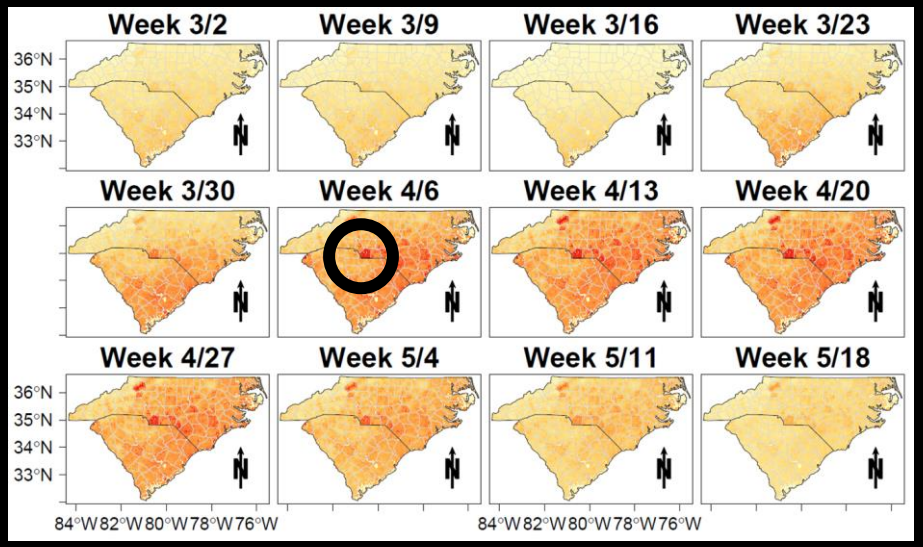
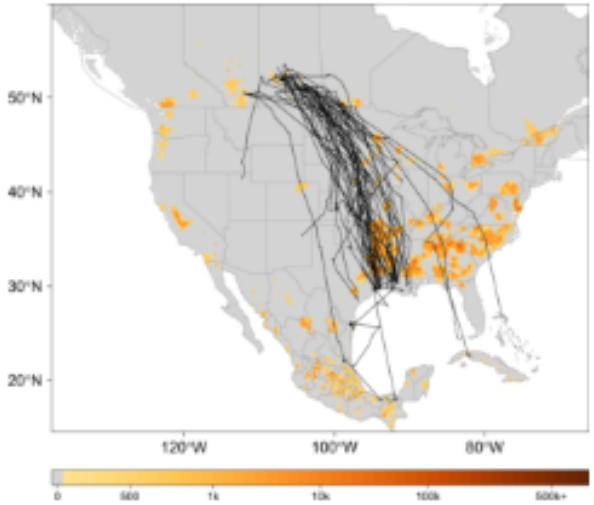
Blue Winged Teal Movements and Avian Influenza

Partners: USGS ASC

Models



Subsequent H7N3 outbreak in NC: LPAI March 10, HPAI April 9, 2020



Waterfowl occurrence and residence time as indicators of H5 and H7 avian influenza in North American Poultry | Scientific Reports - Nature

Avian influenza (AI) affects wild aquatic birds and poses hazards to human health, food security, and wildlife conservation globally. Accordingly, there is a recognized need for new methods and ...

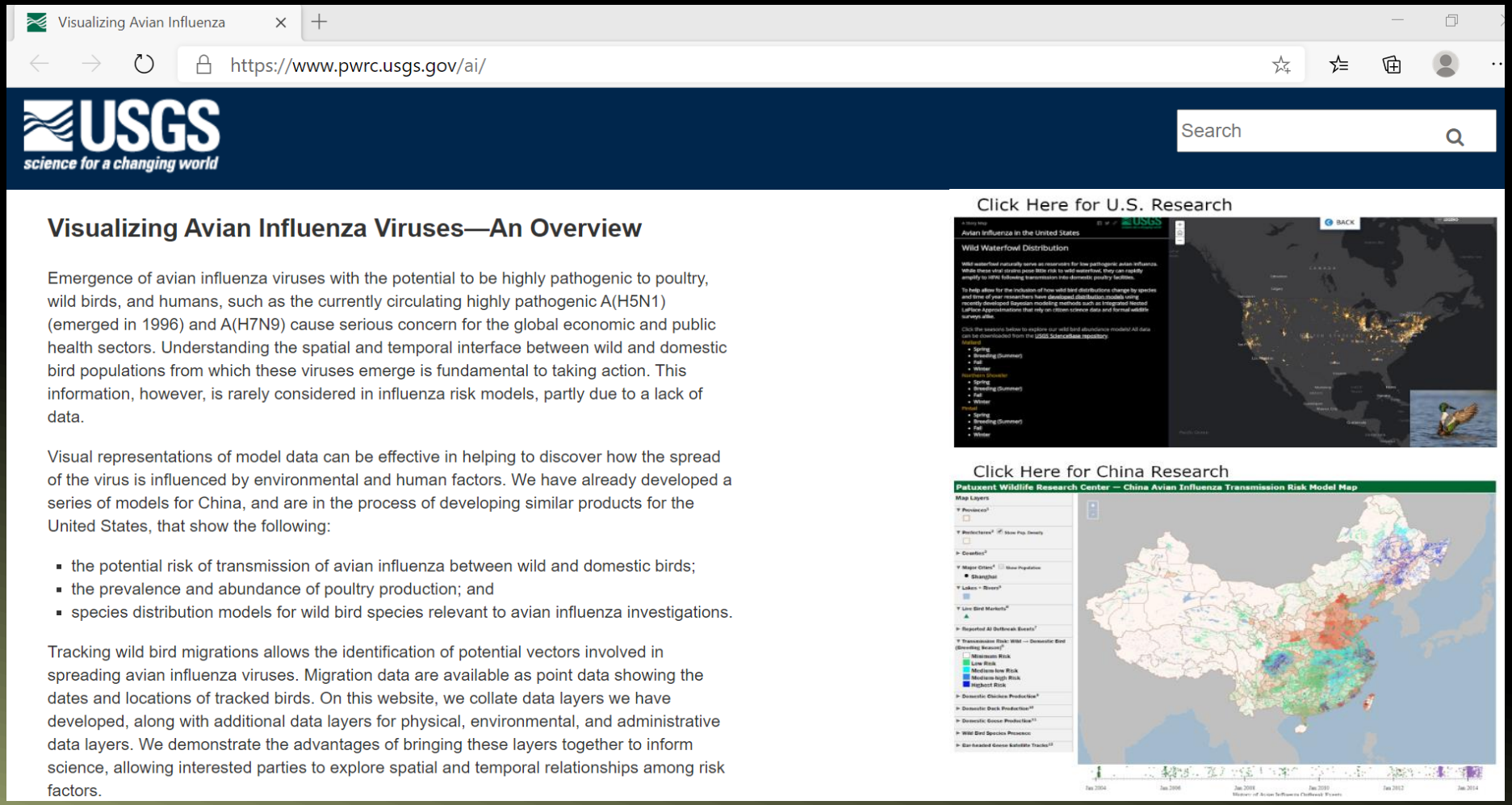
www.nature.com

Scientific Reports, 2020

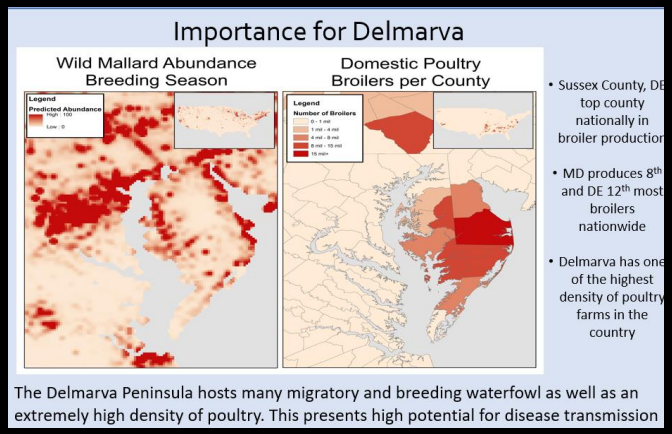
Web-based Visualization Tool

Online interactive web interface
Model download portal

http://www.pwrc.usgs.gov/ai/
(in development)



Spatio-temporal Wild-Domestic Bird AIV Risk Modeling for Delmarva



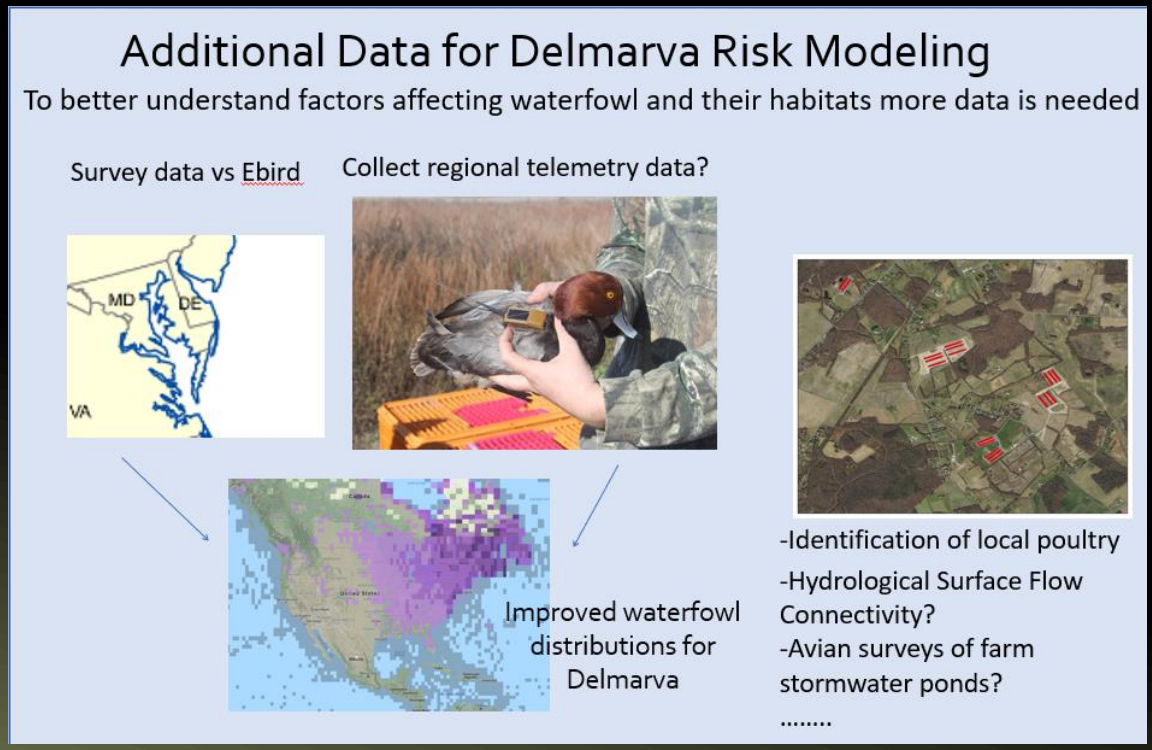
Items for input

-We believe focused risk models for Delmarva are important for this region

- Do others agree? Would these be helpful to you?

-We are working on focal improvements for Delmarva

- open to input
- open to working together if common need identified



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Hoping to open discussion with WG members
Feedback on model targets, useful research
Happy to follow up with additional meetings, if interested

Mark Nardi, mrnardi@usgs.gov
Diann Prosser, dprosser@usgs.gov

USGS