Policy and Science for Global Health Security: Lessons from the West African Ebola Outbreak

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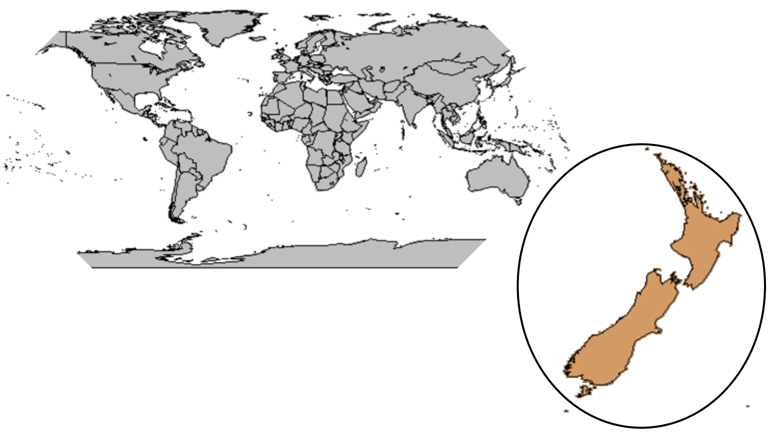
- OIE Collaborating Centre for Veterinary Epidemiology and Public Health



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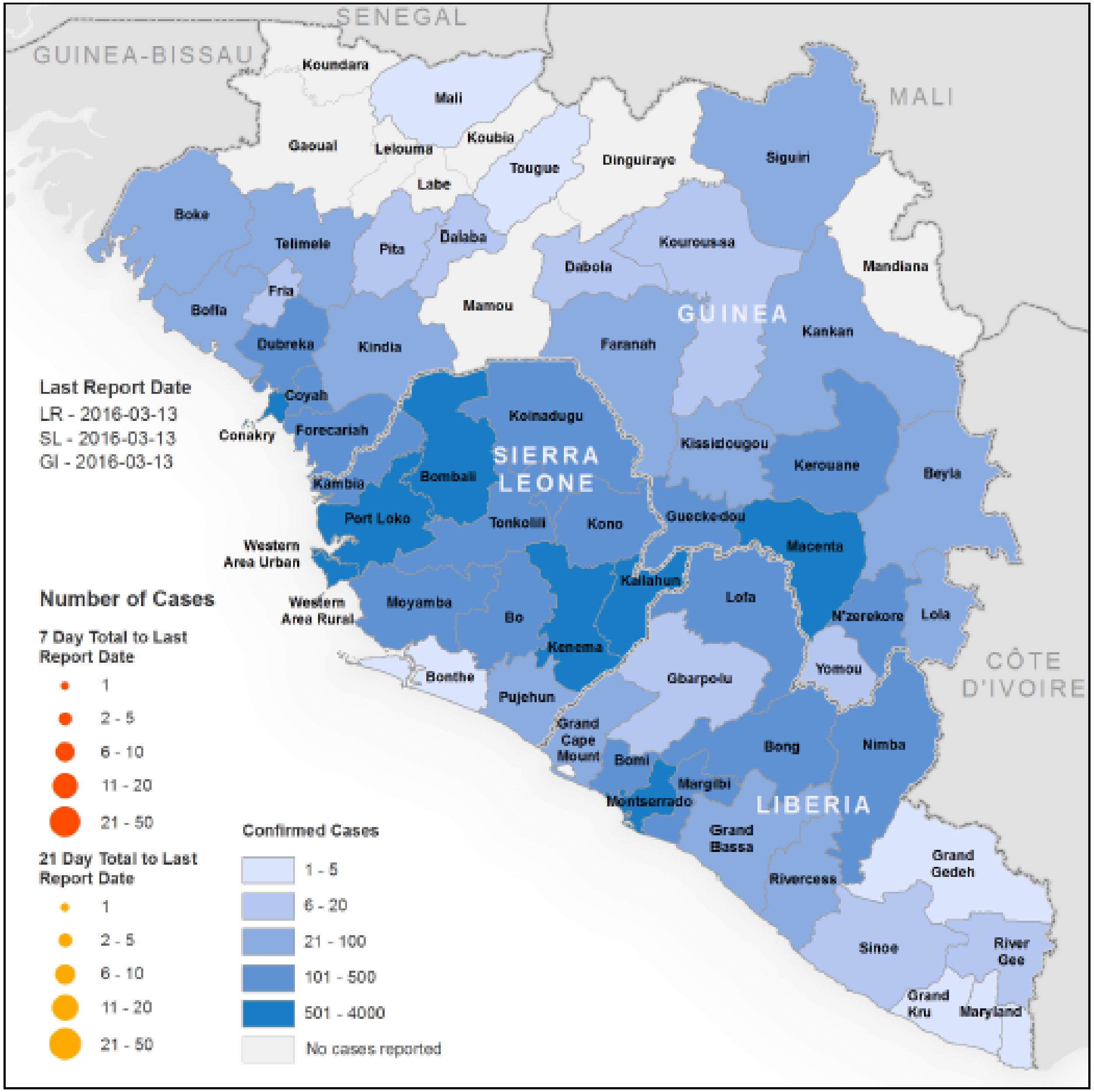
VETERINARY, ANIMAL AND BIOMEDICAL SCIENCES

West African Ebola Outbreak

Figure 2: Geographical distribution of new and total confirmed cases in Guinea, Liberia, and Sierra Leone



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 and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Image: WHO

Figure 1: Confirmed, probable, and suspected EVD cases worldwide (data up to 13 March 2016)

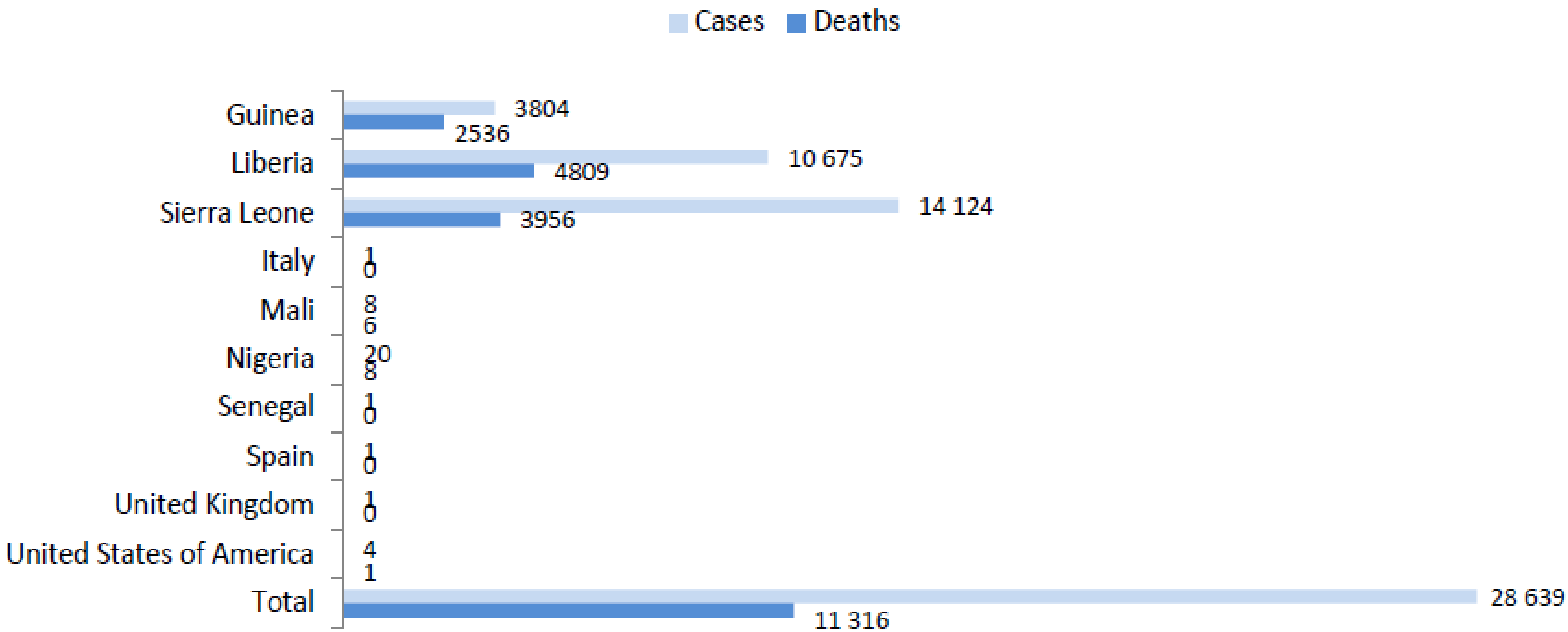


Image: WHO

Image: Action Aid

Image: Getty Images

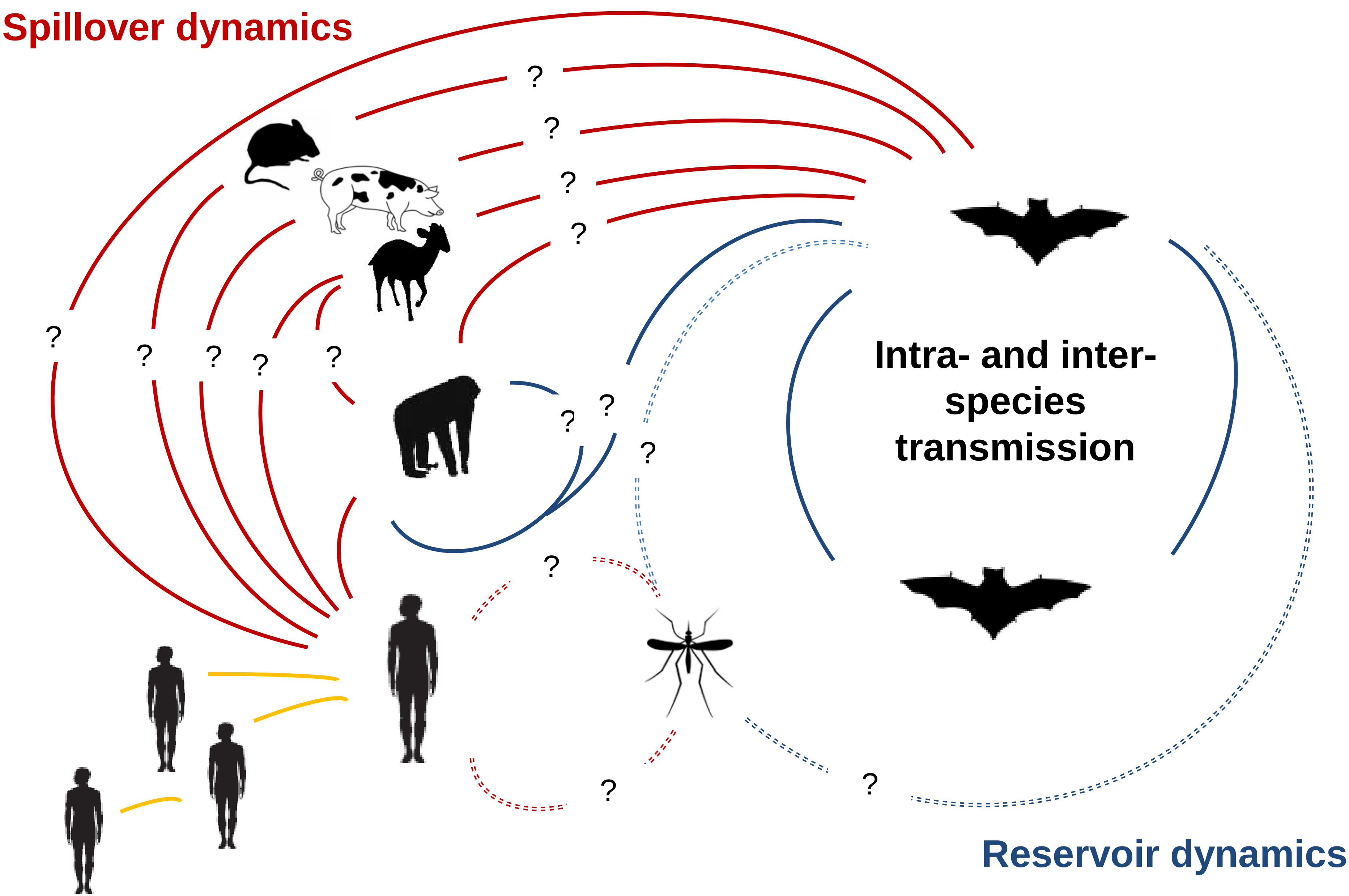
Image: EPA

“**The recent emergence of *Zaire ebolavirus* in West Africa has come as a surprise** in a region more commonly known for its endemic Lassa fever, another viral hemorrhagic fever caused by an Old World arenavirus. **Yet the region has seen previous ebolavirus activity**”

New England Journal of Medicine

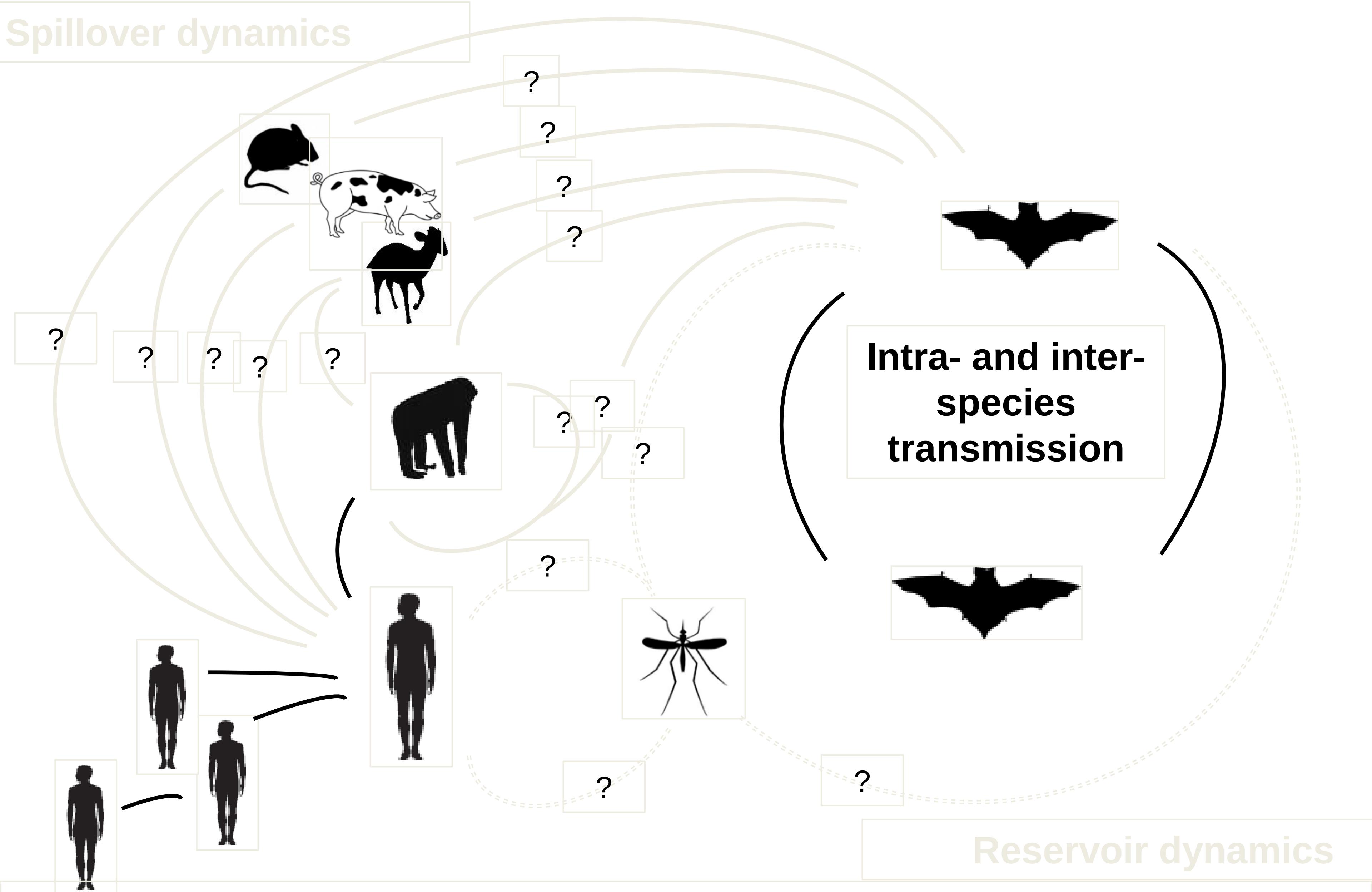
2014; 371:1375-1378 October 9, 2014

Ebolavirus transmission pathways



Olival and Hayman, 2014 Viruses

Ebolavirus transmission dynamics



Olival and Hayman, 2014 Viruses

Relevant animal studies

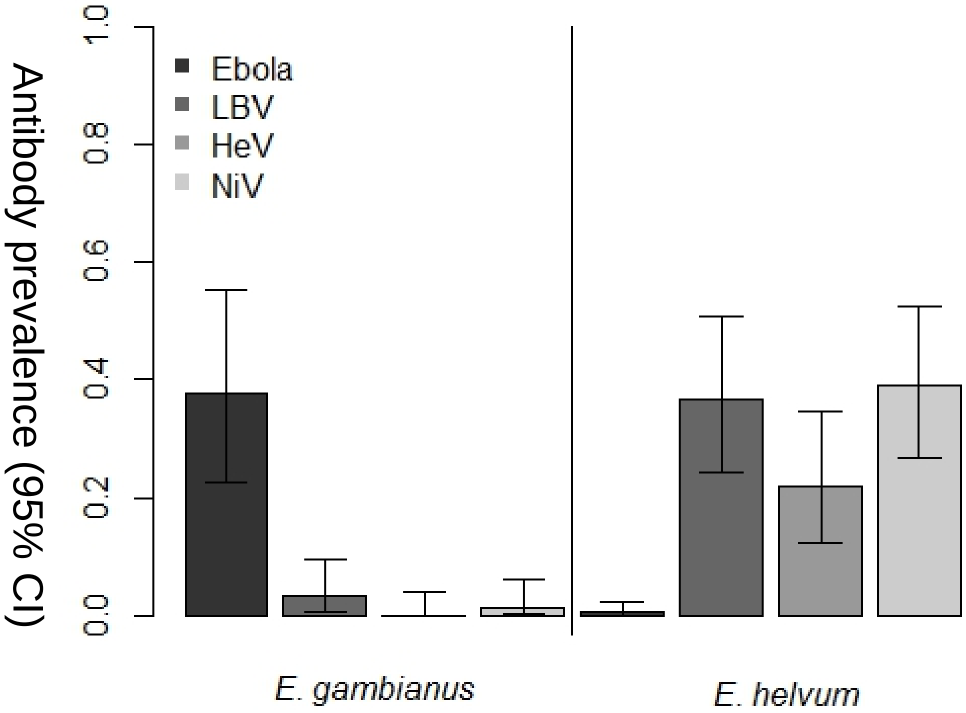
Year(s) sample collected	Country	Scientific data	Ref.
1992	Cote d'Ivoire	An outbreak of disease led to the death of wild chimpanzees (*Pan troglodytes verus*) in Tai National Park in Cote d'Ivoire	(50)
1994	Cote d'Ivoire	Approximately 25% of 43 chimpanzees (*Pan troglodytes verus*) died during an outbreak in Tai National Park, in which ebolavirus antigen was detected in autopsy tissues. A veterinarian was infected and a new virus, Tai forest virus, isolated	(50, 51)
1999	-	Common African bats in Democratic Republic of Congo were detected positive for MARV by molecular testing (PCR), with 3.0%–3.6% of 2 species of insectivorous bat (*Miniopterus inflatus*, *Rhinolophus eloquens*) and 1 species of fruit bat (*Rousettus aegyptiacus*) positive by PCR and antibodies positive to MARV in 9.7% of 1 of the insectivorous species (*R. eloquens*) and in 20.5% of the fruit bat species (*Rousettus aegyptiacus*). Several subsequent studies consolidate these results.	(6, 54-58)
2002-2003	-	Identification of bats as likely reservoir hosts for Ebola virus in Central Africa through serological and molecular studies is published and includes species (*Hypsignathus monstrosus*, *Epomops franqueti* and *Myonycteris torquata*) that occur throughout West Africa	(59)
2004	-	Ecological niche models predict the presence of Ebola virus in West Africa and efforts to identify unidentified hosts are published that include West African species	(10, 25)
2007-2008	Ghana	Bats sampled in Ghana were positive for anti- Zaire EBOV/Reston EBOV virus antibodies, with 32 from 88 (36%) in one study (*Epomops franqueti*, *Epomophorus gambianus*, *Hypsignathus monstrosus*, *Nanonycteris veldkampii*, and *Epomops buettikoferi*), and 1 from 262 (<1%) in another (*Eidolon helvum*).	(60, 61)
2009	-	Global review of bats as bushmeat suggests high levels of direct human-bat contact in West Africa	(62)
2011	Ghana	Extent of bat hunting in Ghana is published with estimates of 128,000 *Eidolon helvum* fruit bats eaten annually	(20)

Ebola Virus Antibodies in Fruit Bats, Ghana, West Africa

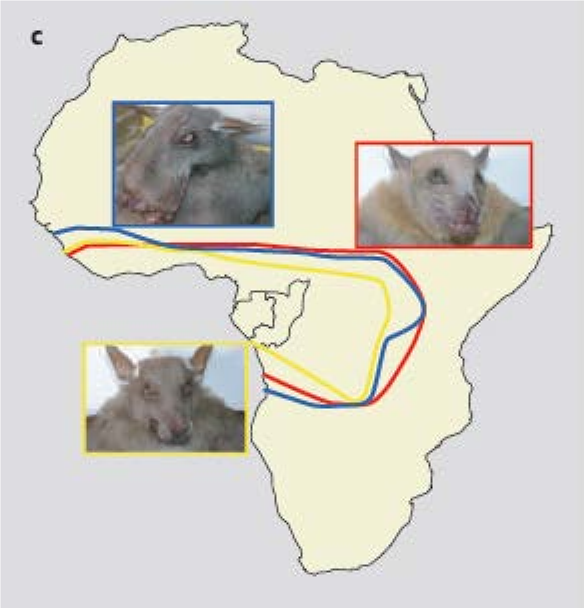
To the Editor: Fruit bats are the
...
presumptive reservoir hosts of Ebola

Hayman *et al.*, Emerging Infectious Diseases 2012

Evidence of *Zaire ebolavirus*



Hayman *et al.*, EID 2008; PLoS ONE 2008; PLoS ONE 2010; EID 2012



Vol 438|1 December 2005

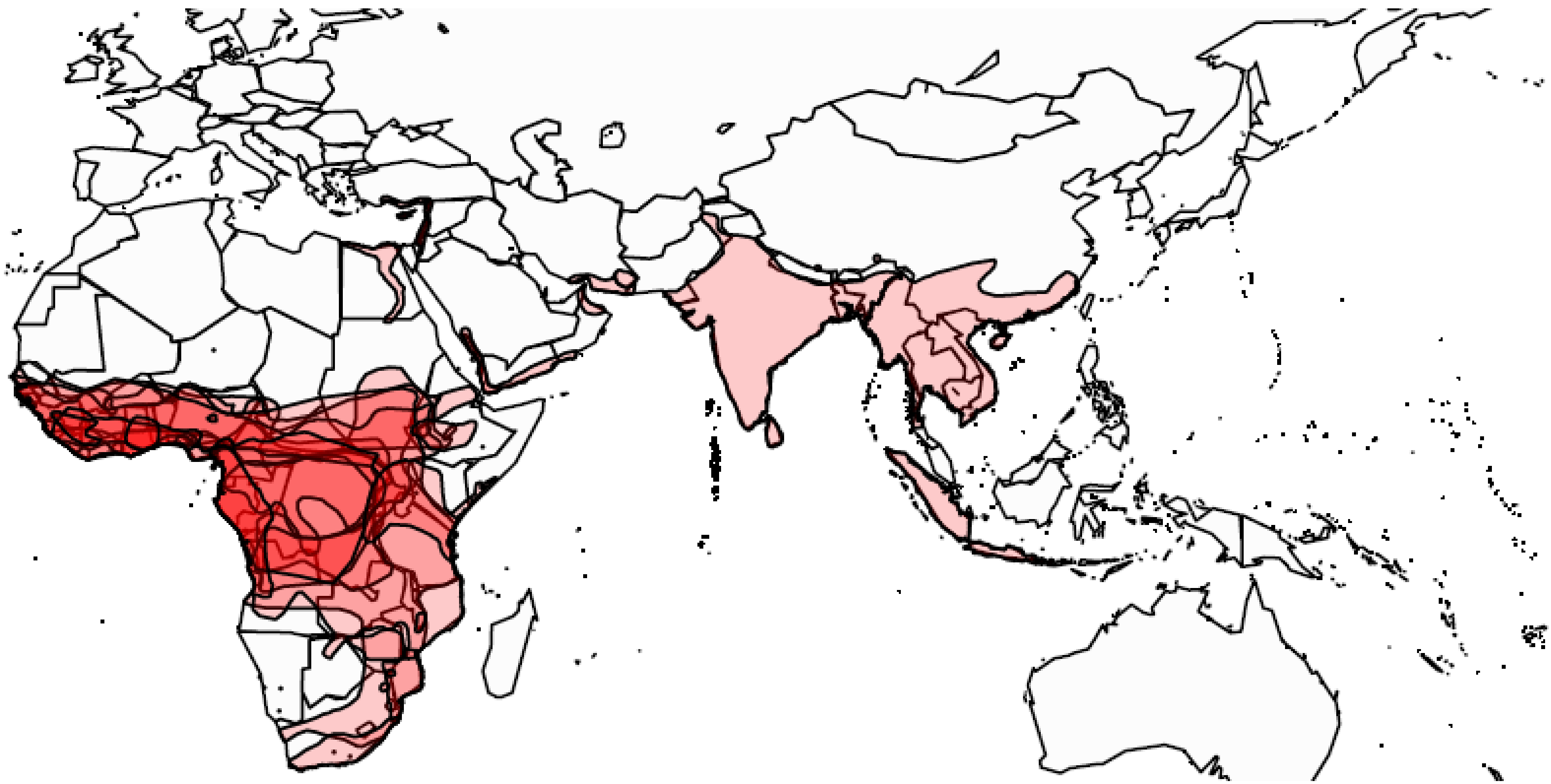
nature

BRIEF COMMUNICATIONS

Fruit bats as reservoirs of Ebola virus

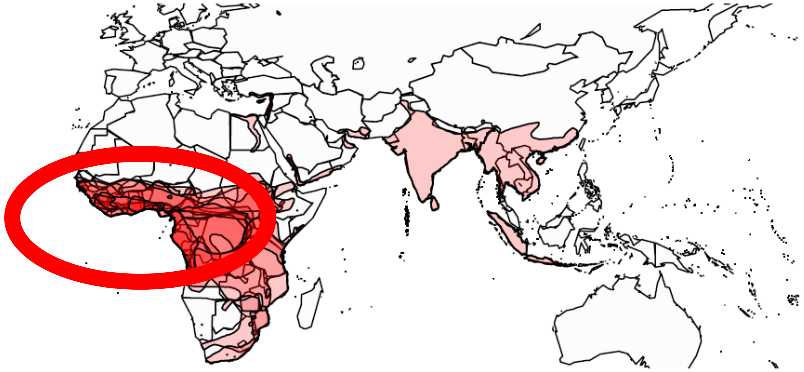
Bat species eaten by people in central Africa show evidence of symptomless Ebola infection.

Zaire ebolavirus



Olival and Hayman, 2013 Viruses

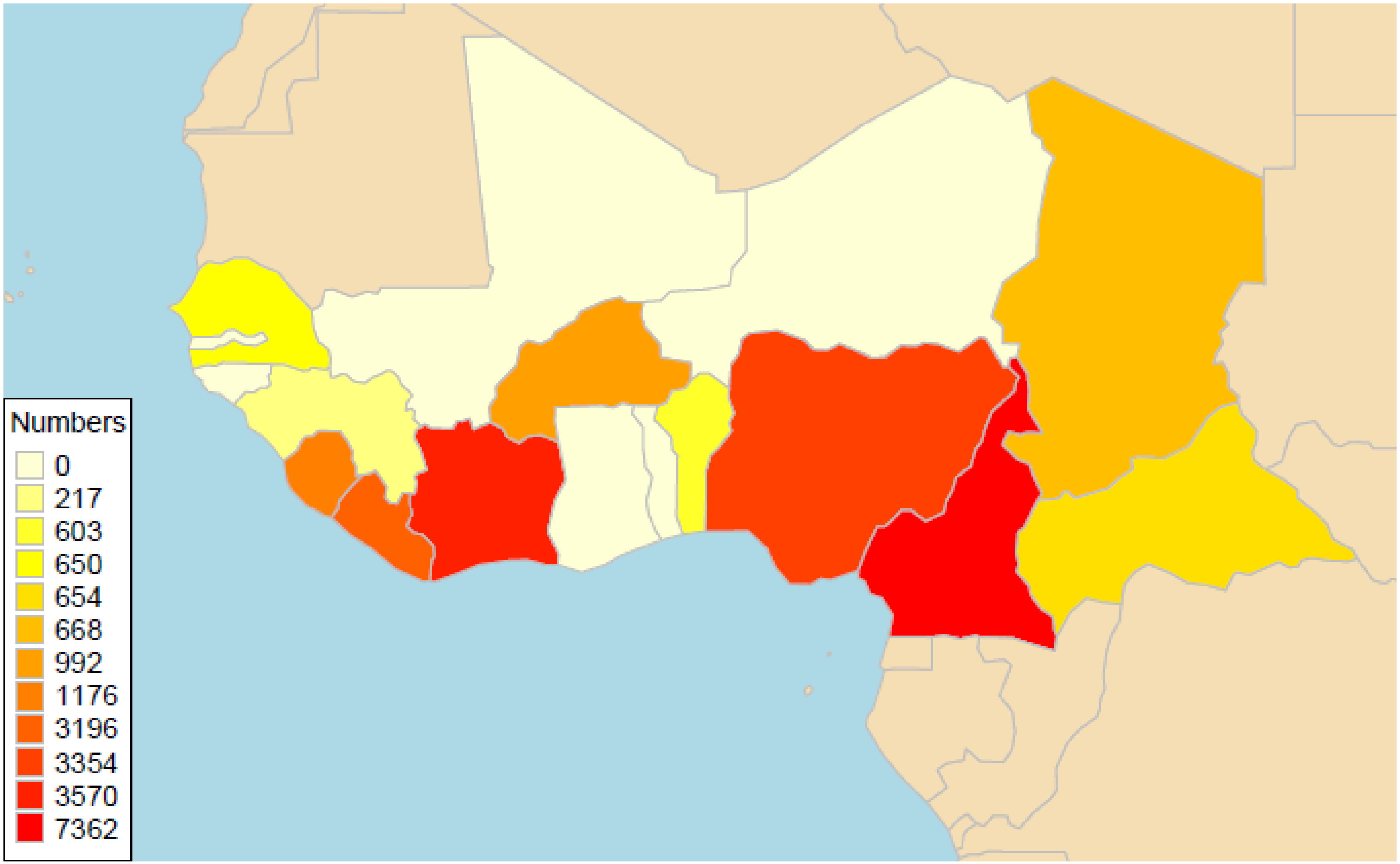
Harvesting in the Zaire ebolavirus host species distributions



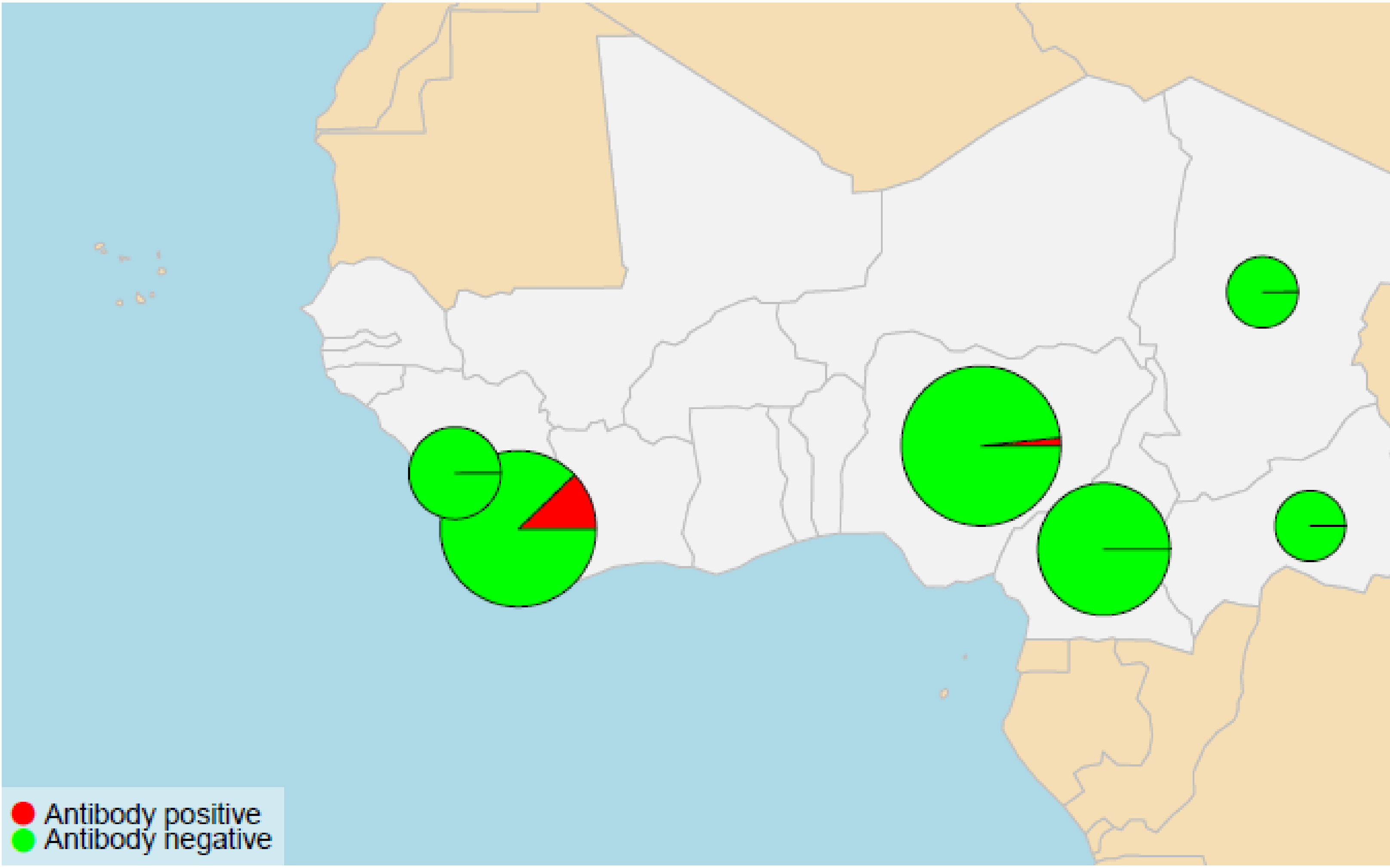
Relevant human studies

Year(s) sample collected	Country	Scientific data	Ref.
1973	Liberia	12[illegible]/592 (2[illegible]%) antibody positive to MARV (MARV antigen) and 83/592 ([illegible]4%) antibody positive to EBOV (EBOV antigen) in the Harbel, Bong-Town and Yekepa areas	(31)
1978-1979	Cameroon	71/891 (8%) antibody positive to EBOV (EBOV antigen) in the Moloundou and Mbatika areas.	(32, 33)
1978-1979	Liberia	26/433 (6%) antibody positive to EBOV (EBOV antigen) and 5/433 (1%) antibody positive to MARV (MARV antigen) in the Bong County and Lofa County areas	(34, 35)
Presented 1980	Sierra Leone	19/64 (30%) antibody positive to filoviruses (Zaire EBOV/MARV antigen) in the Mobai, Eastern Province areas	(33, 36)
1981-1982	Liberia	30/225 (13%) antibody positive to EBOV (Sudan EBOV/Zaire EBOV antigen) and 3/225 (1%) antibody positive to MARV (MARV antigen) in Grand Bassa County. The highest seroprevalence (52%) was found among workers of a rubber plantation	(33, 37)
Published 1982-83	Cameroon	147/1517 (10%) antibody positive to EBOV (EBOV antigen) and 9/1517 (1%) antibody positive to MARV (MARV antigen) from people sampled across a number of regions.	(38, 39)
1982–1983	Guinea	26/217 (12%) antibody positive to EBOV (Zaire EBOV antigen) in the Madina-Ula district area.	(40)
1982-1983	Togo	Sampling was undertaken in Togo, reporting the possible seropositivity in human sera against ebolaviruses.	See (33)
1983	Benin	2/603 (<1%) antibody positive to EBOV (Sudan EBOV/Zaire EBOV antigens)	See (33)
1983	Burkina Faso	0/992 (0%) antibody positive to EBOV (Sudan EBOV/Zaire EBOV antigens)	See (33)
1984	Senegal	149/650 (23%) antibody positive to EBOV (EBOV antigen)	(41)
1985	Togo	MARV antibodies detected in a patient	See (33)
1985	Cameroon	7/375 (2%) antibody positive to EBOV (Zaire EBOV antigen) in urban areas.	(42)
1985-1987	Cameroon	89/1152 (8%) antibody positive to EBOV (EBOV antigen) in the Mora, Maroua, and Nkongsamba areas.	(43)
1985-1987	Central African Republic	107/327 (33%) antibody positive to EBOV (EBOV antigen) in the Bangui area.	(43)
1985-1987	Chad	12/334 (4%) antibody positive to EBOV (EBOV antigen) in N'Djamena	(43)
1985-1987	Cameroon	0/1152 (0%) antibody positive to MARV (MARV antigen) in the Mora, Maroua, and Nkongsamba areas.	(43)
1985-1987	Central African Republic	0/327 (0%) antibody positive to MARV (MARV antigen) in Bangui	(43)
1985-1987	Chad	1/334 (<1%) antibody positive to MARV (MARV antigen) in N'Djamena	(43)
1986	Cameroon	49/379 (13%) antibody positive to EBOV (SEBOV antigen) and 29/379 (8%) antibody positive to EBOV (Zaire EBOV antigen) in the Maroua area	See (33)
Published 1987	Sierra Leone	14/556 (3%) antibody positive to EBOV (Zaire EBOV antigen) and 1/556 (<1%) antibody positive to MARV (MARV antigen) in the Mobai, Eastern Province areas	(33, 44-46)
1987	Liberia	37/348 (11%) antibody positive to EBOV (EBOV antigen) and 63/348 (18%) antibody positive to MARV (MARV antigen)	(33, 47, 48)
1987	Nigeria	30/1677 (2%) antibody positive to EBOV (Sudan EBOV/ Zaire EBOV antigens) and 29/1677 (2%) antibody positive to MARV (MARV antigen) in many areas.	(49)
1993	Cote d'Ivoire	A number of people from 257 are reported antibody positive to MARV (MARV antigen) around Tai National Park	See (33)
1994	Cote d'Ivoire	An outbreak of disease in chimpanzees (*Pan troglodytes verus*, see Box 2) led to a single human infection by a new virus, Tai forest virus.	(50, 51)
1994	Cote d'Ivoire	A small number of people (13) were tested for antibody positive to EBOV (EBOV antigen) around Tai National Park	See (33)
1995	Liberia	A suspected Ebola virus disease case was reported in Liberia and the diagnosis of Ebola virus infection was confirmed by serological tests at the Institute Pasteur in Paris	(52)
1996	Cote d'Ivoire	A number of people from a large survey (3300) tested antibody positive to EBOV (EBOV antigen) from Tabou	See (33)

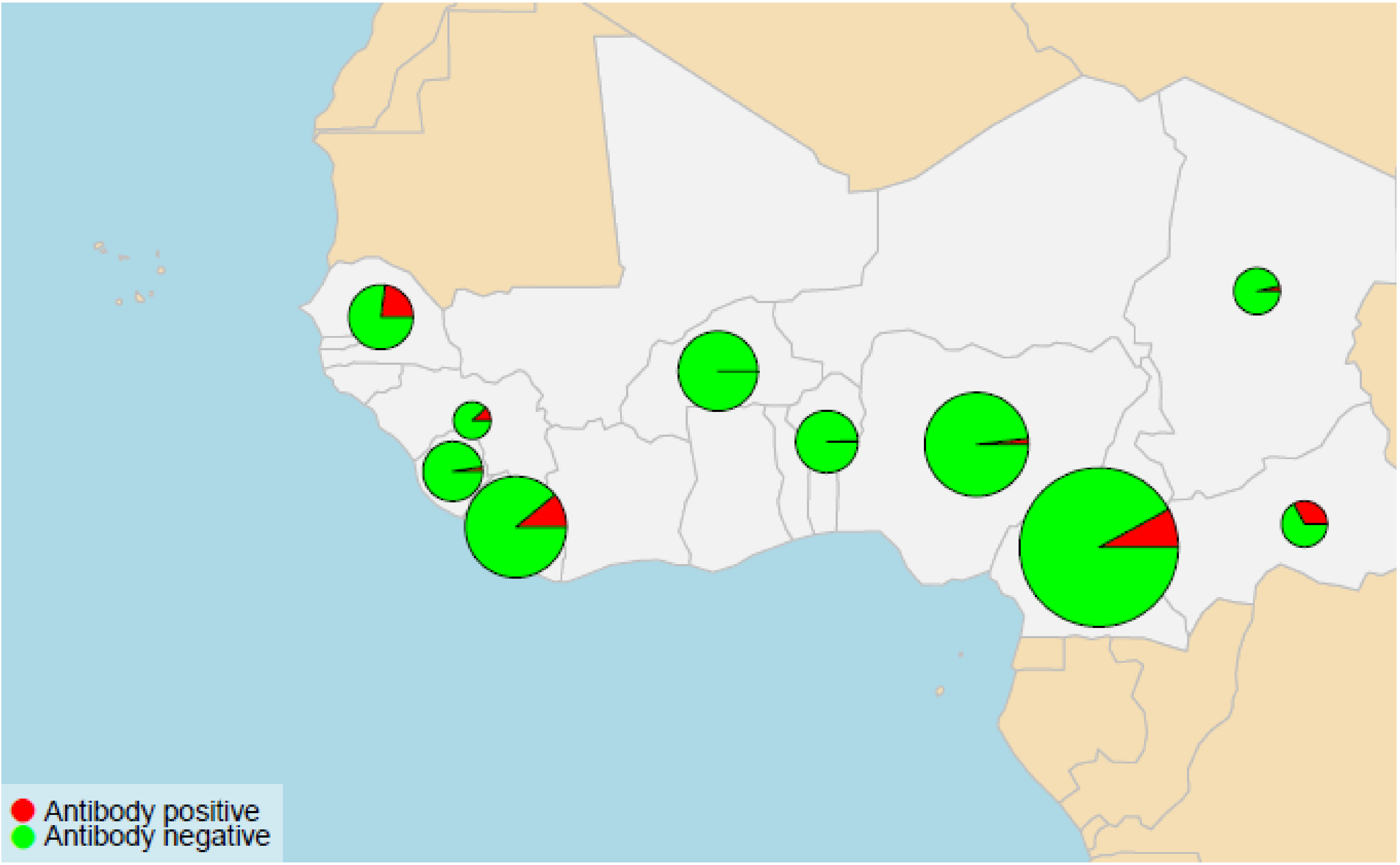
People tested for filovirus antibodies



Antibodies against Marburgvirus in West African people



Antibodies against Ebolavirus in West African people



“The recent emergence of *Zaire ebolavirus* in West Africa has come as a surprise”

New England Journal of Medicine

2014; 371:1375-1378 October 9, 2014

Policy and Science for Global Health Security

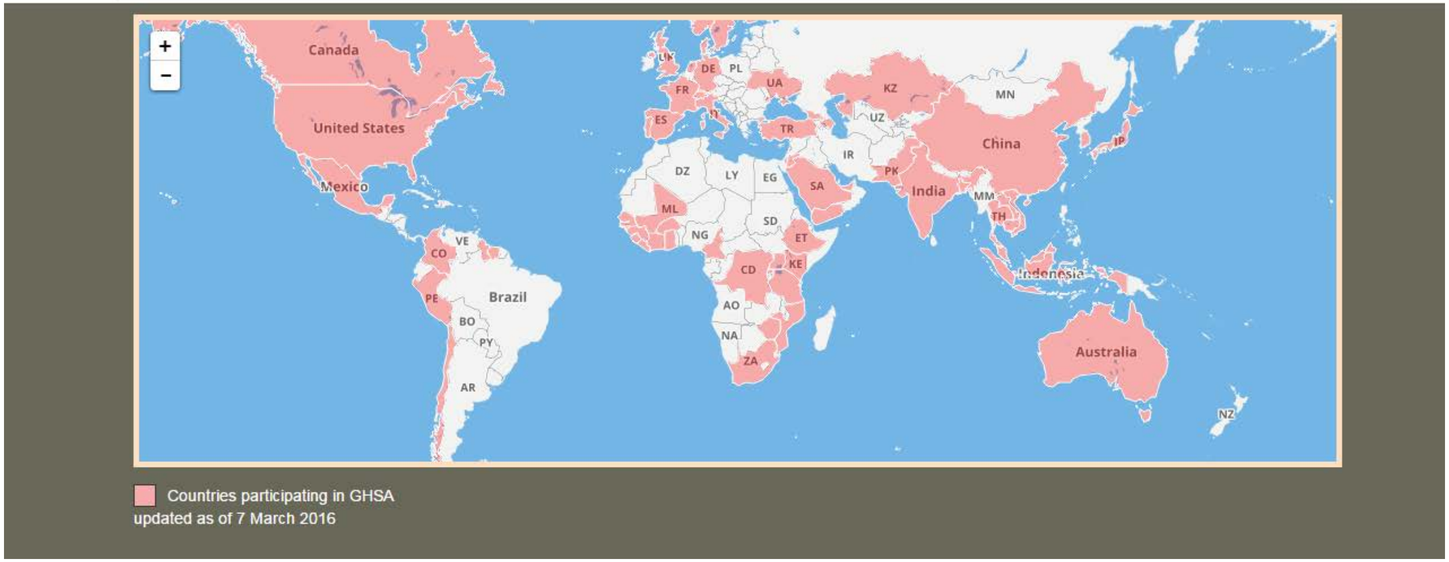
need to identify frameworks:

a) for policy makers to receive & interpret scientific results

b) for scientific researchers to find appropriate approaches and channels for communication to policy makers.

Global Health Security Agenda

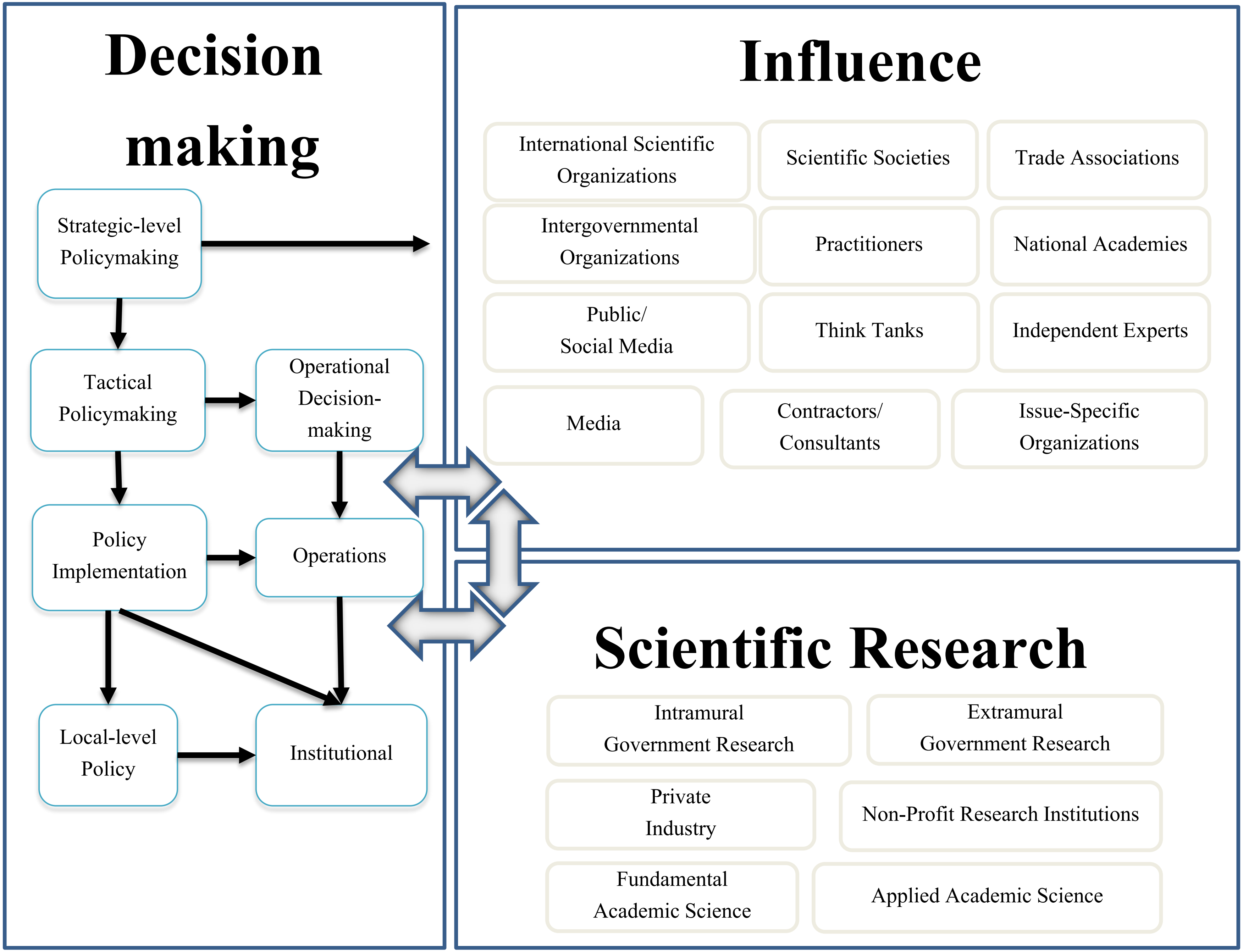
ABOUT | MEMBERS & MEMBERSHIP | COUNTRY ROADMAPS | ACTION PACKAGES | ASSESSMENTS | EVENTS & UPDATES | RESOURCES



U.S. DEPARTMENT OF HOMELAND SECURITY

NIH National Institutes of Health
Turning Discovery Into Health

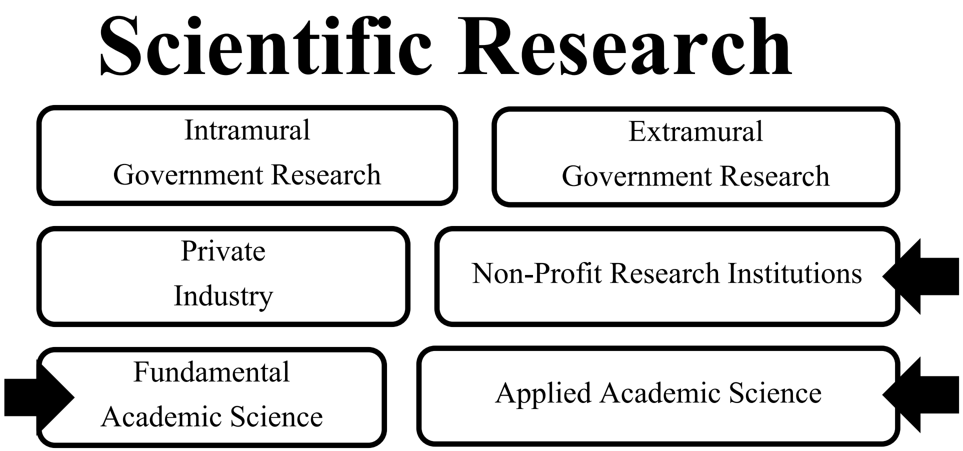
NIH Fogarty International Center
Advancing Science for Global Health


Decision making
Strategic-level Policymaking
Tactical Policymaking
Operational Decision-making
Policy Implementation
Operations
Local-level Policy
Institutional
Influence
International Scientific Organizations
Scientific Societies
Trade Associations
Intergovernmental Organizations
Practitioners
National Academies
Public/ Social Media
Think Tanks
Independent Experts
Media
Contractors/ Consultants
Issue-Specific Organizations
Scientific Research
Intramural Government Research
Extramural Government Research
Private Industry
Non-Profit Research Institutions
Fundamental Academic Science
Applied Academic Science

Who funds academic research?

Mainly government with taxpayers money

What are the barriers to academic science informing policy?



One Health

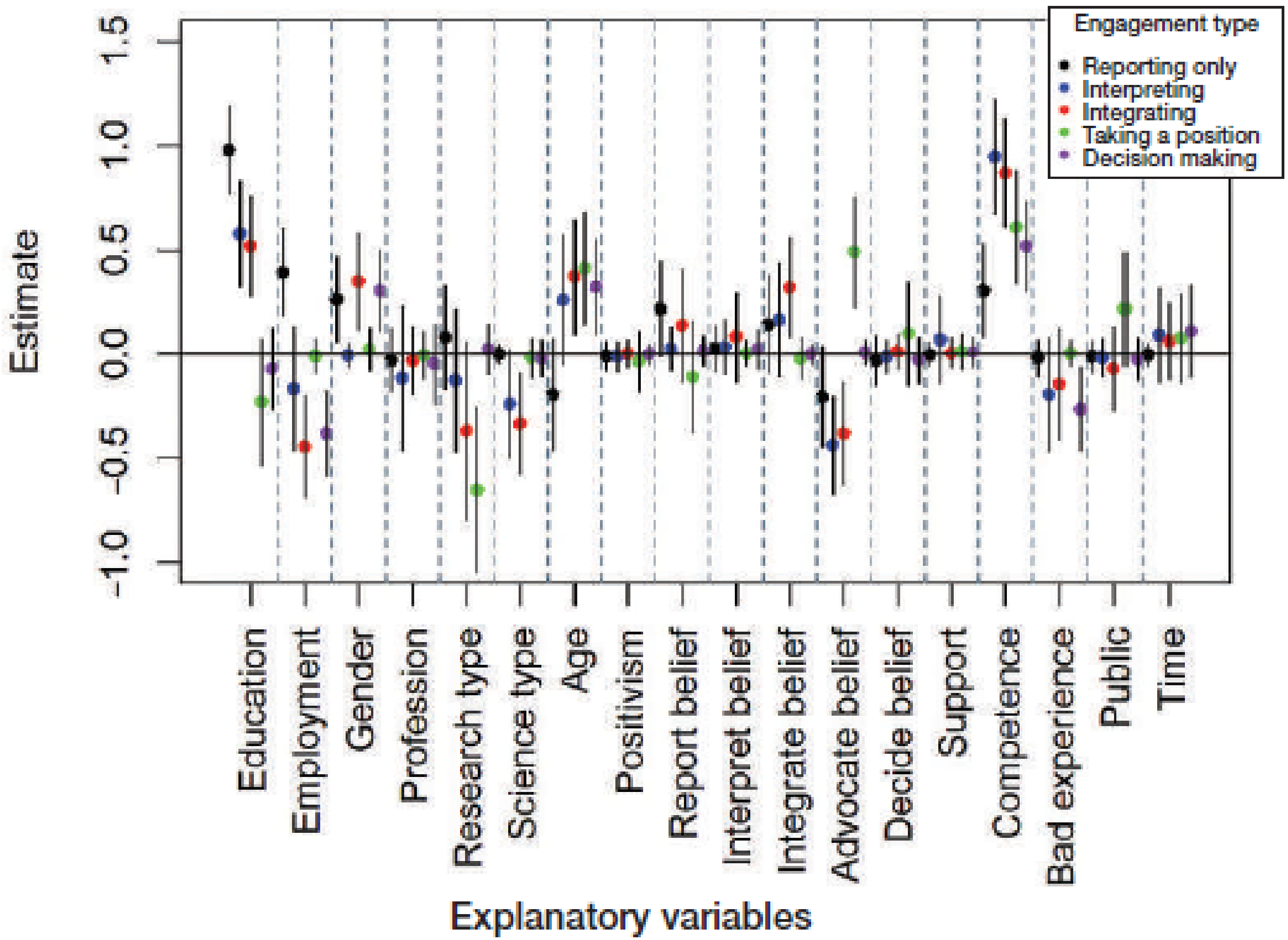
- >500 'conservation' scientists asked about their engagement in policy

Front Ecol Environ 2014; 12(3): 161–166, doi:10.1890/130011 (published online 7 Feb 2014)

 RESEARCH COMMUNICATIONS

A more social science: barriers and incentives for scientists engaging in policy

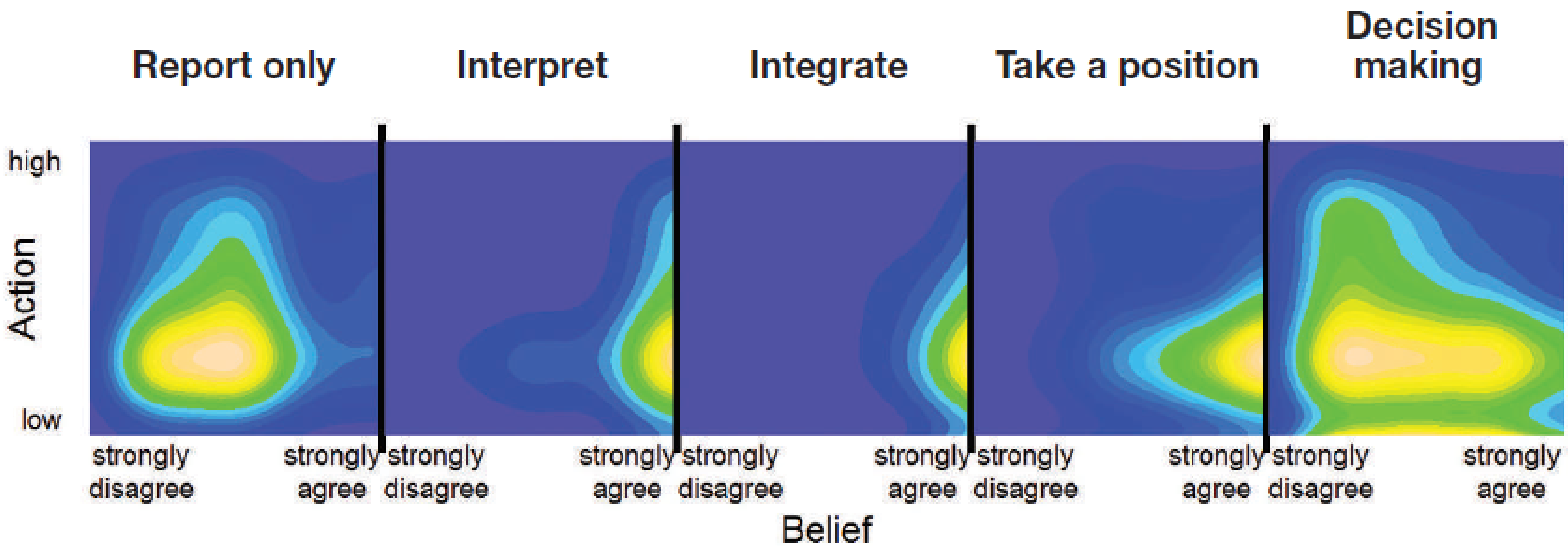
Gerald G Singh[1*†], Jordan Tam[1†], Thomas D Sisk[2], Sarah C Klain[1], Megan E Mach[1], Rebecca G Martone[1], and Kai MA Chan[1]



Engagement type
Reporting only
Interpreting
Integrating
Taking a position
Decision making
Estimate
1.5
1.0
0.5
0.0
-0.5
-1.0
Education
Employment
Gender
Profession
Research type
Science type
Age
Positivism
Report belief
Interpret belief
Integrate belief
Advocate belief
Decide belief
Support
Competence
Bad experience
Public
Time
Explanatory variables

.... For *acting as a decision maker*, high self-perceived competence, being older, and being male had strong positive associations, ...

.... while working in a university or college and having had previous bad experiences while engaging in policy were negatively related.



There is a disconnect between beliefs in how scientists should engage in policy making as compared with actual engagement.

Academic scientific research informing Ebola virus related ‘policy’…?

PROCEEDINGS B

rspb.royalsocietypublishing.org

Research

Biannual birth pulses allow filoviruses to persist in bat populations

David T. S. Hayman

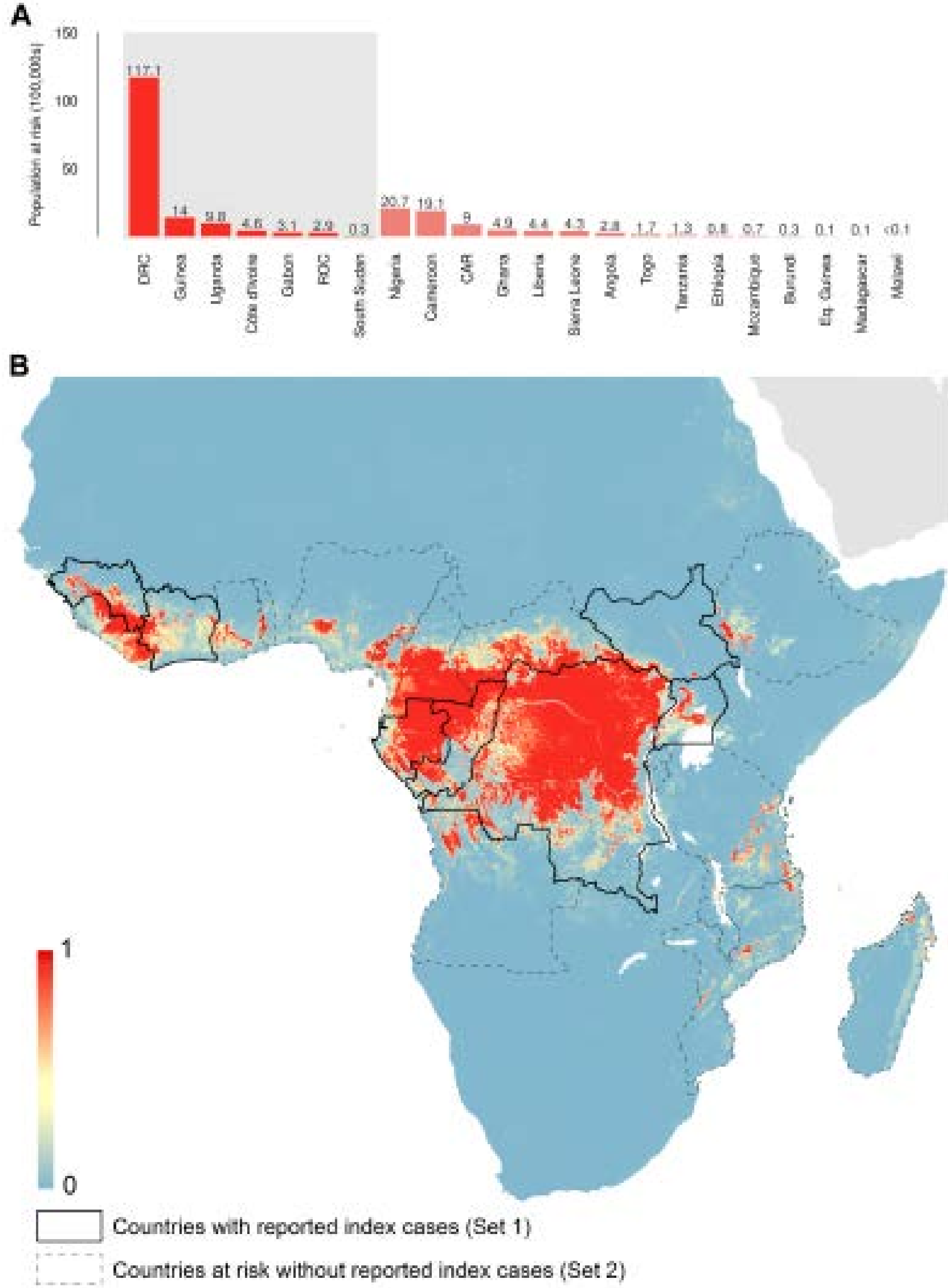
Molecular Epidemiology and Public Health Laboratory, Hopkirk Research Institute, Massey University, Private Bag 11 222, Palmerston North 4442, New Zealand

eLIFE elifesciences.org

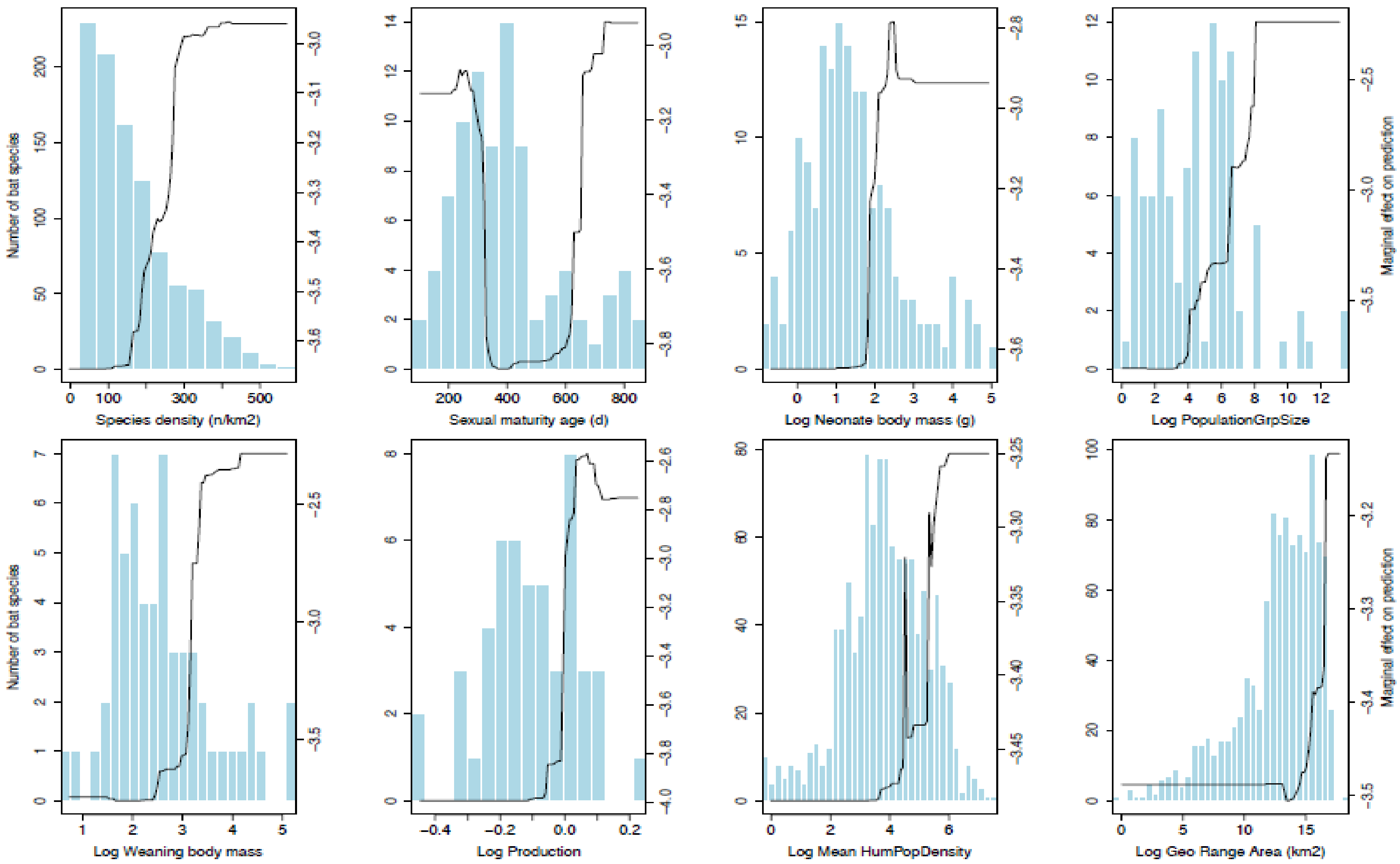
RESEARCH ARTICLE

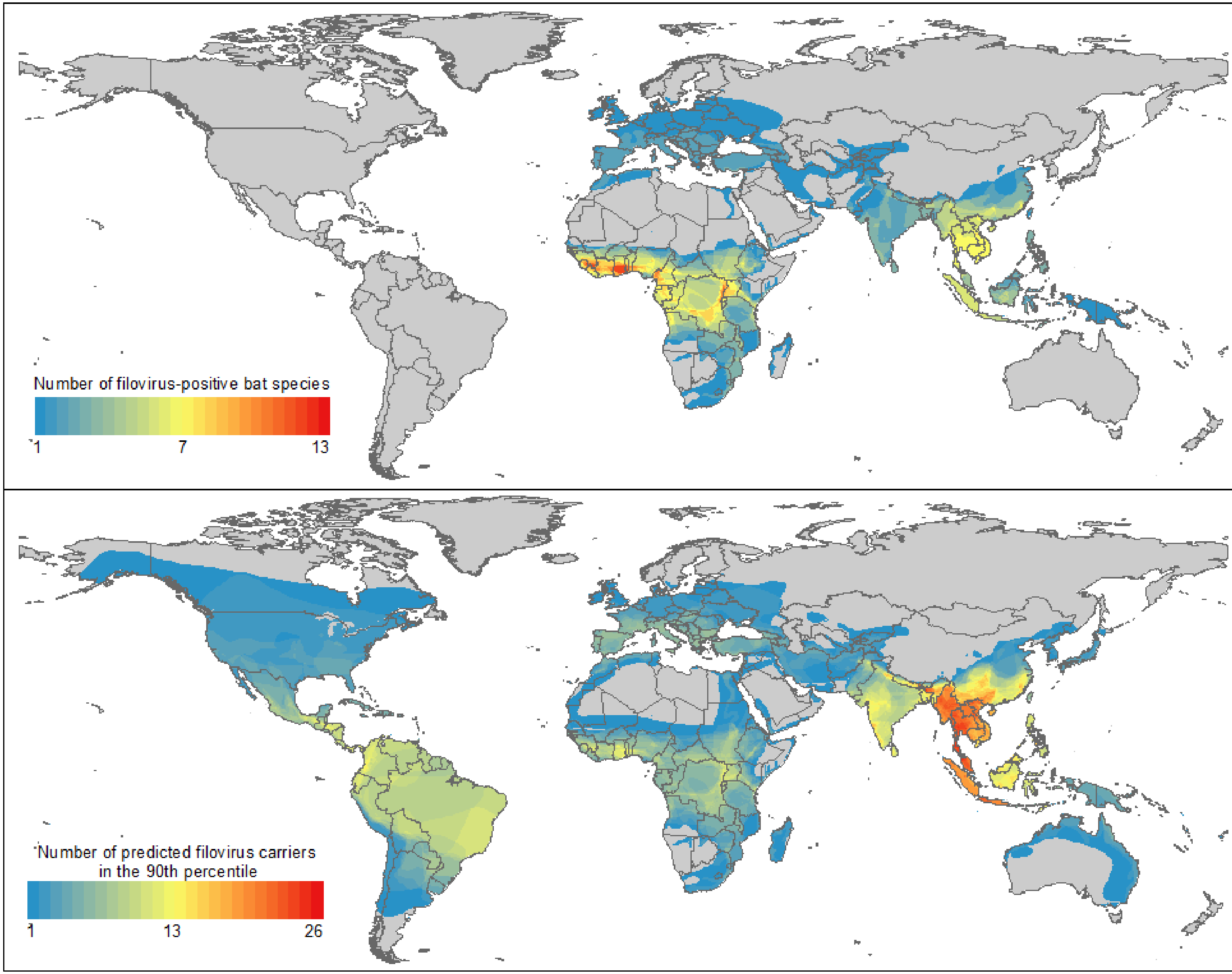
Mapping the zoonotic niche of Ebola virus disease in Africa

David M Pigott[1†], Nick Golding[1†], Adrian Mylne[1], Zhi Huang[1], Andrew J Henry[1], Daniel J Weiss[1], Oliver J Brady[1], Moritz UG Kraemer[1], David L Smith[1,2], Catherine L Moyes[1], Samir Bhatt[1], Peter W Gething[1], Peter W Horby[3], Isaac I Bogoch[4,5], John S Brownstein[6,7], Sumiko R Mekaru[8], Andrew J Tatem[9,10,13], Kamran Khan[4,11], Simon I Hay[1,12*]



Han *et al, In Review*




Number of filovirus-positive bat species
1
7
13
Number of predicted filovirus carriers in the 90th percentile
1
13
26

Acknowledgements

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Gary Crameri

Veterinary Services of Ghana

Massey University, New Zealand
Prof. Nigel French
Dr Jonathan Marshall

Research and Policy for Infectious Disease Dynamics (RAPIDD) Small Mammal Working Group

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Dr Angie Luis

UCLA, USA

Centers for Disease Control and Prevention, USA

US Department of Agriculture

Wildlife Division of the Forestry Commission, Ghana

University of Surrey, UK

Bernhard-Nocht Institute, Germany
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Animal Health & Veterinary Laboratories Agency, UK
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Dr Hayley MacGregor

University of Florida, USA
Dr Juliet Pulliam

University of Ghana
Prof. Yaa Ntiamoa-Baidu

US Geological Survey, USA

University of Westminster, UK

Global Health Security Agenda NGO steering committee

RAPIDD/Global Health Security Agenda Workshop attendees

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U.S. Department of Homeland Security

Department of Defense, United States of America

Lubee Bat Conservancy
Saving bats. Conserving ecosystems

wellcome trust

AHVLA
Animal Health and Veterinary Laboratories Agency

NIH National Institutes of Health
Turning Discovery Into Health

Colorado State University

UF University of Florida

ZSL
Living Conservation

Smith Fellows
David H. Smith Conservation Research Fellowship Program

University of Cambridge

cidc
Cambridge Infectious Diseases Consortium

IDReC

OIE

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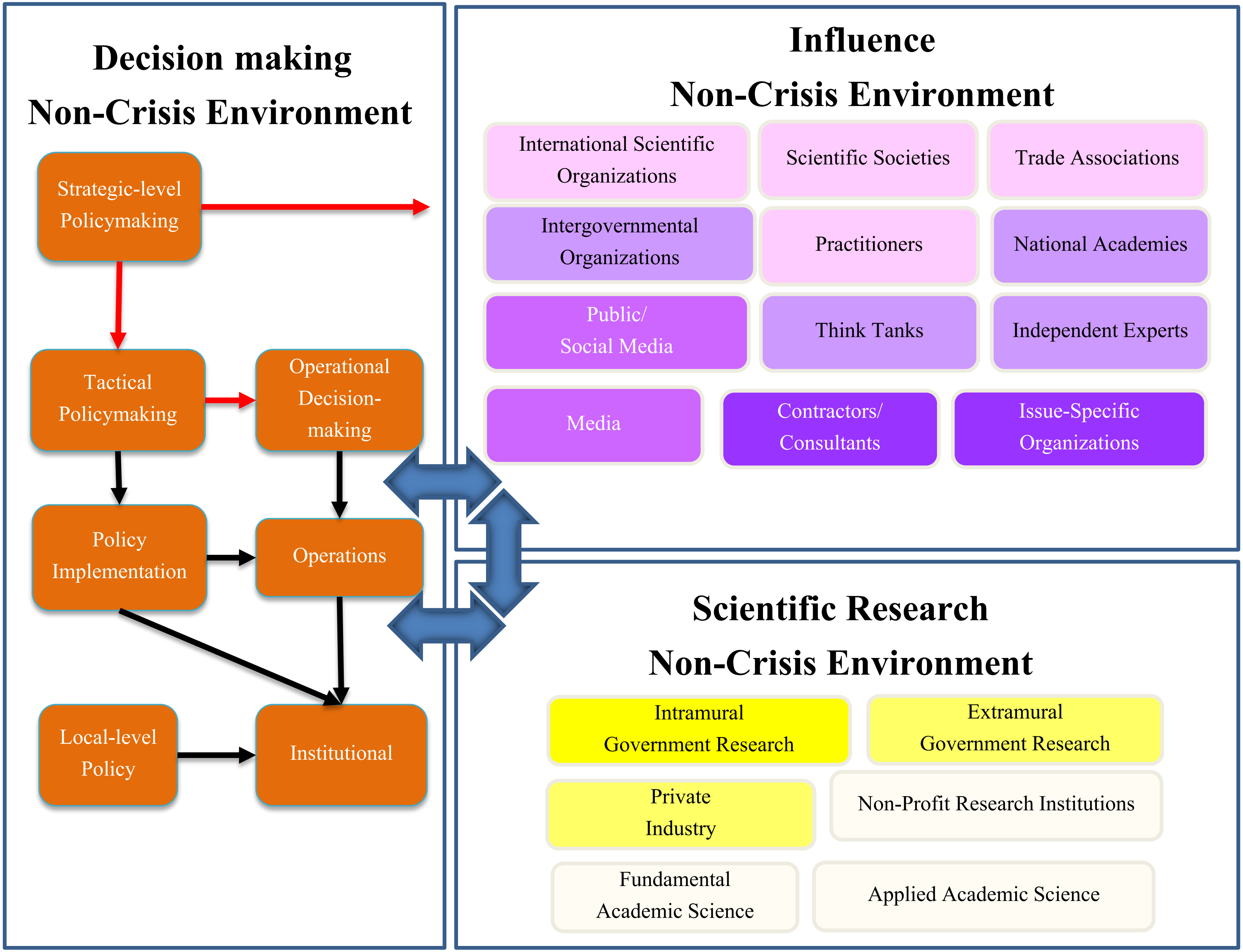
University of New Zealand
Veterinary, Animal and Biomedical Sciences

Questions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Think Tanks
Independent Experts
Media
Contractors/ Consultants
Issue-Specific Organizations
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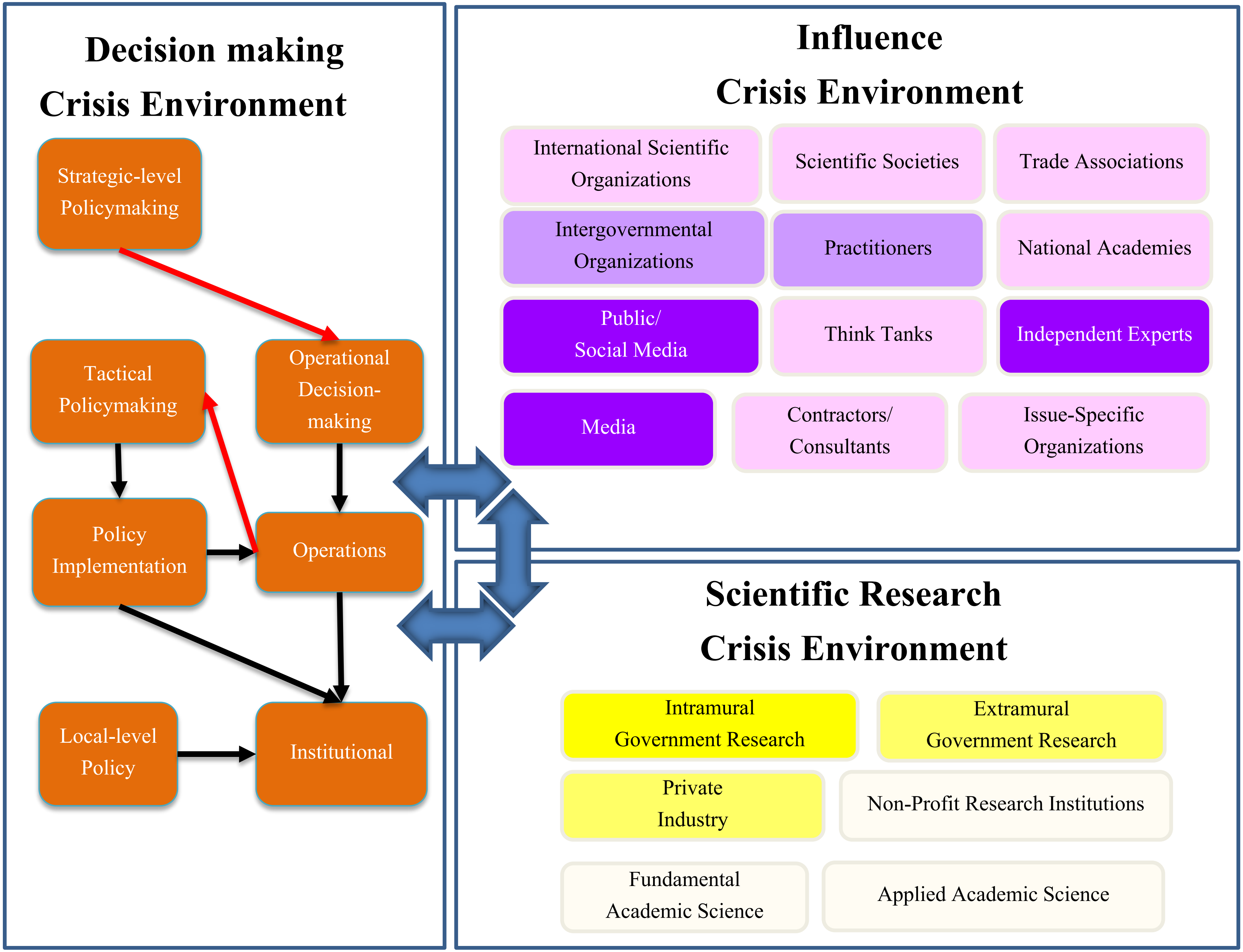
Extramural Government Research
Private Industry
Non-Profit Research Institutions
Fundamental Academic Science
Applied Academic Science



Decision making
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Think Tanks
Independent Experts
Media
Contractors/ Consultants
Issue-Specific Organizations
Scientific Research
Crisis Environment
Intramural Government Research
Extramural Government Research
Private Industry
Non-Profit Research Institutions
Fundamental Academic Science
Applied Academic Science

Barriers …

- time
- resources
- skills
- credit
- relationship and trust
- uncertainty

For scientists… what is ‘impact’?

- Knowledge production (journal articles, etc.)
- Capacity building (PhD training, etc.)
- Informing policy (new policy referring to work, etc.)
- Informing practice (?)

E.g. www.ncver.edu.au

Barriers to researchers

Lack of….

- enthusiasm/interest
- time
- resources
- skills
- professional credit

…. for dissemination and communication

E.g. www.ncver.edu.au

Barriers to users

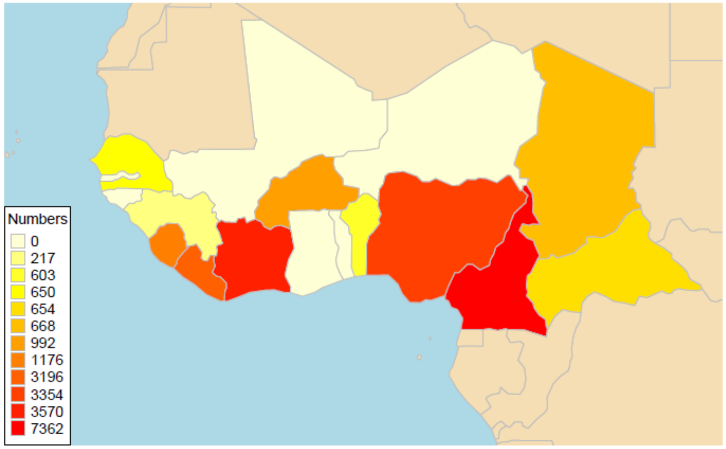
- Lack of time
- Low priority
- Poor communication of research within organizations
- Perceptions of research
- Research is not timely or relevant to [perceived] needs
  - Signal to noise and ‘cry wolf’ problems
- Controversial findings
- Other sources of information available
- [lack of understanding]
- Trust – where is the info coming from
- Politics
- Presentation from researchers to government (way to present results to government)
- Access – what are the entry points (both way)

E.g. *www.ncver.edu.au*

Barriers to users

- Media interference
  - Changing – twitter/anyone can be a journalist
  - Media eg films and mis-communication
- Presumption of rational thinking
- PIPA – framework for engagement
  - Language used (translating English to English)
  - Inter-agency/discipline communication
- Process from paper through to end user (too many steps)
- Human interest
- Engagement prior to research
- Social science
- Many 'science communication' programs, but still problems
- Predictions of when and where – how to do that?
- Communication of uncertainty/complexity

People tested for filovirus antibodies



- Unpublished and difficult to find results

Final thought…

- Policy makers responsible to explain what science was used to inform the decision.