Investigating pathogens and diseases in flying foxes

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SEABCRU Flying Fox Workshop
Phnom Penh, Cambodia
17-19 October 2013

Local conservation.
Global health.

EcoHealth Alliance

Today's Outline

1) Overview: bats and emerging disease

2) Reconciling Conservation and Public Health

3) Nipah virus, disease ecology field example

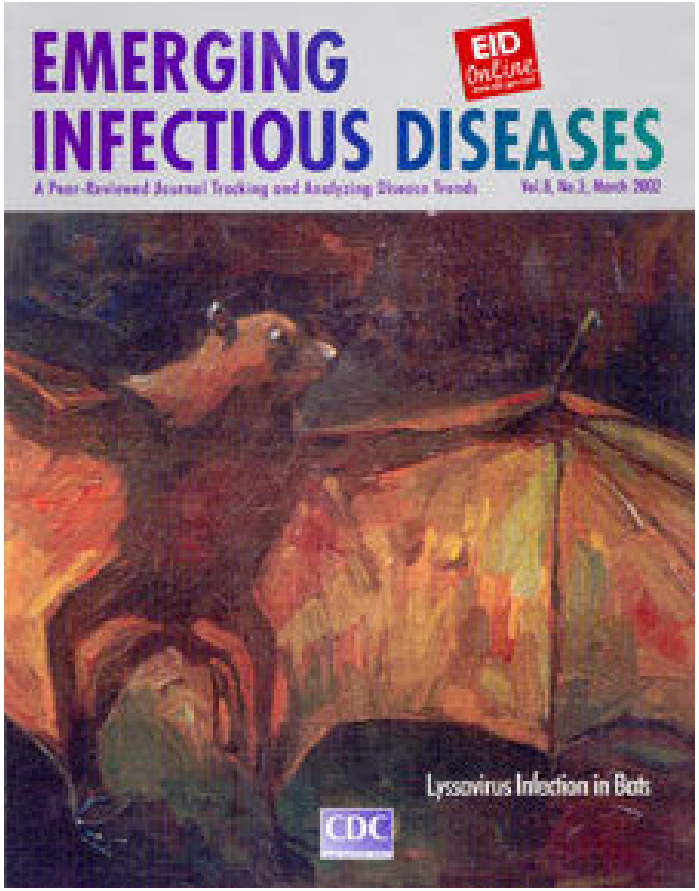
4)Personal Protection while doing bat research

Emerging Zoonoses from Bats

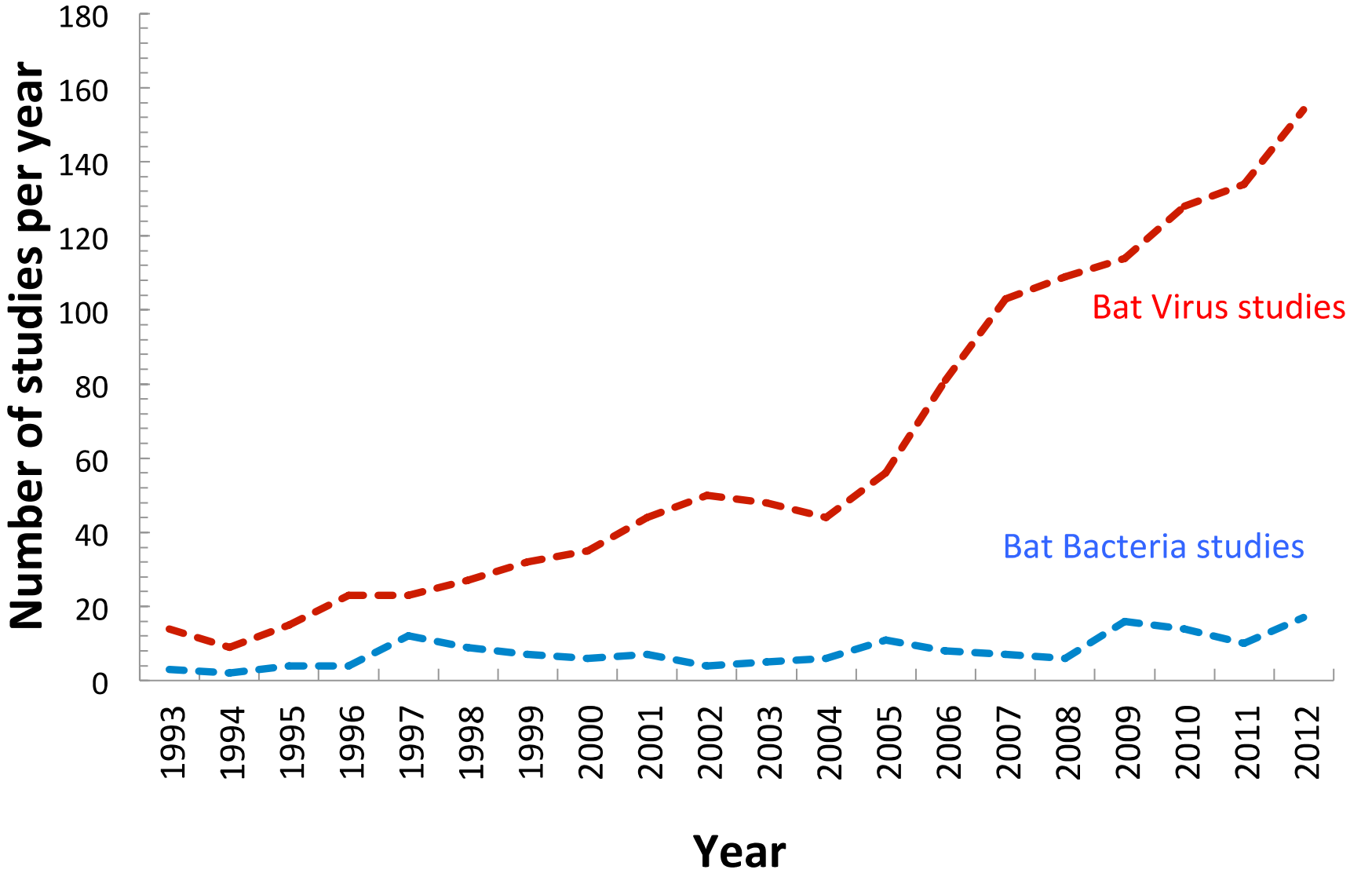
- Growing number of zoonotic, bat-borne viruses recognized (e.g. Ebola, Marburg, Nipah, Hendra, SARS, MERS)

- 70% of emerging diseases from animals are from wildlife

- **Yet, Greater need for viral ECOLOGY, and conservation-minded approaches**



Increase in Bat Virus Research



Lei and Olival, In Review

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Of birdsong and babble. BY TIM REQUARTH AND MEEHAN CRIST

3 THE DOCTOR'S WORLD
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ScienceTimes
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Solving a Viral Mystery

Experts are testing bats and other animals in Saudi Arabia as they try to trace the emergence of a deadly coronavirus, a relative of SARS, in the Middle East.

By DENISE GRADY

As the scientists peered into the darkness, their headlamps revealed an eerie sight. Hundreds of eyes glinted back at them from the walls and ceiling. They had discovered, in a crumbling, long-abandoned village half-buried in sand near a remote town in southwestern Saudi Arabia, a roosting spot for bats.

It was an ideal place to set up traps.

The search for bats is part of an investigation into a deadly new viral disease that has drawn scientists from around the world to Saudi Arabia. The virus, first detected there last year, is known to have infected at least 77 people, killing 40 of them, in eight countries. The illness, called MERS, for Middle Eastern respiratory syndrome, is caused by a coronavirus, a relative of the virus that caused SARS (severe acute respiratory syndrome), which originated in China and caused an international outbreak in 2003 that infected at least 8,000 people and killed nearly 800.

N.I.A.A.I.D. Via ASSOCIATED PRESS

As the case count climbs, critical questions about MERS remain unanswered. Scientists do not know where it came from, where the virus exists in nature, why it has appeared now, how people are being exposed to it, or whether it is becoming more contagious and could erupt into a much larger outbreak, as SARS did. The disease almost certainly originated with one or more people contracting the virus from animals — probably bats — but scientists do not know how many times that kind of spillover to humans has occurred, or how likely it is to keep happening.

There is urgency to the hunt for answers. Half the known cases have been fatal, though the real death rate is probably lower, because there almost certainly have been mild cases that have gone undetected. But the virus still worries health experts, because it can cause such severe disease and has shown an alarming ability to spread among patients in a hospital. It causes flulike symptoms that can progress

CONTINUED ON PAGE D4

Mystery Virus That's Killed 47 Is Tied to Bats in Saudi Arabia

A match to the virus was found in a fecal sample of this type of

What's Popular Now

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Gunman and 12 Victims Killed in Shooting at D.C. Navy Yard

Well Tara Parker-Pope on Health

'Everyday Sadists' Among Us
September 19, 2013

To Help a Shy Child, I...
September 16, 2013

Beha...

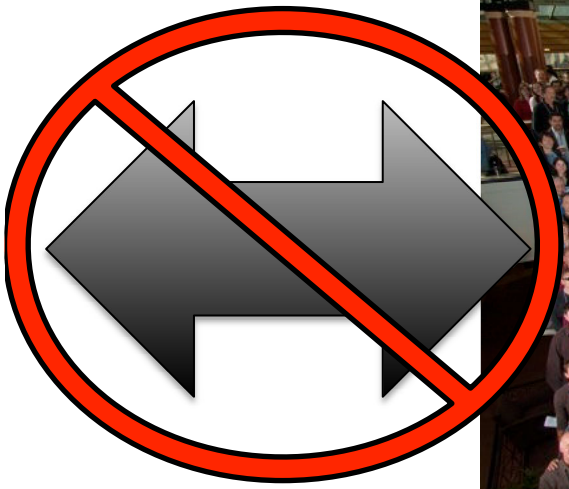
Some Scientists Cast Doubt on Finding of Origins of a Virus

By DONALD G. McNEIL Jr.
Published: August 27, 2013

Since scientists announced last week that they had tracked a dangerous new coronavirus to bats in Saudi Arabia, a debate has emerged among virologists as to whether there really is enough evidence to back up the claim.

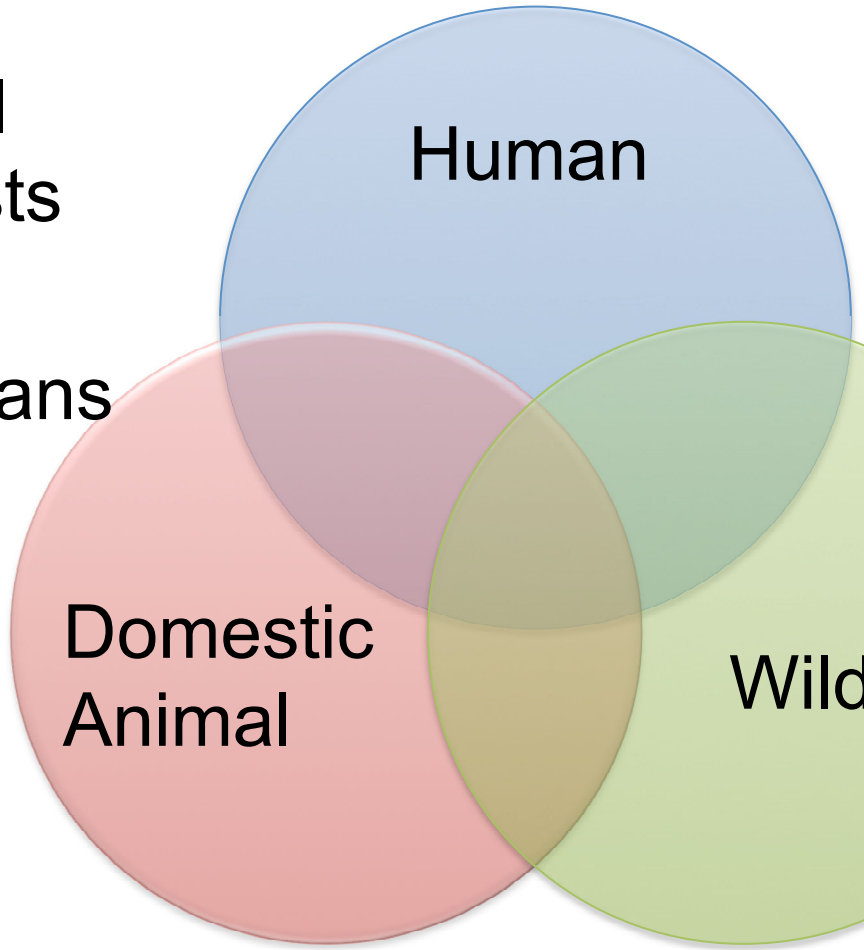
Public Health/ Virology Community

Bat Conservation Community



2010 NASBR

‘One Health’



Spatial Analysts

Epidemiologists

Public Health

Virologists

Veterinarians

MDs/clinicians

Farmers

Hunters

Ecologists

Evolutionary Biologists

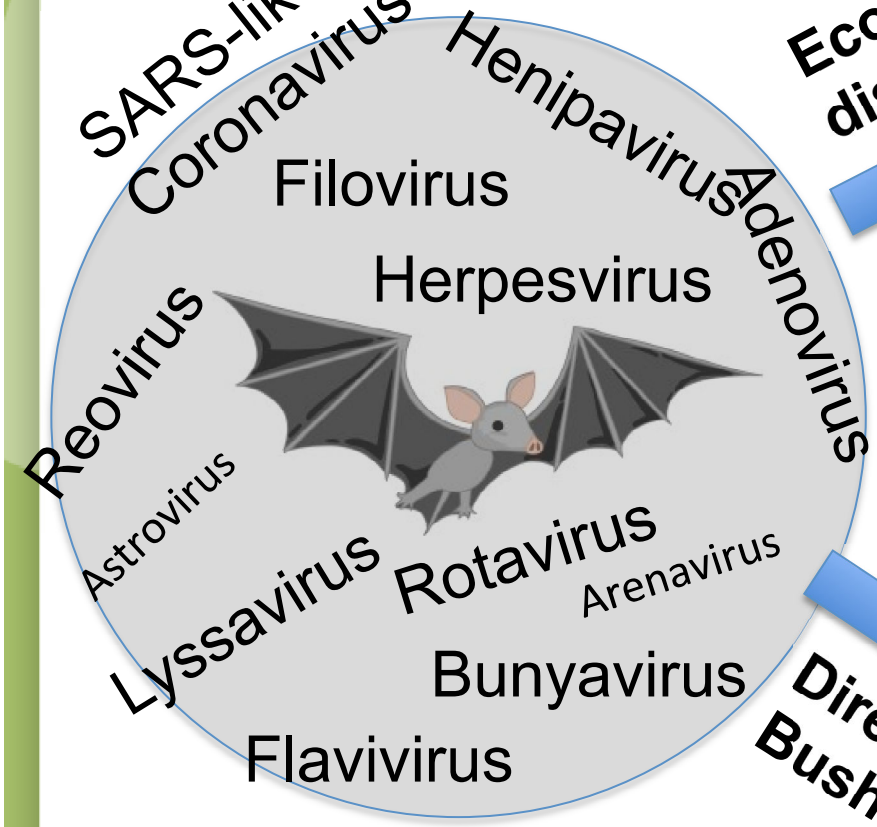
Climate scientists

Population geneticists

Anthropologists

Mathematical modelers

Drivers of viral "spillover"
= Threats to Bats



'Viral Diversity'

Ecological disruption

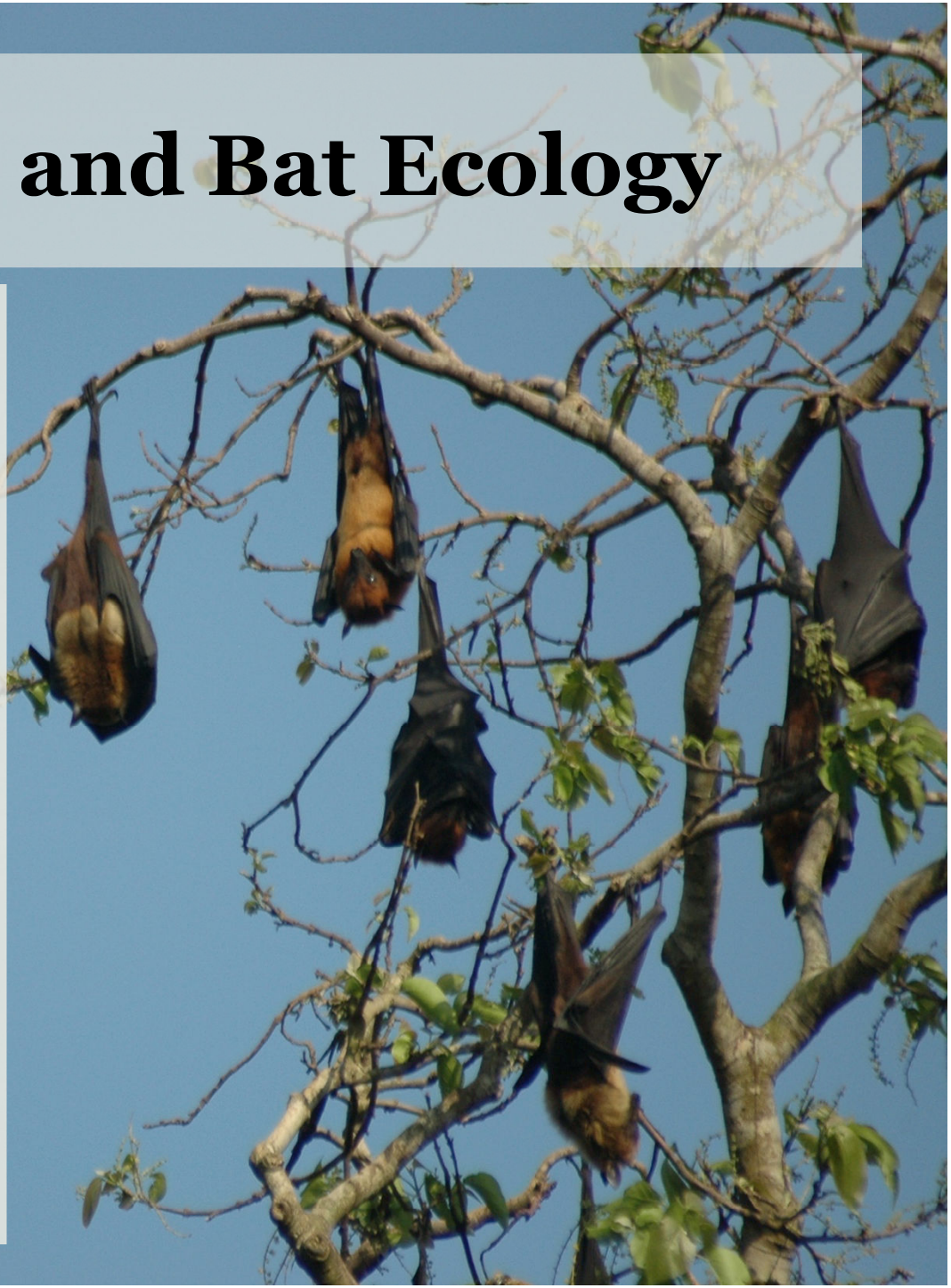
Agricultural Expansion

Direct contact/ Bushmeat

Disease emergence in people is most often linked with human disturbance of natural ecosystems!

Nipah Virus and Bat Ecology

- What is the prevalence of Nipah virus?
  - Spatial / Temporal variation in infection?
- Bat abundance?
- Movement patterns?



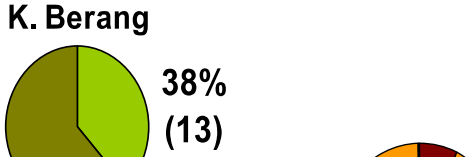
Nipah virus in Malaysia, 1998-1999

- Most human cases worked on infected pig farms

- > 1 million pigs culled
- 800 pig-farms demolished
- 36,000 jobs lost
- > $300 (US) million exports lost

Conduct on-the-ground disease ecology and conservation research – example Nipah virus

Nipah serology in Malaysian *Pteropus* spp.



- Widespread

DISPATCHES

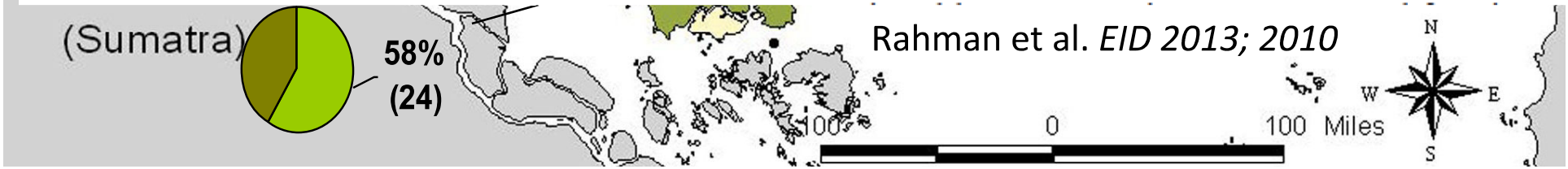
Characterization of Nipah Virus from Naturally Infected *Pteropus vampyrus* Bats, Malaysia

Sohayati A. Rahman, Sharifah S. Hassan, Kevin J. Olival, Maizan Mohamed, Li-Yen Chang, Latiffah Hassan, Norsharina M. Saad, Syamsiah A. Shohaimi, Zaini C. Mamat, M.S. Naim, Jonathan H. Epstein, Arshad S. Suri, Hume E. Field, Peter Daszak, and the Henipavirus Ecology Research Group[1]

The Study

We conducted a prospective cohort study from June 2004 through June 2005 on a group of 17 *P. vampyrus* flying foxes captured in 2 locations, using a nonrandom sampling method. Fourteen bats (73%) were from Lenggong (5°07′01.1″N, 100°58′32.7″E), and 3 bats (27%) were from Kampung Gajah (4°10′35″N, 100°55′37″E), Malaysia. This project was approved by the Wildlife Trust Institutional Animal Care and Use Committee, New York, New York, USA, and Department of Wildlife and National Park Malaysia research committee.

Because bats were included in the study in a staggered manner, each bat was monitored for antibody titer against NiV and virus excretion for 5 to 12 months. Bats were quarantined at Taiping Zoo (4°54′N, 100°45′E), Taiping, Malaysia, in a wire net (1 inch square) enclosure, 5 m long × 4 m wide × 3 m high; with a roof and cement floor.



Rahman et al. *EID 2013; 2010*

vampyrus 2004-2005

Archives Home > Archives

Published: Wednesday August 26, 2009 MYT 6:55:00 PM

Malaysia urged to ban flying fox hunting

KUALA LUMPUR: The world's largest species of fruit bat, also known as the flying fox, could be driven to extinction in Malaysia as early as 2015 unless the government bans its hunting, a scientific study published Wednesday said.

Flying foxes, which have a wingspan of up to five feet (1.5 meters), eat fruit and nectar. In the process they disperse seeds around a vast area and pollinate trees, making them key to the well-being of the rainforest ecosystem in this part of Southeast Asia.

They are commonly hunted for food, medicine and sport in Malaysia and many other countries in Southeast Asia.

Years

Epstein, Olival, et al. 2009

Develop low-cost, non-lethal interventions strategies for zoonoses

- e.g. Working with Bangladesh government and icddr,b to implement **on-the-ground disease interventions for Nipah virus**
- Protective bamboo skirts
- Prevent Nipah virus but also 50+ other potential viral zoonoses

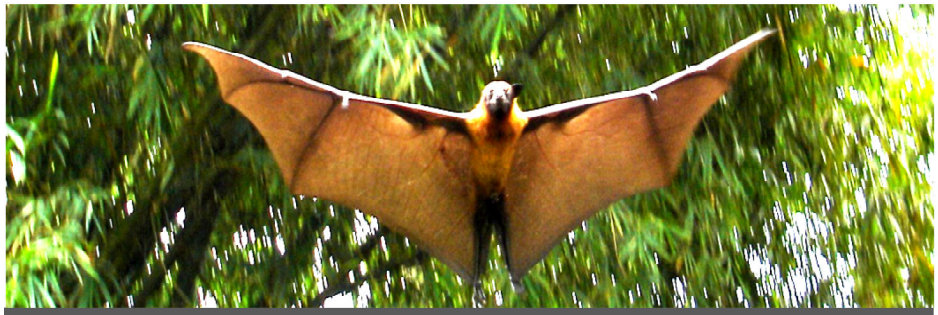
FLYING FOXES HAVE ECONOMIC VALUE

Flying foxes are essential for the pollination, dispersal, and genetic diversity of economically important fruit plants.

•Some plants such as durian and petai rely entirely on flying foxes for pollination. Trade in durian in Southeast Asia is worth about US $120 million per year (B 3.6 billion).

•Flying foxes carry seeds between areas as they digest food, which is important in forest regeneration. This also helps maintain genetic diversity in wild plants such as banana and mango. Without genetic diversity, economically important cultivated plants could become more susceptible to disease.

•Flying foxes sustain ecosystems through their guano. In 1983, guano mined for fertilizer from Khao Chong Pran Cave in Ratchaburi Province earned roughly US $53,000 (B 1.6 million) annually in support of a local monastery and school, but later on, as the flying fox population declined, profits dropped.



"Last but not least, the major reason for protecting fruit bats is that they are beautiful, gentle, intelligent living creatures that deserve to live."

-Flying Fox Conservation Fund

THREATS TO FLYING FOXES

Humans are the greatest threat to flying foxes. We destroy their habitats: roosts and feeding areas are lost as forests are cut down and caves are blasted, disturbed, and closed. Flying foxes are hunted for food and traditional medicines, even though there is no scientific evidence that medicine made from flying foxes work. Hunting has caused the extinction of several species of fruit-eating bats.

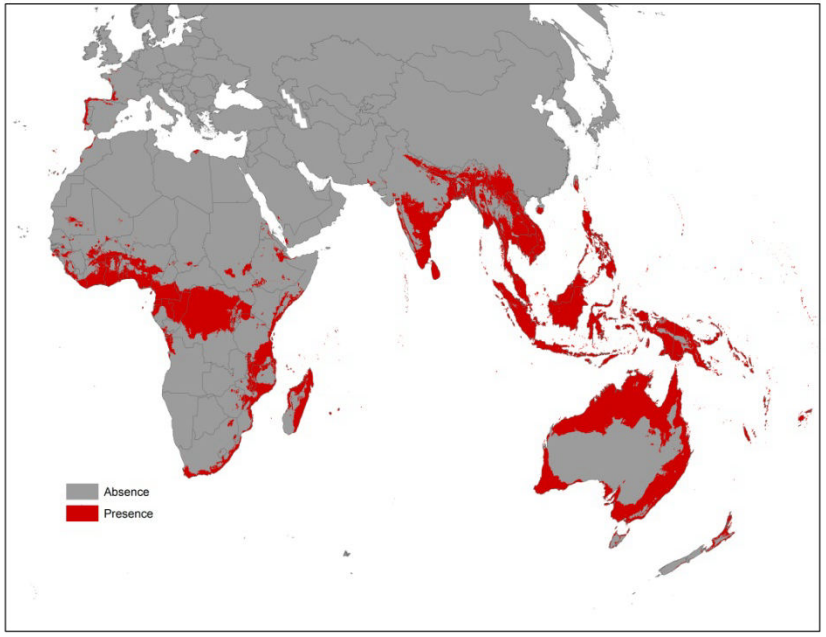
NIPAH VIRUS (NiV)

There is strong evidence that the emergence of bat-related viral infection communicable to humans and animals has been attributed to the loss of natural habitats of bats.

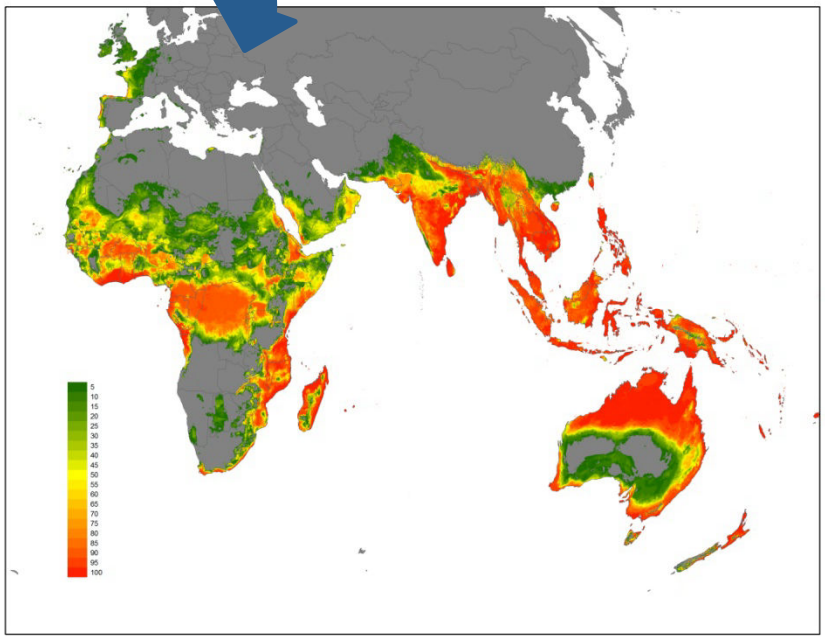
Nipah virus (NiV) is a deadly infectious disease that can infect flying foxes, livestock, and humans. Flying foxes have been identified as natural reservoirs of NiV, and infected bats shed virus in their saliva and excreta. In 1999, direct contact with infected pigs was identified as the predominant mode of transmission to humans in a large outbreak in Malaysia.

Risk of infection increases when people consume either flying foxes or the livestock that live close to flying fox roosts, or when they eat fruits and date palm sap that flying foxes also have eaten. NiV has been detected in Thailand, but by keeping a safe distance from flying foxes, risk of infection and spread can be minimized.

Nipah virus, bat reservoir Distribution and Climate Change



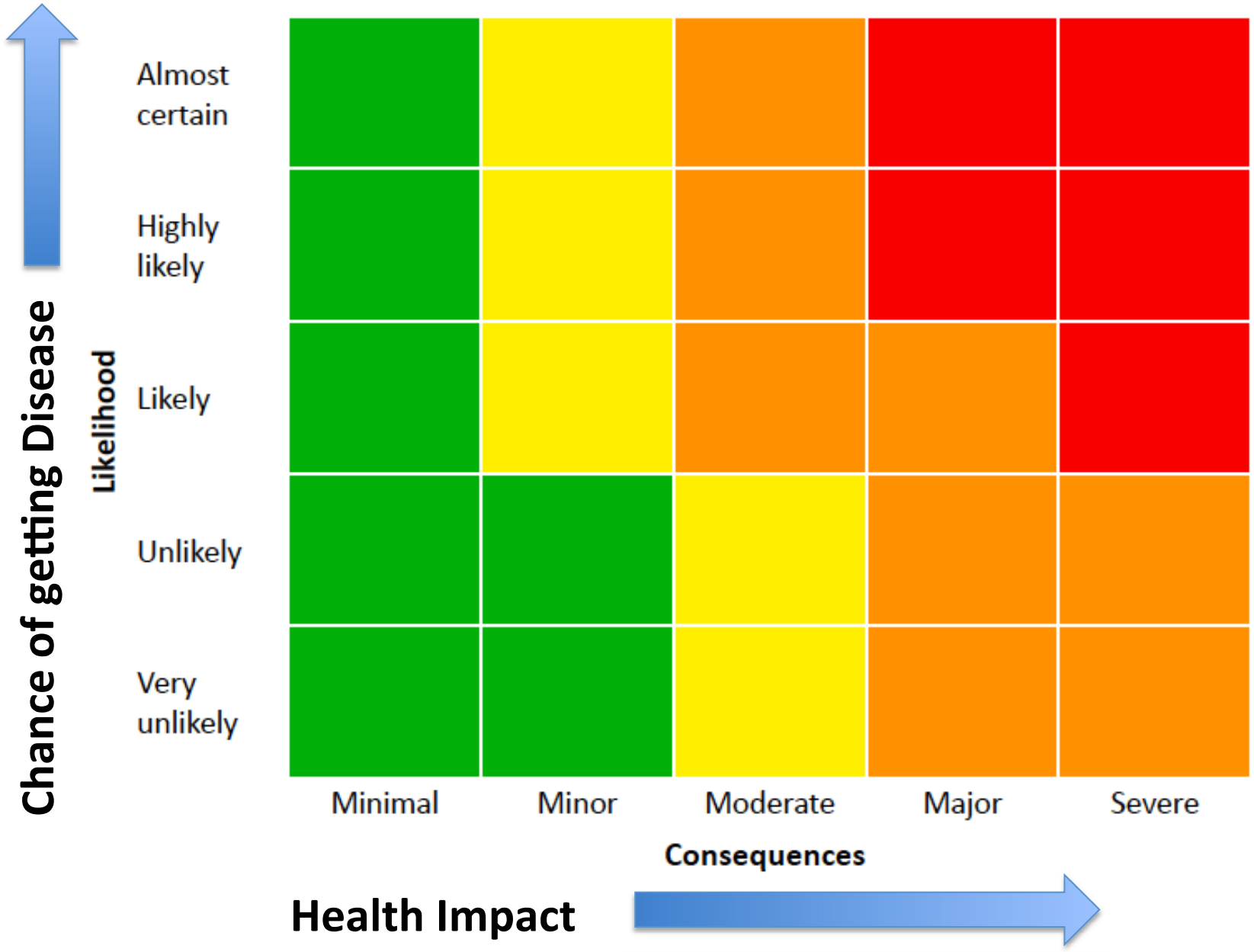
Current distribution



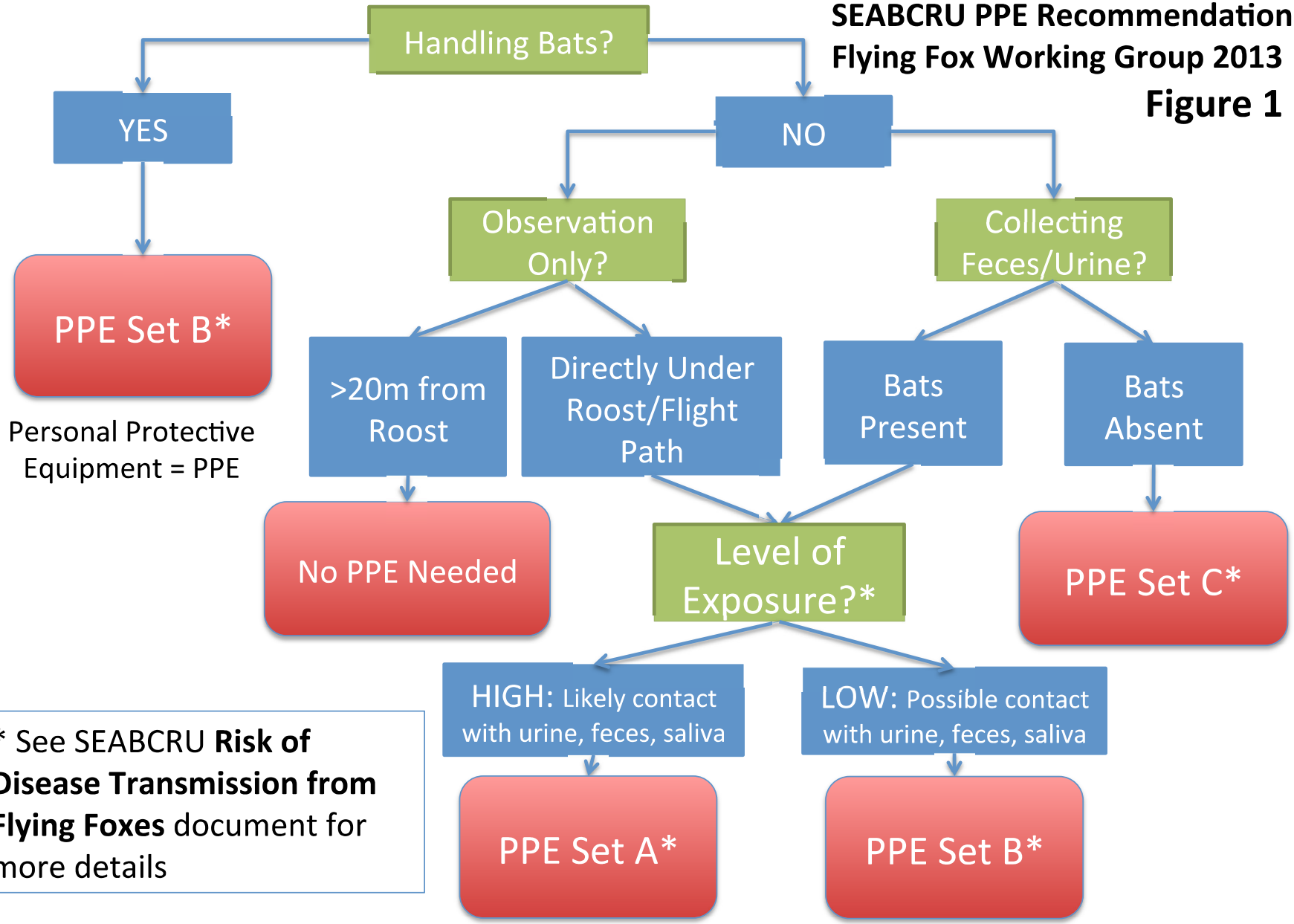
Future distribution
Ensemble of 20 GCM's

Daszak *et al.* PNAS 2012

Risk Assessment



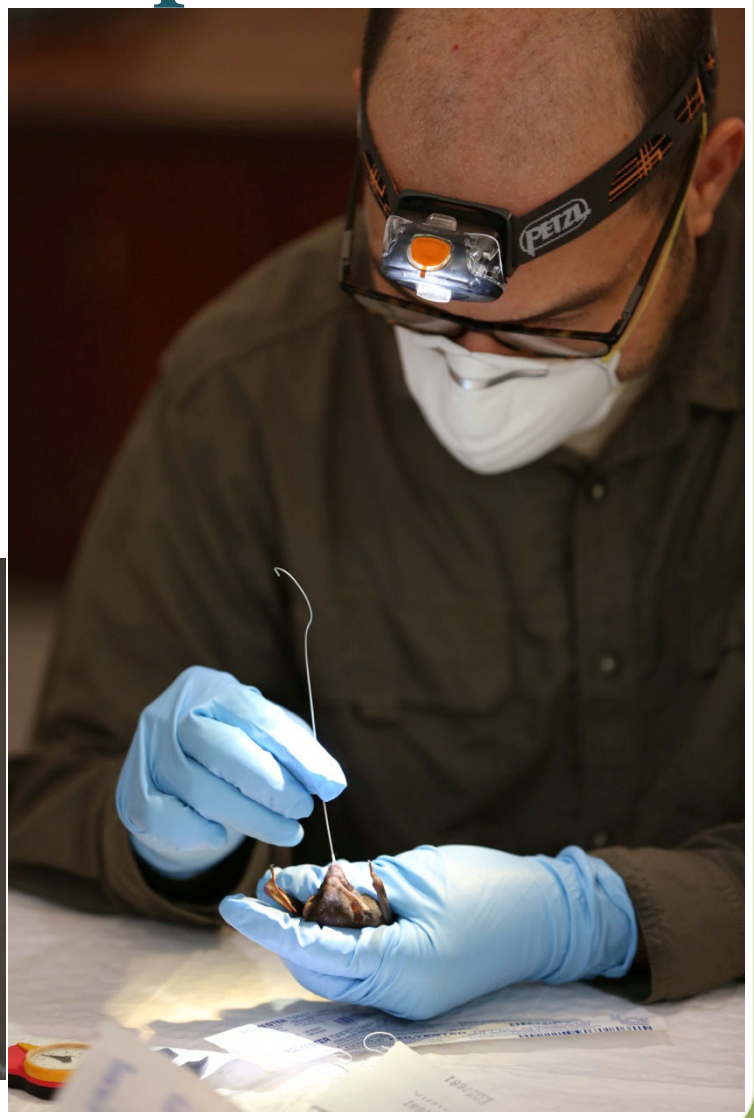
SEABCRU PPE Recommendations
Flying Fox Working Group 2013
Figure 1



* See SEABCRU **Risk of Disease Transmission from Flying Foxes** document for more details

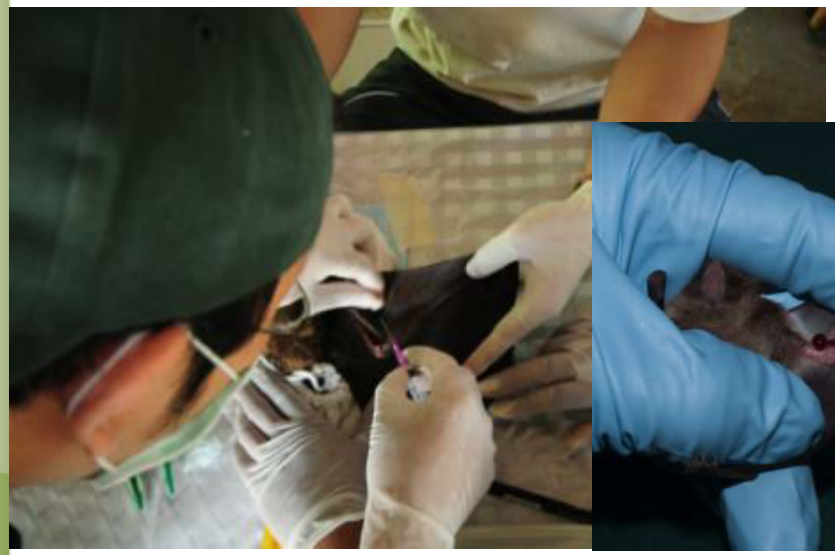
Personal Protective Equipment training e.g. Bangladesh Nipah investigations

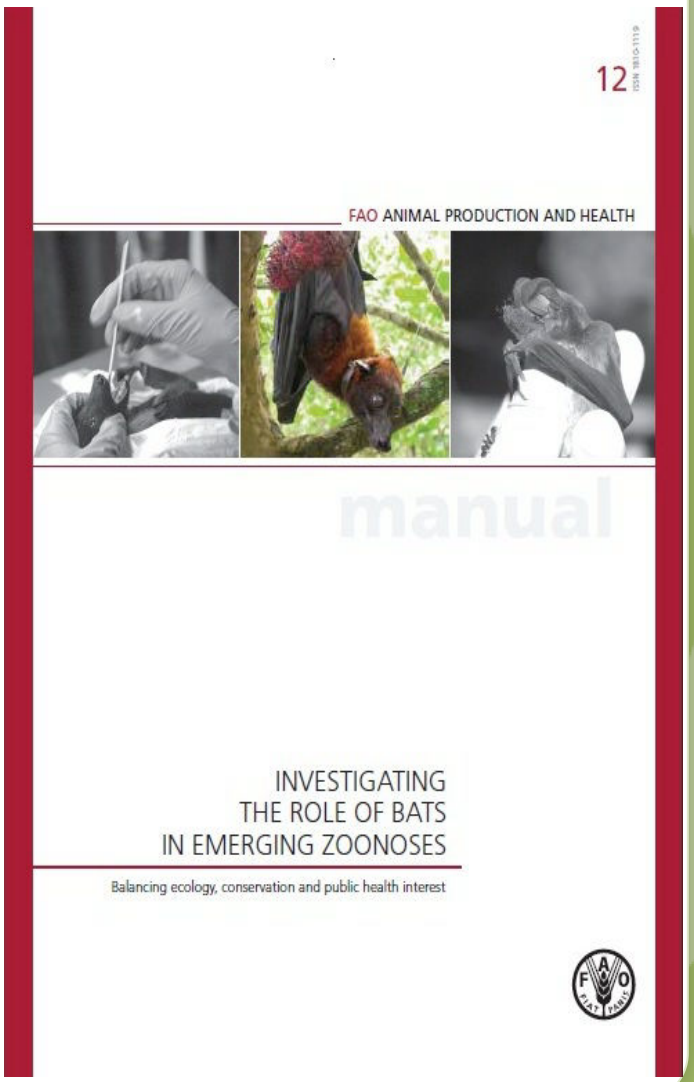
Sampling wildlife for urine, feces, saliva, blood = routes of human exposure



Blood, saliva, feces, urine

Develop and use minimally-invasive viral sampling protocols





*PPE Recommendations for bat handling

- Dedicated clothing
- Gloves
- Face mask
- Goggles or glasses

*See SEABCRU recommendation protocols for minimum PPE

Example: Hands-on Training in Thailand

Bat capture and handling

Sample collection

Before and after PPE training

White Nose Syndrome, >6 Million Bats Dead

Questions?

Pic: Solon Morse
Puerto Rico 2012

Acknowledgements, Funding

Thanks to SEABCRU for travel support
ALL EcoHealth Alliance staff, interns, and in-country partners
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Department of Defense, Defense Threat Reduction Agency

USAID
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