



# **Integrating Earth Observation and Satellite Telemetry of Wild Birds for Decision Support System of Avian Influenza**

**Xiangming Xiao**

Department of Microbiology and Plant Biology, College of Arts and Sciences  
Center for Spatial Analysis, College of Atmospheric & Geographic Sciences  
University of Oklahoma, Norman, Oklahoma

<http://www.eomf.ou.edu>

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# Acknowledgements



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## Belgium

Marius Gilbert

Many in-country collaborators

In China, Mongolia,

Bangladesh and India

**This NASA Public Health Feasibility project is built upon our previous projects, including NIH-funded Ecology-based risk assessment of avian influenza in Asia**

NASA Land Use and Land Cover Change

National Institutes of Health

National Science Foundation

USGS

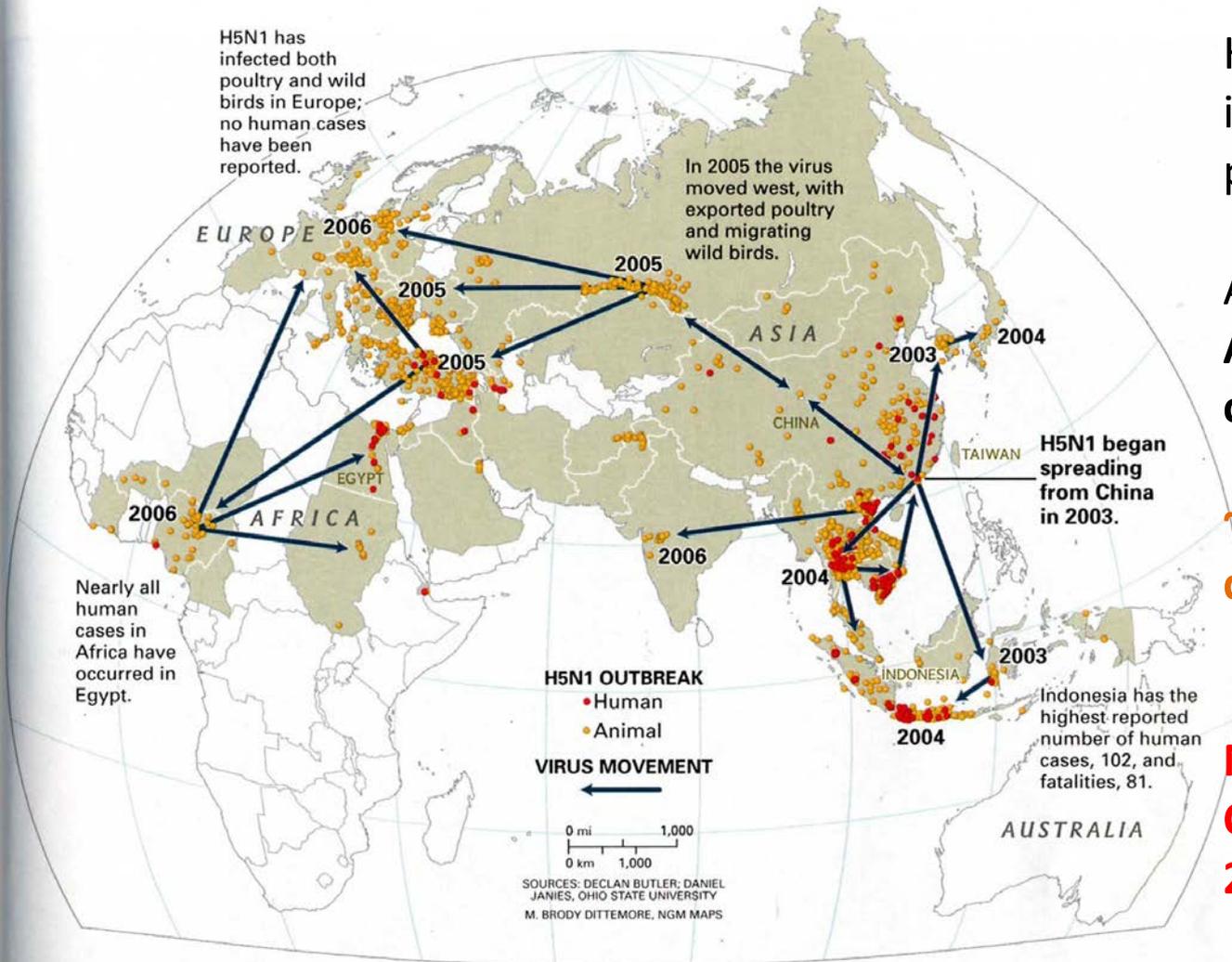
FAO



## **The major topics**

1. GeoHealth Data Portal
2. Geo-referenced Field Photo Library
3. Spatial epidemiological models

# Global patterns and dynamics of H5N1 HPAI (2003 – 2006)



H5N1 has continued to infect poultry, birds and people.

As of August 10, 2012, A total of 608 human cases and 359 deaths

~ \$20 billion of economic damage

New H5N1 clade 2.3.2.1 in China and Vietnam in 2011

**MARCH OF THE BIRD FLU** *The avian influenza strain H5N1 is the world's top pandemic threat. Starting in China, in 2003 it began spreading through other parts of Asia and by 2006 had shown up in Europe and Africa. Experts fear that H5N1, which has killed fewer than 200 people, may mutate to a virulent form able to wipe out millions.*

From David Quammen, How animals and humans exchange disease -- *Deadly Contact*, National Geographic, 10/2007

# Food & Agriculture Organization of the United Nations (FAO)

## Animal Production and Health Division

## Decision support system in FAO

## The Emergency Prevention System (EMPRES) for Priority Animal and Plant Pest and Diseases

## Crisis Management Center

www.fao.org/avianflu/en/index.html

**AVIAN INFLUENZA**

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Animal Production and Health Division

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**BIRD FLU REARS ITS HEAD AGAIN**



Preparedness and surveillance remain essential. This is no time for complacency. No one can let their guard down with avian influenza...>>>

**EMPRES** emergency prevention systems

**GLEWS** Global Early Warning and Response System

**CMC-AH** Crisis Management Centre Animal Health

**Oiflu** OIE/FAO Network of Expertise on Avian Influenza

**HPAI** PRO-POOR HPAI RISK REDUCTION

**NEWSLETTERS & BROCHURES**

- FAO AIDenews: **Latest issue!!!** [archive...]
- ECTAD News Asia and the Pacific **Latest issue!!!** [archive...]
- The Avian Influenza Project in the Great Lakes [En - Fr] [click [here](#) for archive]

**NEWS**

**27 July 2011**  
The science against avian influenza in Viet Nam is sponsored by donors >>>

**22 July 2011**  
Ten lessons learned from the work of UNSIC >>> [click [here](#) for archive]

**KEY DOCUMENTS**

The Global Strategy for the Prevention and Control of H5N1 Highly Pathogenic Avian Influenza (October 2008) >>>

Global Programme for the Prevention and Control of H5N1 Highly Pathogenic Avian Influenza (February 2008) >>>

Fourth Report of the Global Programme for the Prevention and Control of Highly Pathogenic Avian Influenza (January - December 2010) >>>

FAO Regional Strategy for Highly Pathogenic Avian Influenza and other Emerging Diseases of Animals in Asia and the Pacific >>>

**OUTBREAKS**



**HSN1 HPAI GLOBAL OVERVIEW**

Issue No.28 April-June 2011 [click [here](#) for archive]

**Q & A**

- How is avian influenza transmitted?
- Can wild birds transmit avian influenza to humans?
- What can be done to limit spread of the disease?

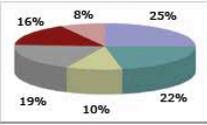
[click [here](#) for FAO's answers to these and other questions]

**EVENTS**

**7-9 September 2011**  
Glasgow, Scotland, United Kingdom  
30th Poultry Science Symposium >>>

**6-9 September 2011**  
Buenos Aires, Argentina  
XXII Latin American Poultry Congress >>> [click [here](#) for a archive]

**DONOR SUPPORT**



**FUNDING REQUEST**

Emerging and Transboundary Animal Diseases Funding Request to Donors >>>

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# To link FAO EMPRES-i data portal with OU EOMF GeoHealth data portal

EMPRES-i Global animal disease information system

empres-i.fao.org/empres-i/home

english français español

**EMPRES**  
EMERGENCY PREVENTION SYSTEM

Food and Agriculture Organization of the United Nations  
for a world without hunger

Home Disease Events Library Directory About Empres-i Sign-in

EMPRES-i website is a global animal health information system of FAO's Emergency Prevention Programme for Transboundary Animal Diseases (EMPRES), that focus on the user need to easily find and collect in one place all the information available for animal health and transboundary animal diseases (TADs). EMPRES-i compiles, stores and verifies animal diseases outbreaks data (including zoonoses) from numerous sources (FAO representatives, FAO reports, OIE reports, official government, European Commission, FAO reference centres, laboratories,...), for early warning and risk analysis. [More Info](#)

**Disease events list** RSS

1 / 101 [1-10 / 1006]

- 08/09/2011: Highly pathogenic avian influenza in Assam (India)
- 06/09/2011: Highly pathogenic avian influenza in Dhaka (Bangladesh)
- 02/09/2011: Highly pathogenic avian influenza in Thai Binh (Viet Nam)
- 31/08/2011: Highly pathogenic avian influenza in Quang Ngai (Viet Nam)
- 30/08/2011: Highly pathogenic avian influenza in Quang Tri (Viet Nam)
- 30/08/2011: Highly pathogenic avian influenza in Quang Tri (Viet Nam)
- 29/08/2011: Highly pathogenic avian influenza in Khulna (Bangladesh)
- 27/08/2011: Highly pathogenic avian influenza in Khulna (Bangladesh)
- 26/08/2011: Highly pathogenic

**Disease events map** Show legend Export map Full size

All Regions/All Countries-territories - Highly pathogenic avian influenza [since 01/03/2011]

106.23939, -7.47675

**Disease events chart**

Chart Data

By month By region

Total number of Highly pathogenic avian influenza since 01/03/2011

Month	Confirmed	Denies
March	~180	0
April	~180	0
May	~180	0
June	~180	0
July	~180	0
August	~180	0

**Library**

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1 / 217 [1-4 / 867]

- 2011 Avian Influenza Disease Emergency: issue No. 80 (07/09/2011) Sigfrido Burgos, ECTAD Communications Unit (8pp) [MORE] [PDF]
- 2011 EMPRES - Boletín de enfermedades transfronterizas de los animales: Fascículo No. 37 null (52pp) [MORE] [PDF]
- 2011 Wild bird highly pathogenic avian influenza surveillance (Thai language) Karrie Rose, Scott Newman, Marcela Uhart, Juan Lubroth (66pp) [MORE] [PDF]

**Directory**

EMPRES-i compiles information from numerous sources (FAO representatives or country missions, FAO reports, OIE, official government sources, European Commission, FAO reference centres, laboratories and FAO collaborators) and produces composite maps in a representative effort to provide full and accurate information.

EMPRES-i welcomes information on animal diseases events/rumors worldwide. This information will be tracked by FAO for further validation and verification through the network of FAO officers deployed in the field in 192 member countries, FAO collaborators and personal contacts with NGOs, and other institutions.

EMPRES-i team also welcomes information to clarify/rectify disease events reported on the website. If you want to share any such information with us please send a message to [empres-i@fao.org](mailto:empres-i@fao.org). If you have any questions or suggestions on how to improve the EMPRES-i platform and the information provided please send your message to [empres-i@fao.org](mailto:empres-i@fao.org)

If you want to be informed about news concerning

Comments: EMPRES-i EMPRES-i Information System © FAO, 2011 EMPRES-i Ver: 1.5

Earth Observation and Modeling

www.eomf.ou.edu/geohealth/

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**Data Integration and Visualization over Google Earth**

**Data Tree**

- HPAI H5N1 Outbreak
  - HPAI H5N1
- Wild Bird Tracking
  - Birds
  - Description
- EcoHealth Paper
  - Human Population
  - Duck density
  - Chicken density
  - Cropping intensity (new method)
  - Cropping intensity (PNAS version)
  - Elevation
  - Country Code(categorical)
  - Risk map (PNAS model)
  - Risk map (EcoHealth model)

9/30/2003 12/14/2011

2003 2011

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30°32'38.59" N 79°27'53.91" E elev. 6740ft alt. 1395.09 mi

This 3D global view shows three different datasets:

- Ecohealth Paper Data
- Avian Influenza H5N1 is represented using Geese, Chicken, Human icons respectively for Wild birds, Domesticated birds and Human cases.

**Data Disclaimer**

- Wild bird migration data are provided by FAO and USGS. <http://www.werc.usgs.gov/ResearchTopicPage.aspx?id=12>
- HPAI H5N1 disease outbreak data are provided by the FAO. <http://www.fao.org/ag/qa/info/programmes/en/empres/home.asp>

NASA NATIONAL INSTITUTES OF HEALTH NSF USGS science for a changing world FAO EMPRES

# GeoHealth data portal

- Informatics approach to integrate disparate sources of datasets
- Data visualization

## Disparate datasets

- Highly pathogenic avian influenza H5N1 data
- Human population
- Poultry, pigs,
- Satellite telemetry of wild birds
  - Wild bird migration
- Satellite-based mapping of agricultural land use - paddy rice
- AIV surveillance data (GenBank, OpenFlu)
- Market chain data
- Geo-tagged field photos
- Weather and climate

Earth Observation and Modeling Data Visualization - Google Earth View - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://eomf-dev.ou.edu/visualization/gemap/

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Earth Observation and Modeling Data...

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### Data Integration and Visualization over Google Earth

Data Tree

- Animals
  - Wild Birds
- Diseases
  - Pathogenic Avian Influenza H5N1
- Land cover
  - Field Photos



Nov 30, 2009

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US Dept of State Geographer  
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© 2010 Tele Atlas

23°40'58.12"N 106°22'18.88"E elev: 2313 ft Eye alt: 5046.60 mi

Google  
Terms of Use

This 3D global view shows three different datasets:

- Global Geo-referenced photo database is represented by a camera icon
- Duck tracking data is represented with a yellow push pin.
- Avian Influenza H5N1 is represented using Geese, Chicken, Human icons respectively for Wild birds, Domesticated birds and Human cases.

**Data Disclaimer**

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2. HPAI H5N1 disease outbreak data are provided by the FAO, <http://www.fao.org/qa/qa/info/programmes/en/empres/home.esp>

USGS science for a changing world

FAO

OU

Done

## Transmitters



## Satellite telemetry of waterfowl

Capture and mark waterfowl to study their local movement, habitat use, and migration in relation to potential HAPI H5N1 spread

Qinghai Lake, China

Ruddy shelduck (*Tadorna ferruginea*)

Bar-headed geese (*Anser indicus*)



# Track migratory waterbirds through GPS-based satellite telemetry



524 transmitters  
12 countries  
24 species



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### Data Integration and Visualization over Google Earth

Data Tree

- HPAI H5N1 Outbreak
  - H5N1
- Wild Bird Tracking
- EcoHealth Paper

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20°02'04.09" N 80°34'04.04" E elev -1879 fte alt 1395.09 mi

This 3D global view shows three different datasets:

- Ecohealth Paper Data
- Avian Influenza H5N1 is represented using Geese, Chicken, Human icons respectively for Wild birds, Domesticated birds and Human cases.

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- HPAI H5N1 disease outbreak data are provided by the FAO. <http://www.fao.org/ag/qa/info/programmes/en/emprts/home.asp>

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### Data Integration and Visualization over Google Earth

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  - Birds
  - Description
- EcoHealth Paper

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27°03'50.13" N 94°16'59.13" E elev 1163 fte alt 1395.09 mi

This 3D global view shows three different datasets:

- Ecohealth Paper Data
- Avian Influenza H5N1 is represented using Geese, Chicken, Human icons respectively for Wild birds, Domesticated birds and Human cases.

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- Wild bird migration data are provided by FAO and USGS. <http://www.werc.usgs.gov/ResearchTopicPage.aspx?id=12>
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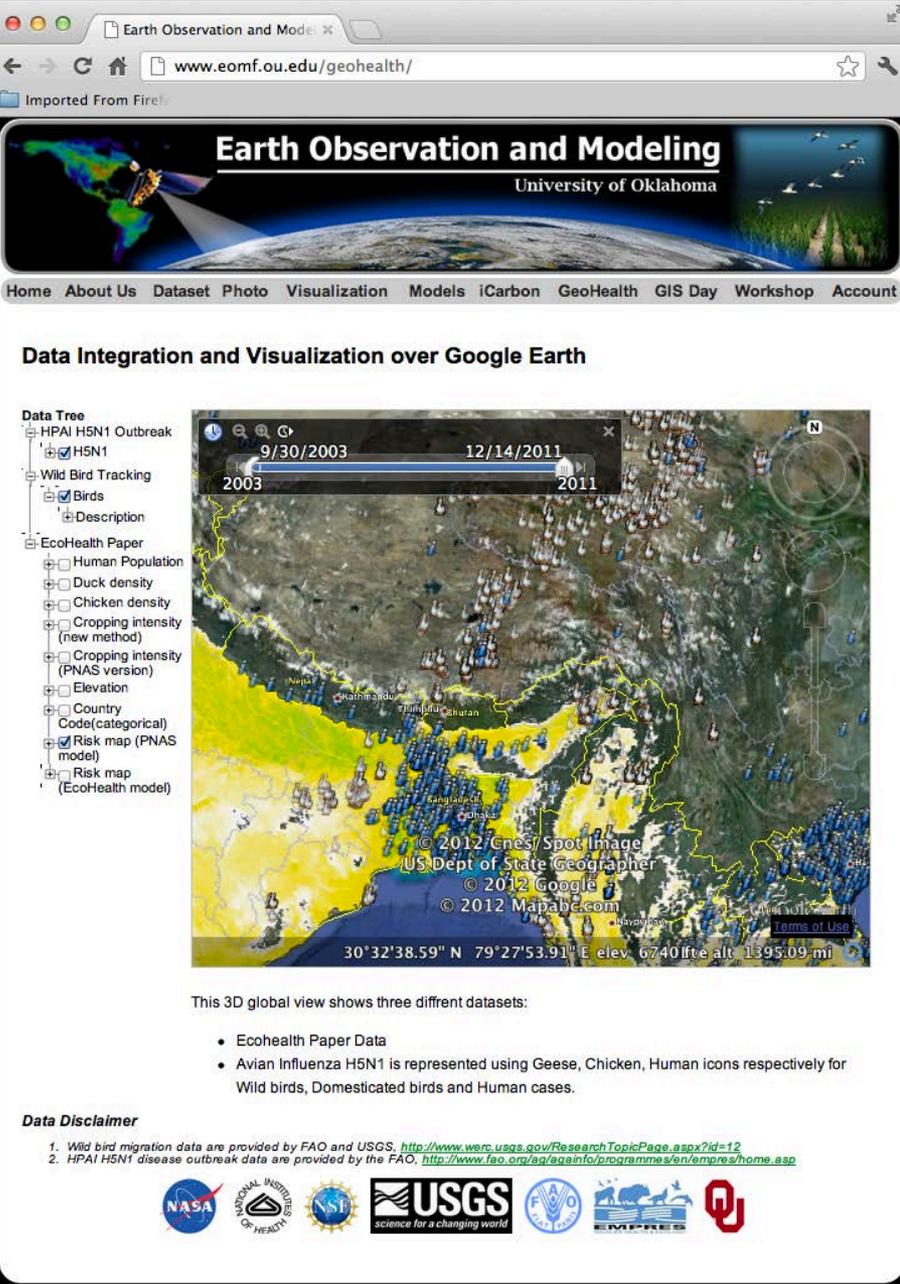
H5N1 outbreak cases

H5N1 cases & wild bird migration data

# GeoHealth data portal

## Dynamic overlay of geospatial datasets

1. H5N1 outbreak case data,
2. Wild bird migration data,
3. Agro-ecological risk factors,
4. Risk maps from spatial epidemiological models



The screenshot shows a web browser window with the URL [www.eomf.ou.edu/geohealth/](http://www.eomf.ou.edu/geohealth/). The page header features the text "Earth Observation and Modeling" and "University of Oklahoma". A navigation menu includes "Home", "About Us", "Dataset", "Photo", "Visualization", "Models", "iCarbon", "GeoHealth", "GIS Day", "Workshop", and "Account".

The main content area is titled "Data Integration and Visualization over Google Earth". On the left is a "Data Tree" with the following items:

- HPAI H5N1 Outbreak
  - H5N1
- Wild Bird Tracking
  - Birds
  - Description
- EcoHealth Paper
  - Human Population
  - Duck density
  - Chicken density
  - Cropping intensity (new method)
  - Cropping intensity (PNAS version)
  - Elevation
  - Country Code(categorical)
  - Risk map (PNAS model)
  - Risk map (EcoHealth model)

The central 3D map shows Southeast Asia with a yellow risk overlay. A timeline at the top of the map interface shows dates from 9/30/2003 to 12/14/2011. The map includes coordinates: 30°32'38.59" N, 79°27'53.91" E, with an elevation of 6,740 feet and an altitude of 13,950.09 miles. Copyright notices for Cnes/Spot Image, US Dept of State Geographer, Google, and Mapabc.com are visible on the map.

Below the map, the text reads: "This 3D global view shows three different datasets:"

- Ecohealth Paper Data
- Avian Influenza H5N1 is represented using Geese, Chicken, Human icons respectively for Wild birds, Domesticated birds and Human cases.

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2. HPAI H5N1 disease outbreak data are provided by the FAO. <http://www.fao.org/ag/againfo/programmes/en/empres/home.asp>

Logos for NASA, NATIONAL INSTITUTE OF HEALTH, USGS (science for a changing world), FAO, EMPRES, and the University of Oklahoma (OU) are displayed at the bottom.

# Geo-Referenced Field Photo Library at the University of Oklahoma (<http://www.eomf.ou.edu/photos>)

A citizen science data portal for sharing and archiving geo-tagged field photos of cropland, rangeland, forest, wetland, water body, wildlife, village, urban, fire, drought and flood in the world. All photos are linked with MODIS satellite images.



GPS camera



smartphone

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### Global Geo-Referenced Field Photo Library

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Jan 1 1990 Feb 11 2012

**Search by metadata:** Categories: Users:  
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**Search by region:** Countries: Geographical:  
All All

Search by keywords:

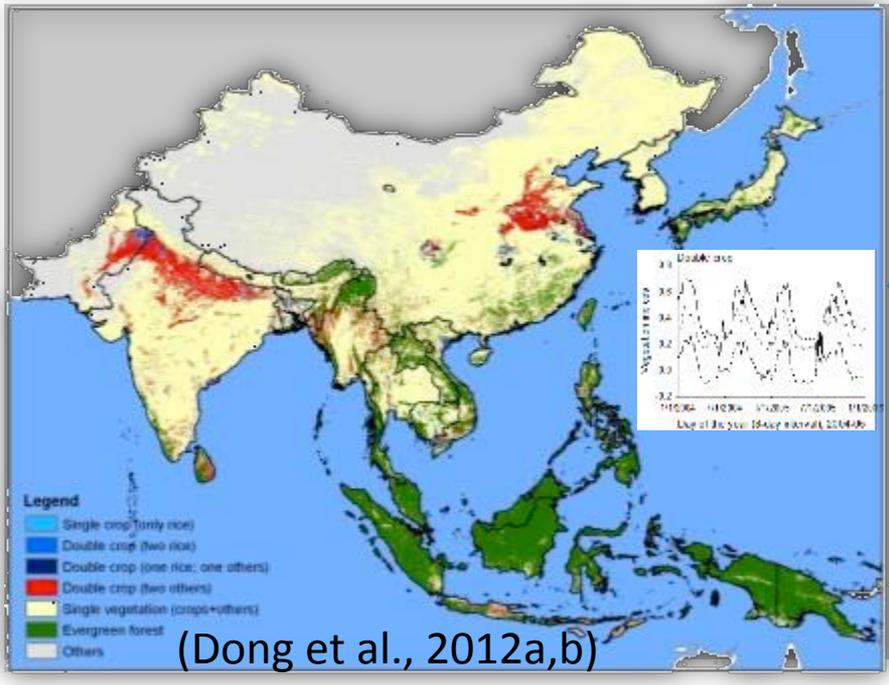
Submit

36004 photos

*Share your field photos, show your footprint  
and support monitoring of our planet Earth*



# Geo-referenced field photos & satellite images are used to map land cover types



# The Geo-Referenced Field Photo Library is now used by other projects.

## Field Photo Weekends

CoCoRaHS - 15,000 volunteers who regularly collect *in-situ* data of precipitation

SCIPP - climate impact research (drought, flood)

EOMF - web data portal and service

Partnership among scientists, stakeholders and amateurs

**SCIPP**  
Southern Climate Impacts Planning Program

### Field Photo Weekends

Sept. 1, 2, 3

**Field Photo weekends**

We all take observations of the weather each day, but have you ever wondered how the weather relates to the world around us? Our data can tell us a lot about balance. Is there enough rain or too much? Is the hailstorm big enough to cause damage? How is the snowpack doing and what will that mean for next year's water supply? But to truly understand the relationship between weather and our landscape, nothing beats a set of eyes.

We invite you to participate in an event to create a national picture of our landscapes. We would like to get as many observers as we can to take pictures of water bodies, fields, forests, or any other facet of our environment that you believe represents the conditions around you. It could be a picture of your favorite fishing hole, a nearby farmer's field, or a nice secluded spot amongst the trees. All of these landscapes are affected by rainfall, or in the case of many places this year, the lack thereof. So why are we doing this?

First of all, it is wonderful to be able to appreciate nature's beauty and to be able to see the world around us. But having everyone taking pictures at approximately the same time allows us to see this landscape as it relates to the things we measure - how it compares to the amounts of rain that have fallen or if it looks like we might expect according to the U.S. Drought Monitor. Is the land around you as green as the satellite seems to think?

This is the first of what we hope will become a somewhat regular event. So while the weather around you may seem normal this year, these photos might give you (and us) a point of reference for what is maybe different next year or in another season. There is no obligation to participate in future Field Photo Weekends, so we encourage everyone to give this one a try and see how it goes.

**Taking Photos**

So what makes a good picture for a project like this? Photos should tell the story of the field or landscape, anything that you feel is representative of the world around you. Just as you do not find the deepest snowdrift for your snowfall measurements, you should not find the vegetation that is in the worst condition for your pictures. We want to see what it may look like walking through a field, where some things may be in better condition than others. So if you see a dead tree, a bunch of trees that are dropping some leaves, and a heavily watered tree with lush green leaves, we want the picture showing the ones dropping leaves.

Photos can be any of the following:

- A water body, showing how much water it is currently holding and where the natural bank might be. For example, a farm pond showing the ring of bare soil around it that is usually submerged.
- A tree, showing the health of its leaves. It may be a tree in your front yard, one in a nearby park, or something over in the woods, whatever you think tells the story about how it is faring this year.
- A field, such as a pasture, meadow, or crops. After all, this is "Field Photo Weekends". The photo should show whether vegetation is brown or green, if soil is becoming exposed, if seeds are burnt up, or if vines are withering.
- A panorama, or series of pictures from a single spot looking in each direction (north, east, south, and west) - and

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The objective of this website is to develop a citizen-based Global Geo-Referenced Field Photos Library. Users can upload, query and download geo-referenced field photos in the library, and use the resultant geospatial data for land use and land cover analysis in a geographical information system. Users who provide photos can decide whether individual photos are to be shared or not. A registered user could upload photos into the library and has access to more field photos in the library than a guest user.

**Introduction to the Field Photo Library**

- About your GPS camera and smartphone [\[pdf\]](#)
- How to use Field Photo Library (upload, edit, query, download) [\[pdf\]](#)
- How to take field photos for monitoring land use and land cover changes [\[pdf\]](#)
- How to take field photos for monitoring water quality and harmful algae blooms [\[pdf\]](#)

### Field Photos Projects

For additional information, please visit [CoCoRaHS](#) and [SCIPP](#) websites

Please read this article "A Library of Georeferenced Photos From the Field", AGU, EOS, 12/8/2011 [\[pdf\]](#)

### Welcome to CoCoRaHS!

"Volunteers working together to measure precipitation across the nation."

Measuring Reference Evapotranspiration **ET<sub>0</sub>**  
"The 'up' side of the water cycle"

6,940 daily precipitation reports received today as of 9/9/2012 9:28 PM EDT

Daily Precipitation (inches x.xx)  
USA  
9/9/2012

**CoCoRaHS**

**COCORAHS NOW IN CANADA!**  
The saying "Rain doesn't fall the same on all" really proves to be true. How often have you seen it rain in your neighborhood and a few blocks away not a drop has fallen.

It is exciting to see that CoCoRaHS has expanded across the United States at a rapid pace over the past few years and is now the largest provider of daily precipitation observations in the country. Even more exciting is the expansion of CoCoRaHS to our neighbors to the north. In December 2011 CoCoRaHS Canada began with the province of Manitoba. Other provinces will follow in the not too distant future.

So when you have the chance please tell a friend or neighbor about this exciting grassroots effort to measure precipitation in the backyards of citizens from the Atlantic to the Pacific. It's easy to join, takes only five minutes a day and is a fun way to learn about this wonderful natural resource that falls from the sky. We are striving to have 30,000-40,000 active observers by the end of 2013 which will give us an ever clearer picture of the amount of precipitation

# Spatial epidemiological models

## Mapping H5N1 highly pathogenic avian influenza risk in Southeast Asia

Marius Gilbert<sup>\*†</sup>, Xiangming Xiao<sup>‡</sup>, Dirk U. Pfeiffer<sup>§</sup>, M. Epprecht<sup>¶</sup>, Stephen Boles<sup>‡</sup>, Christina Czarnecki<sup>‡</sup>, Prasit Chaitaweesub<sup>||</sup>, Wantanee Kalpravidh<sup>\*\*</sup>, Phan Q. Minh<sup>††</sup>, M. J. Otte<sup>\*\*</sup>, Vincent Martin<sup>\*\*</sup>, and Jan Slingenbergh<sup>\*\*</sup>

<sup>\*</sup>Biological Control and Spatial Ecology, Université Libre de Bruxelles, CP160/12, Avenue FD Roosevelt 50, B-1050 Brussels, Belgium; <sup>†</sup>Institute for the Study of Earth, Oceans, and Space, University of New Hampshire, 39 College Road, Durham, NH 03824; <sup>‡</sup>Epidemiology Division, Department of Veterinary Clinical Sciences, The Royal Veterinary College, University of London, London AL9 7TA, United Kingdom; <sup>§</sup>Swiss National Center of Competence in Research North-South, 3012 Berne, Switzerland; <sup>¶</sup>Department of Livestock Development, Ministry of Agriculture and Cooperatives, Bangkok 10400, Thailand; <sup>\*\*</sup>Regional Office for Asia and the Pacific, Food and Agriculture Organization of the United Nations, Bangkok 10200, Thailand; <sup>††</sup>Department of Animal Health, Ministry of Agriculture and Rural Development, Hanoi, Vietnam; and <sup>\*\*</sup>Food and Agriculture Organization of the United Nations, Viale delle Terme di Caracalla, 00100 Rome, Italy

Edited by Rita R. Colwell, University of Maryland, College Park, MD, and approved February 7, 2008 (received for review November 9, 2007)

The highly pathogenic avian influenza (HPAI) H5N1 virus that emerged in southern China in the mid-1990s has in recent years evolved into the first HPAI panzootic. In many countries where the virus was detected, the virus was successfully controlled, whereas

established, spread, and persist everywhere equally. Virus establishment is influenced by the extent of surveillance and early detection, and therefore it is subject to an unknown degree of underreporting bias. Once established, HPAI H5N1 virus spread

OPEN ACCESS Freely available online

PLoS PATHOGENS

## Spatial Distribution and Risk Factors of Highly Pathogenic Avian Influenza (HPAI) H5N1 in China

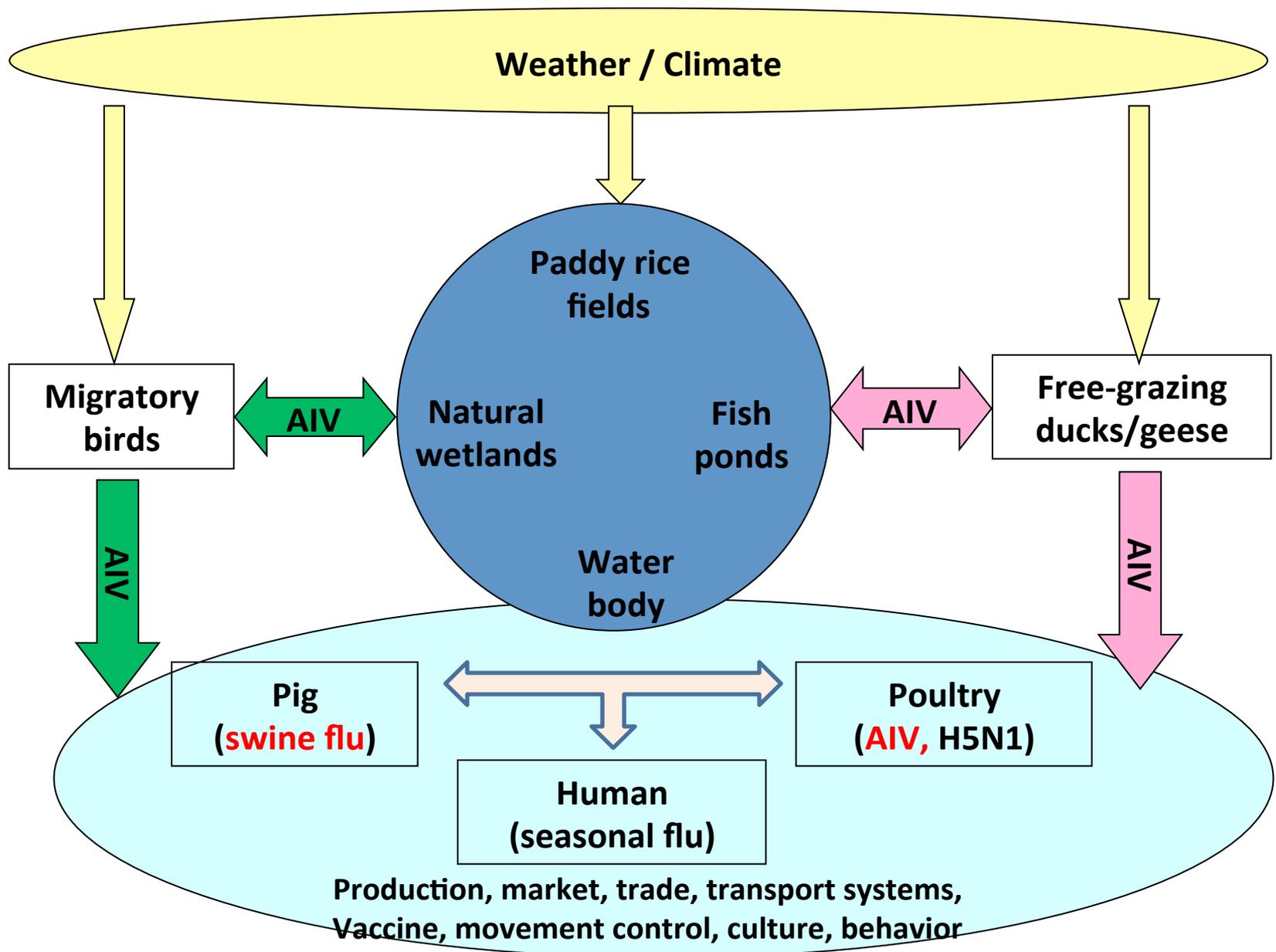
Vincent Martin<sup>1</sup>, Dirk U. Pfeiffer<sup>2</sup>, Xiaoyan Zhou<sup>1</sup>, Xiangming Xiao<sup>3</sup>, Diann J. Prosser<sup>4,5</sup>, Fusheng Guo<sup>1</sup>, Marius Gilbert<sup>6,7\*</sup>

<sup>1</sup>Emergency Centre for the Control of Transboundary Animal Diseases, Food and Agriculture Organization of the United Nations (FAO), Beijing, China, <sup>2</sup>Veterinary Epidemiology & Public Health Group, Department of Veterinary Clinical Sciences, The Royal Veterinary College, University of London, London, United Kingdom, <sup>3</sup>Department of Botany and Microbiology, Center for Spatial Analysis, University of Oklahoma, Norman, Oklahoma, United States of America, <sup>4</sup>USGS Patuxent Wildlife Research Center, Beltsville, Maryland, United States of America, <sup>5</sup>University of Maryland, College Park, Maryland, United States of America, <sup>6</sup>Biological Control and Spatial Ecology, Université Libre de Bruxelles, Brussels, Belgium, <sup>7</sup>Fonds National de la Recherche Scientifique, Brussels, Belgium

### Abstract

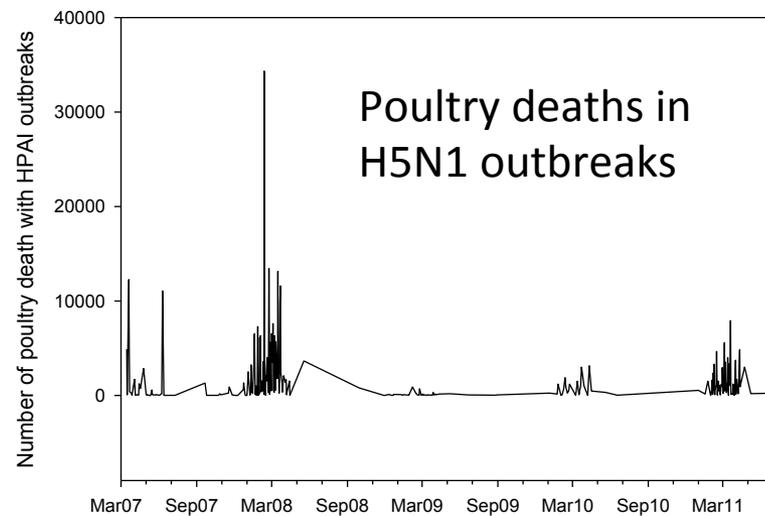
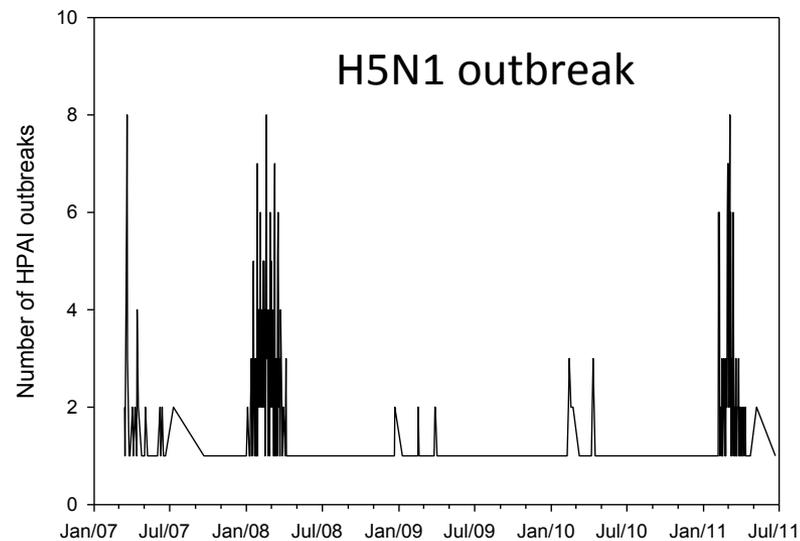
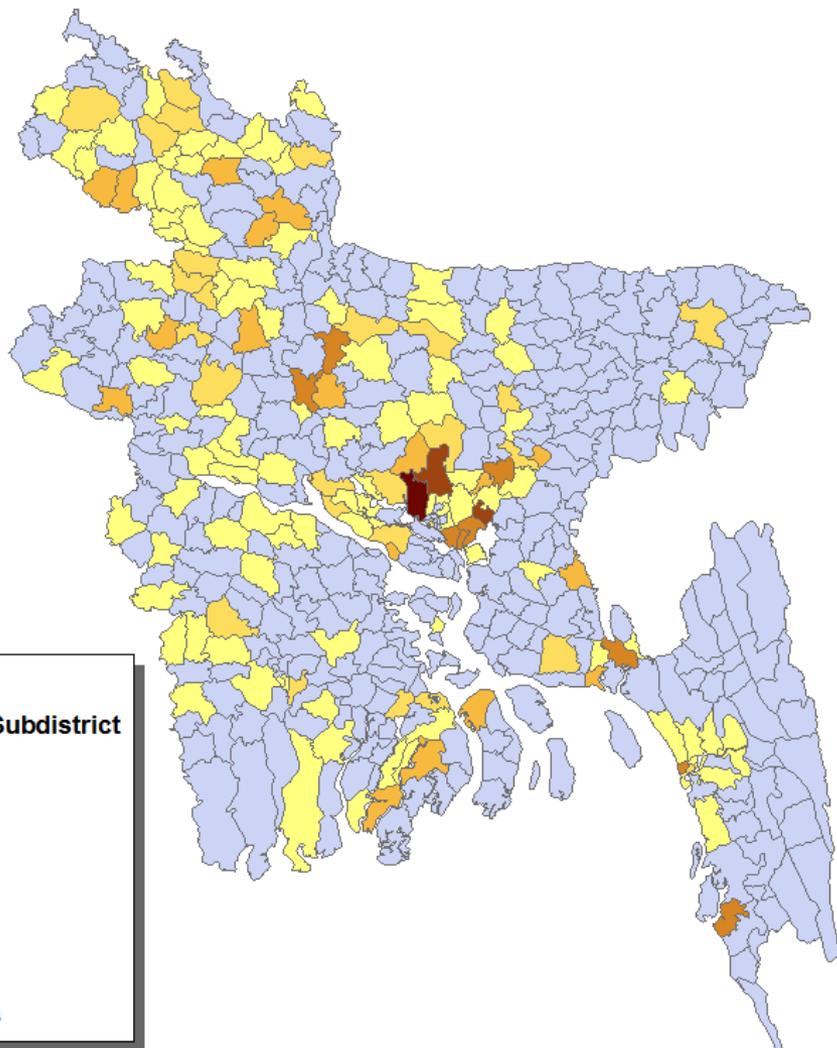
Highly pathogenic avian influenza (HPAI) H5N1 was first encountered in 1996 in Guangdong province (China) and started spreading throughout Asia and the western Palearctic in 2004–2006. Compared to several other countries where the HPAI H5N1 distribution has been studied in some detail, little is known about the environmental correlates of the HPAI H5N1 distribution in China. HPAI H5N1 clinical disease outbreaks, and HPAI virus (HPAIV) H5N1 isolated from active risk-based surveillance sampling of domestic poultry (referred to as HPAIV H5N1 surveillance positives in this manuscript) were

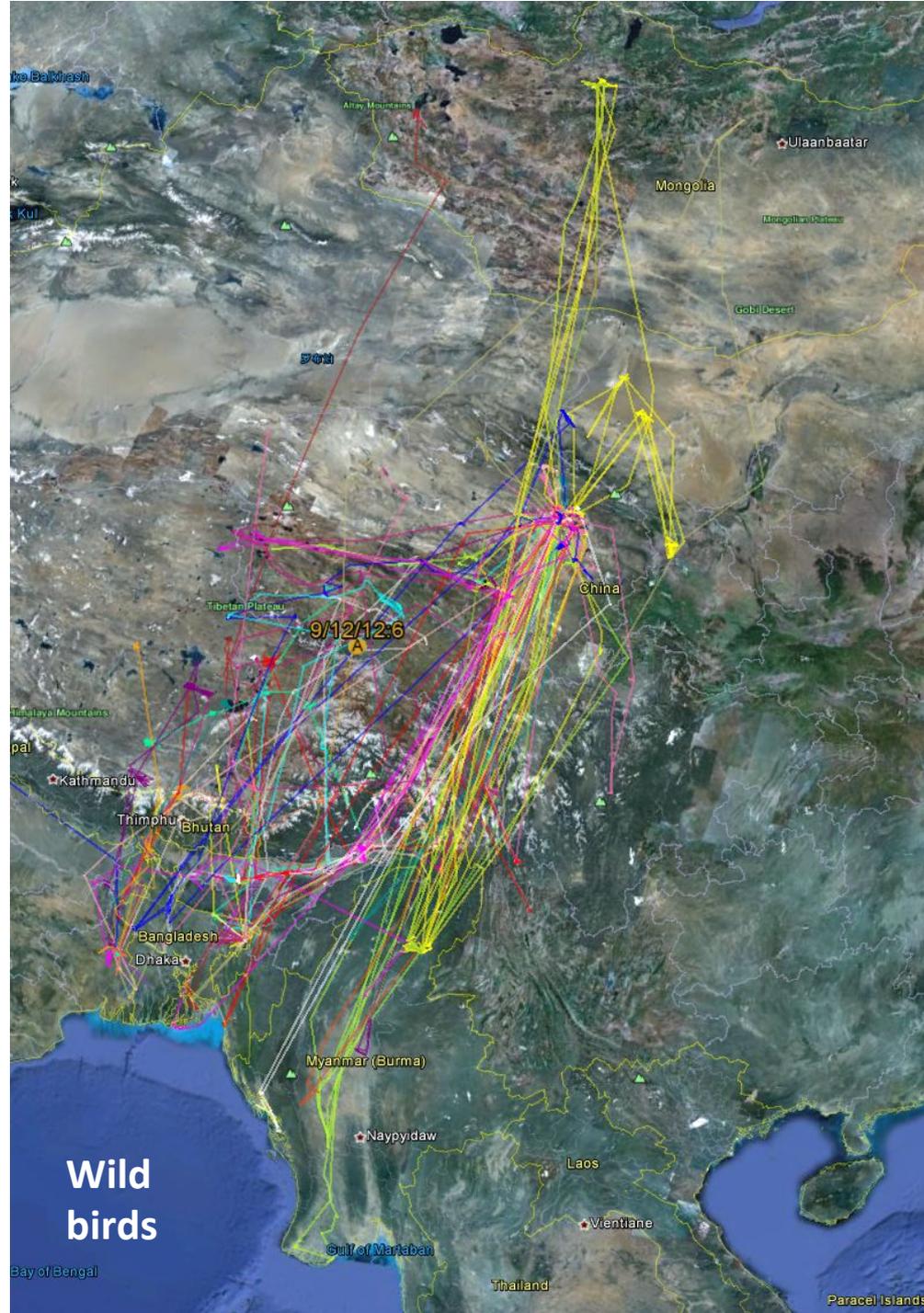
# Ecology and epidemiology of avian influenza



# Spatial patterns and temporal dynamics of HPAI H5N1 outbreaks in Bangladesh

520 HPAI outbreaks in 156 out of a total of 486 sub-districts in Bangladesh





**Wild  
birds**

# Major Concerns for this feasibility project

- Satellite telemetry data in the future
- Web GIS programmer

The screenshot shows the GLEWS (Global Early Warning System for Major Animal Diseases, including Zoonoses) website. The page features a navigation menu on the left with categories like Home, About GLEWS, Publications, and Related links. The main content area includes a 'Latest Diseases Events' list on the left and a 'Diseases Events Map' on the right. The map shows Europe with several red location markers. Below the map, there are news articles such as 'EMPRES Bulletin No. 38' and 'The world is free from rinderpest: OIE completed global free status recognition'. The website is displayed in a browser window with multiple tabs open at the top.



**Thank you**

<http://www.eomf.ou.edu>

