ECOHEALTH IN SOUTHEAST ASIA: THEORY AND PRACTICE

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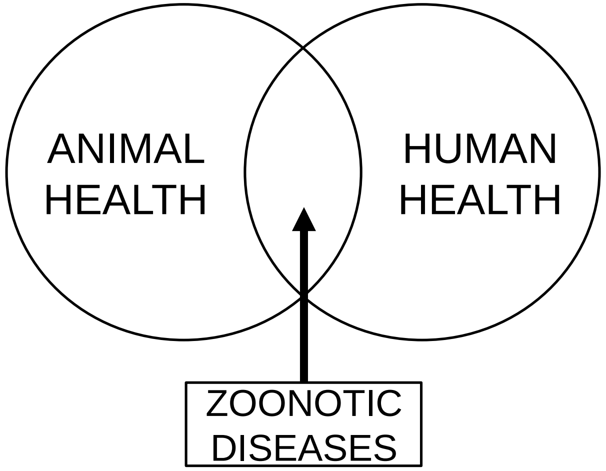
School of Environmental Science and Management, UPLB

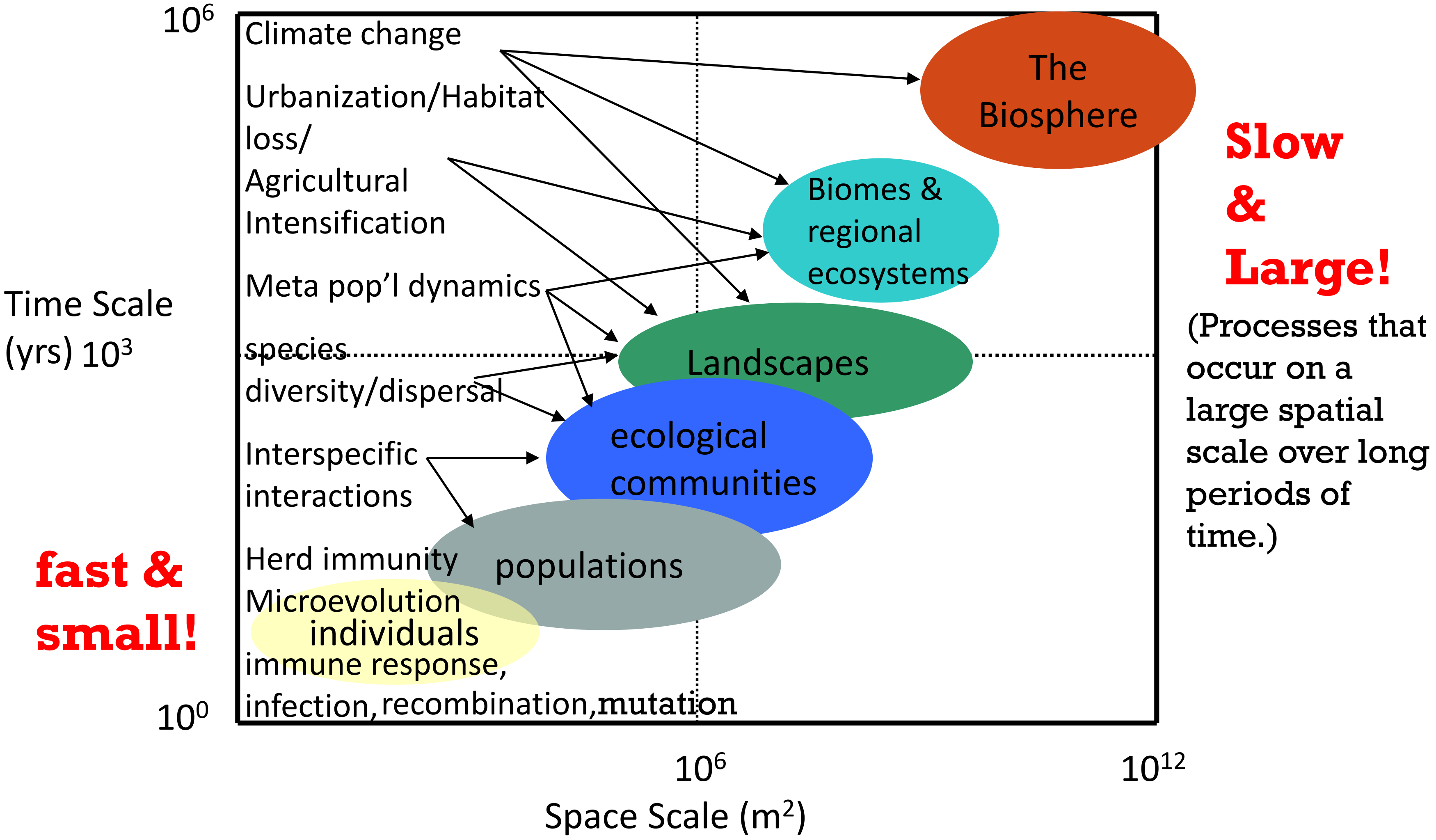
- Southeast Asia is considered as a hotspot for zoonotic diseases due to its tropical condition which is conducive for the spread of such diseases through bacterial multiplication and parasite survival (Gilbert et al., 2014; Nguyen-Viet et al., 2015).

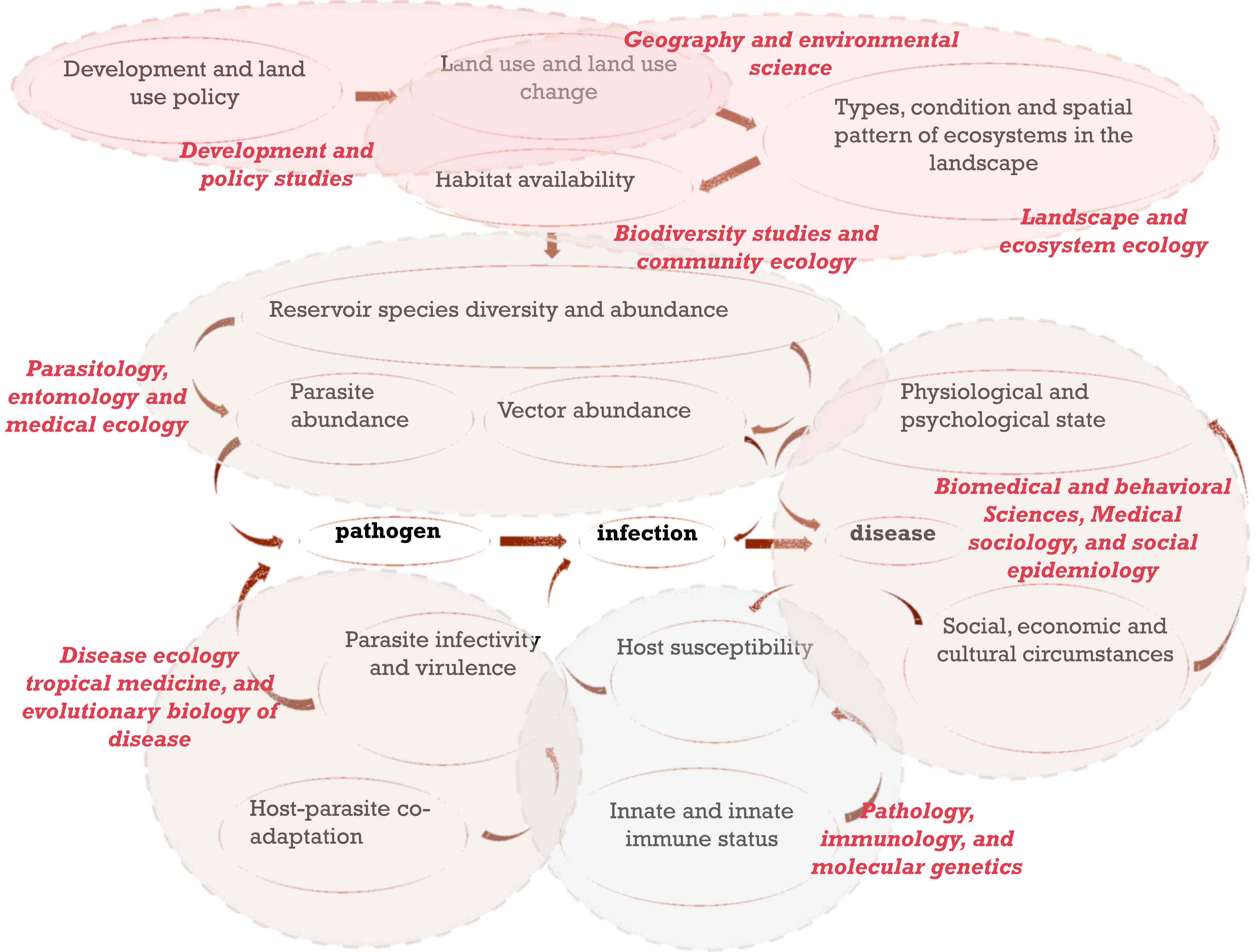


CHALLENGES TOWARDS EMERGING ZOONOTIC DISEASES

- Globalization and international trade
- Forest habitat alteration
- Agriculture intensification
- Urbanization
- Climate change

ECOLOGICAL TIME-SPACE SCALES: LEVELS OF ORGANIZATION RELEVANT TO DISEASE EMERGENCE





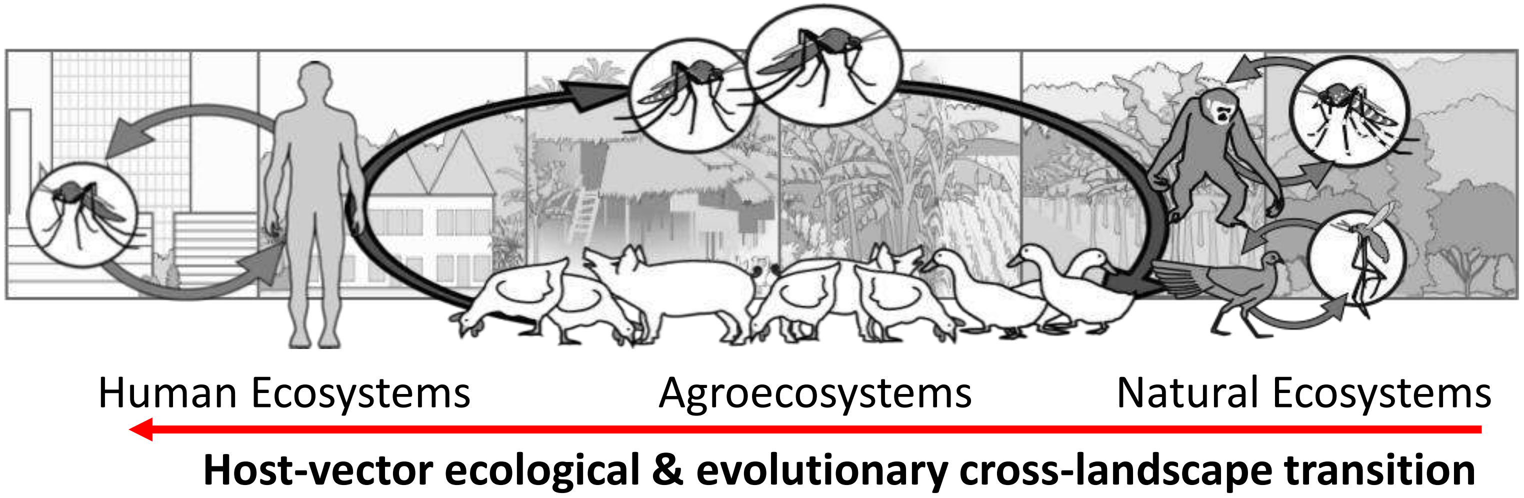
Development and land use policy
Land use and land use change
Geography and environmental science
Types, condition and spatial pattern of ecosystems in the landscape
Development and policy studies
Habitat availability
Landscape and ecosystem ecology
Biodiversity studies and community ecology
Reservoir species diversity and abundance
Parasitology, entomology and medical ecology
Parasite abundance
Vector abundance
Physiological and psychological state
Biomedical and behavioral Sciences, Medical sociology, and social epidemiology
pathogen
infection
disease
Social, economic and cultural circumstances
Parasite infectivity and virulence
Host susceptibility
Disease ecology tropical medicine, and evolutionary biology of disease
Host-parasite co-adaptation
Innate and innate immune status
Pathology, immunology, and molecular genetics

EMERGING ZOONOTIC PATHOGENS AS AN ECOLOGICAL PHENOMENON

- Ecological factors of infectious disease emergence include ***land use change***, ***human movement***, ***encroachment and wildlife translocation***, ***and climate change***.
- The processes influencing transmission of zoonotic pathogens can be described as a consequence of one or a combination of three possible kinds of change: ***expansion of the habitat or geographic range of a host, of a pathogen or both***; ***expansion of human's habitat or geographic range***; or ***change in the habitat or ecosystem occupied by both humans and the natural host***.
- Examples: Malaria transmission, Lyme disease, Liver flukes, Water-borne diseases

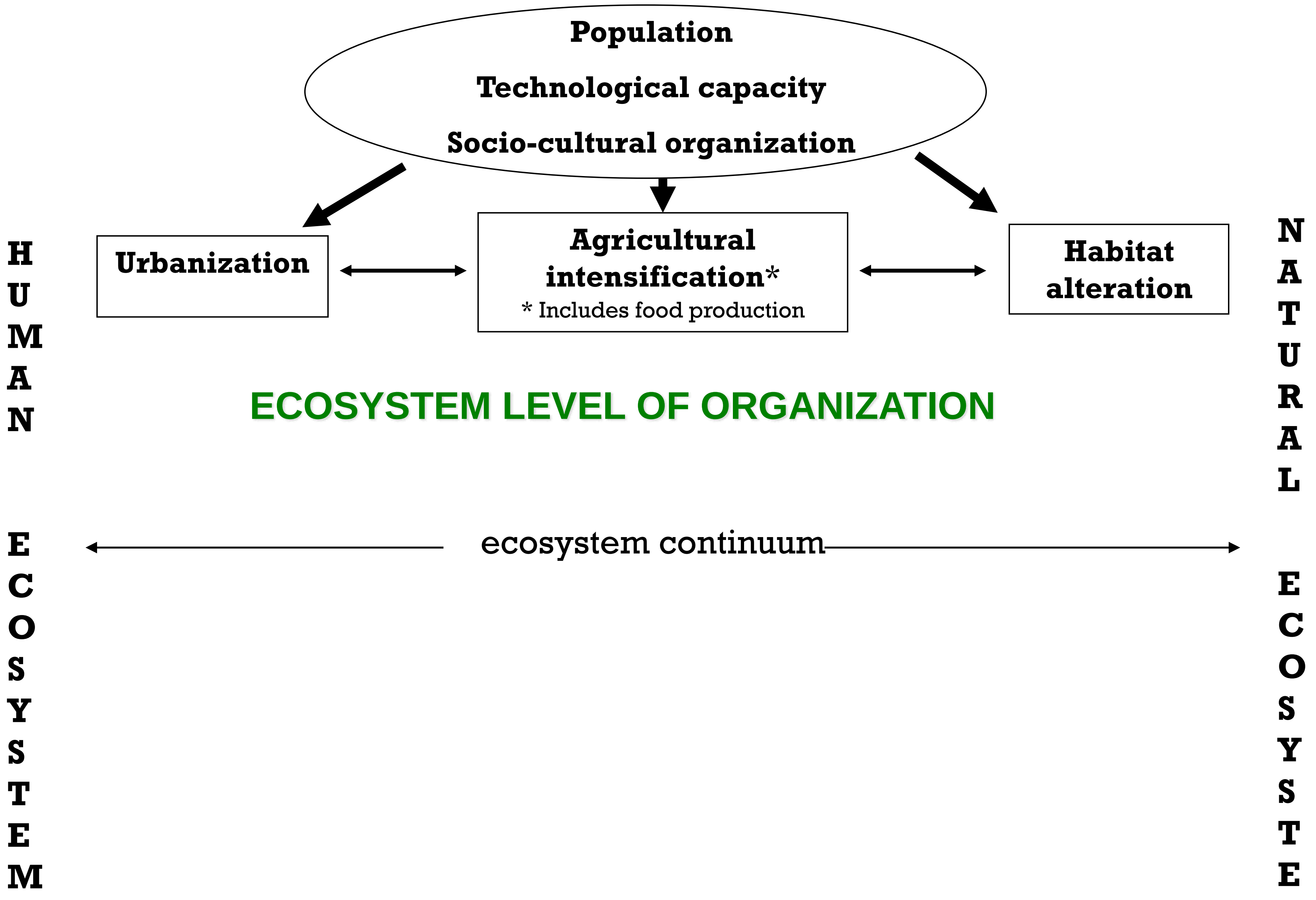
INTEGRATING ECOLOGY AND ENVIRONMENTAL CHANGE

- More than 75% of emerging infectious diseases are zoonotic, that is, they spread from animals to humans from natural host-pathogen cycles in nature.
- The emergence process involves a multitude of social and ecological factors, forces, and mechanisms operating at the level of microbial genetic adaptation to land use transformation and regional environmental change – not to mention globalization.

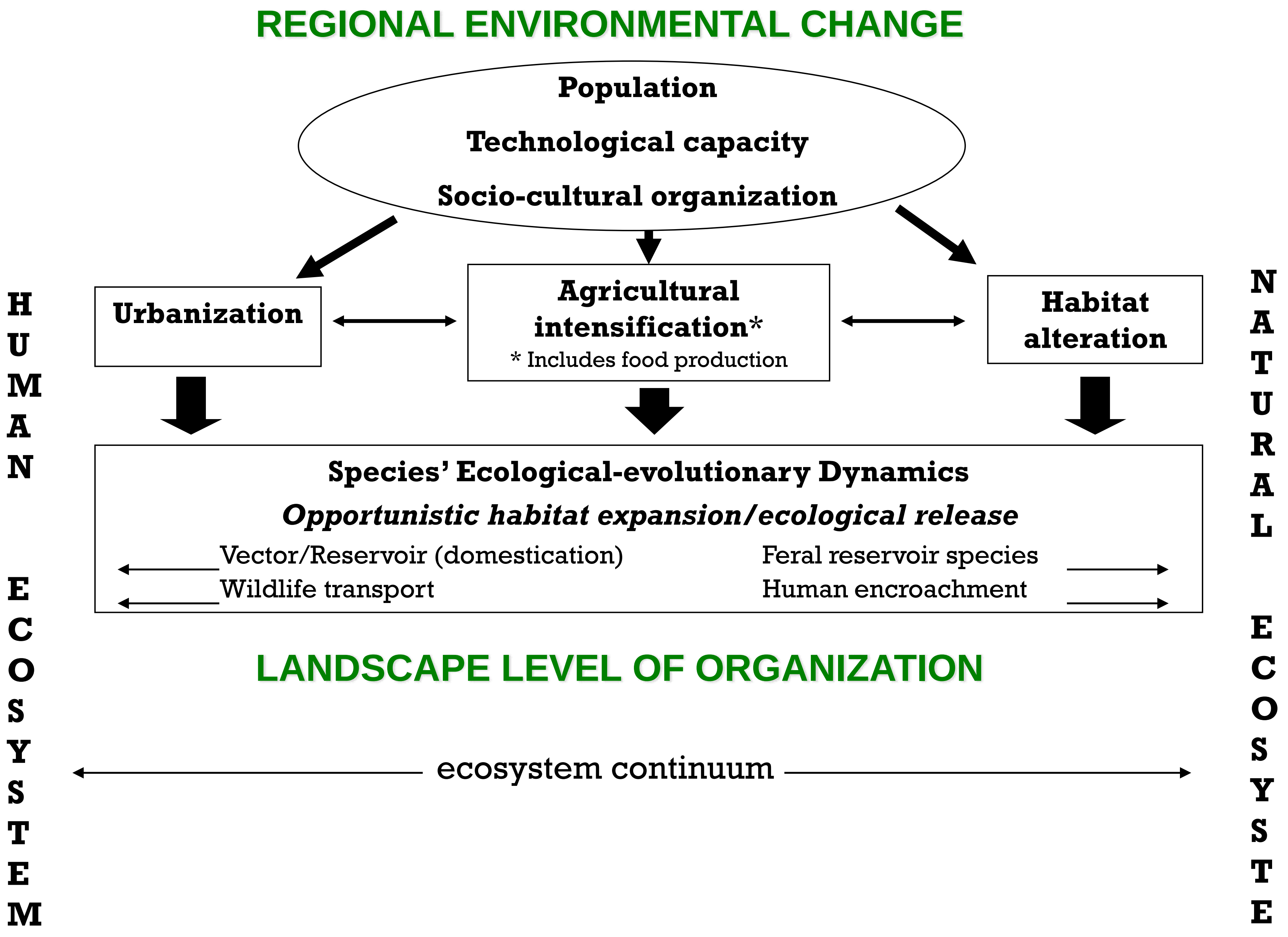


(from Ellis and Wilcox 2009)

REGIONAL ENVIRONMENTAL CHANGE

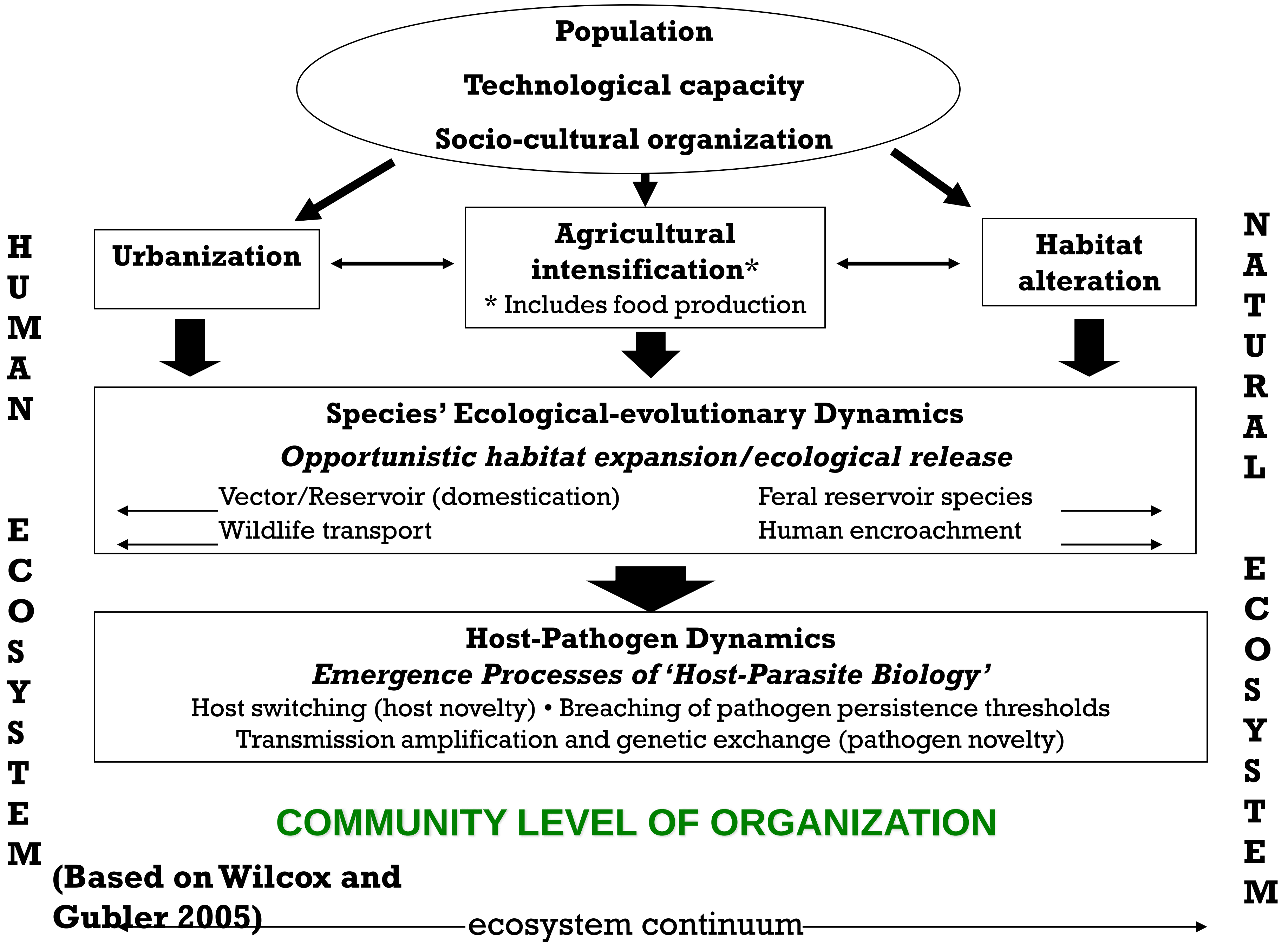


(Based on Wilcox and Gubler 2005)



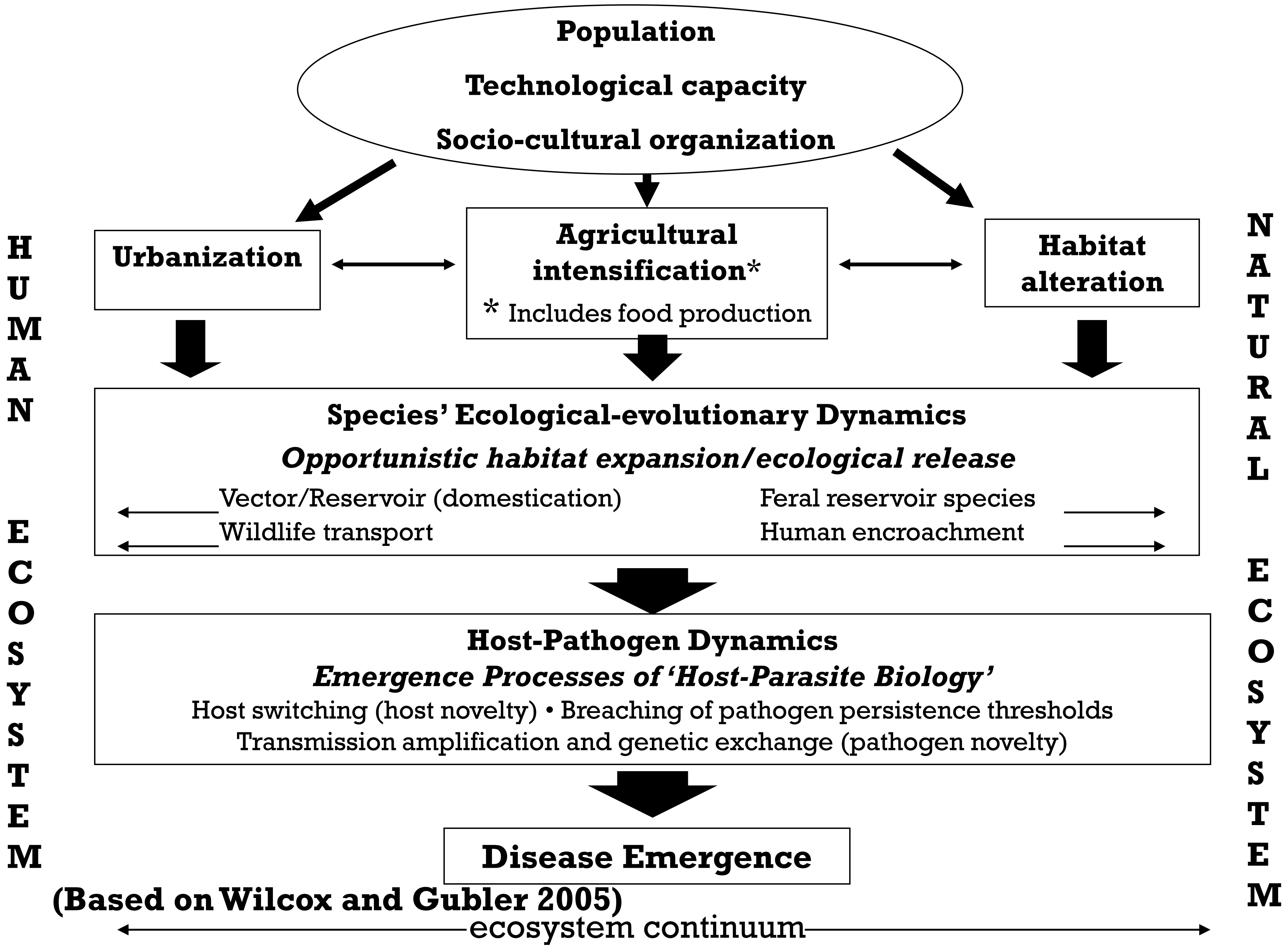
(Based on Wilcox and Gubler 2005, Wilcox and Colwell 2005)

REGIONAL ENVIRONMENTAL CHANGE



(Based on Wilcox and Gubler 2005)

REGIONAL ENVIRONMENTAL CHANGE



(Based on Wilcox and Gubler 2005)

ROLE OF ECOLOGY IN UNDERSTANDING EMERGENCE (RE-EMERGENCE) OF DENGUE (AND OTHER ARBOVIRUSES)

Urbanization and the social ecology of emerging infectious diseases 4

Bruce A. Wilcox, Duane J. Gubler and H.F. Pizer

The twentieth century was a landmark in the history of mankind as a result of the widespread control and eradication of infectious diseases that historically had been the scourge of humans. The advent and effective use of new drugs, vaccines, insecticides, treatment and prevention strategies during and following World War II reinforced public health programs already in place, and provided the tools needed to bring many of the worst diseases under control. Smallpox was eradicated using a mass vaccination strategy. By the late 1960s, the "war on infectious diseases" was declared won by leading experts in the field and by the Surgeon General of the United States (Patlak, 1996).

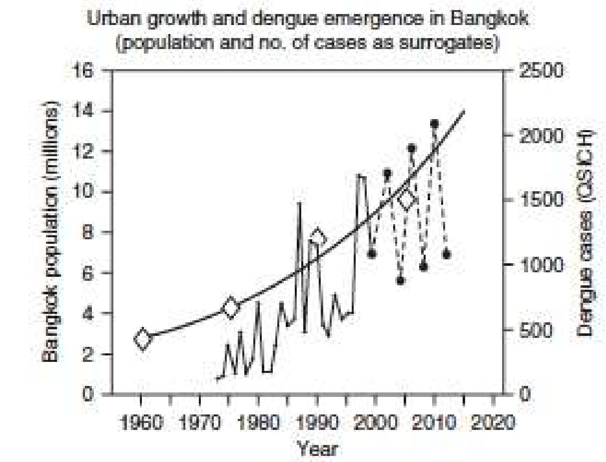
Unfortunately, the major successes in controlling infectious diseases in the 1950s and 1960s was followed by two coincident global trends that would have an impact on the dramatic re-emergence of infectious diseases in the waning years of the twentieth century. The first was the redirection of the resources that were once used to control infectious diseases to other public health priorities, such as the "War on Cancer" in the early 1970s. The perception that infectious diseases were no longer a problem led to decreased resources, widespread deterioration of public health infrastructure to deal with infectious diseases, and complacency among government and public health officials as well as the public (Smolinski *et al.*, 2003). This trend included medical education with a de-emphasis on preventive medicine and a strong focus on curative medicine in medical schools. Today, training in preventive medicine is not included in the curriculum of most medical schools in the US.

The second trend was the sharply increasing and unprecedented rate of human population growth following World War II that has continued for 60 years. Increasing human numbers have been a principal factor leading to uncontrolled

Table 4.2 Urban emerging infectious diseases of public health importance

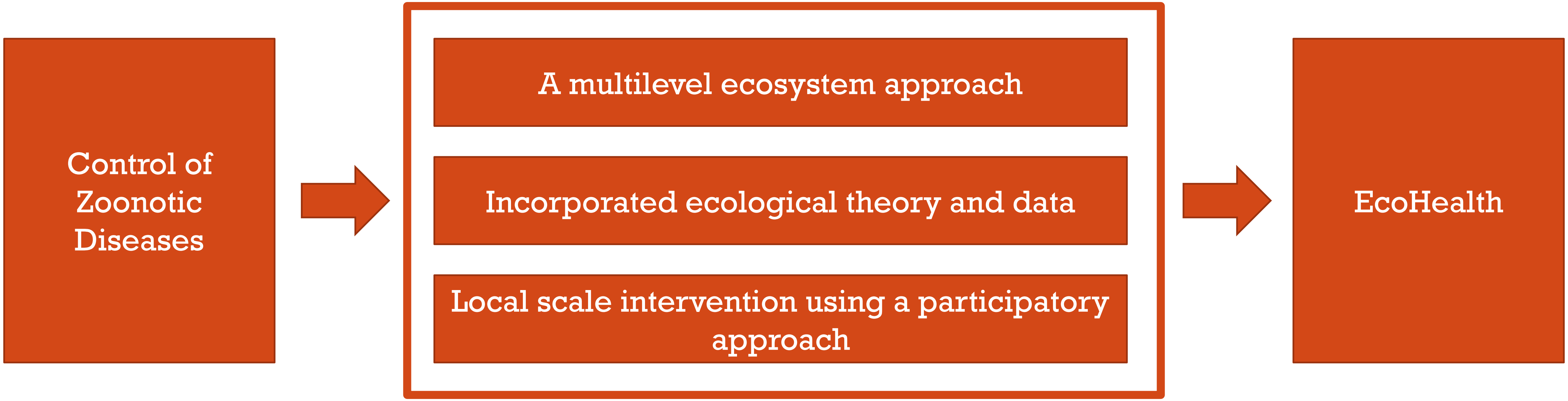
Family/virus	Vector	Vertebrate host	Ecology	Disease in humans	Geographic distribution
Togaviridae					
Chikungunya	Mosquitoes	Human, primates	U, S, R	SFI	Africa, Asia
Ross River	Mosquitoes	Human, primates	R, S, U	SFI	Australia, South Pacific
Mayaro	Mosquitoes	Birds	R, S, U	SFI	South America
Flaviviridae					
Dengue 1–4	Mosquitoes	Human, primates	U, S, R	SFI, HF	Worldwide in tropics
Yellow fever	Mosquitoes	Human, primates	R, S, U	SFI, HF	Africa, South America
Japanese encephalitis	Mosquitoes	Birds, pigs	R, S, U	SFI, ME	Asia, Pacific
St Louis encephalitis	Mosquito				
West Nile Virus	Mosquito				
Bunyaviridae					
Oropouche	Midges				

U, urban; S, suburban; R, rura
HF, hemorrhagic fever
Source: Gubler (2002).



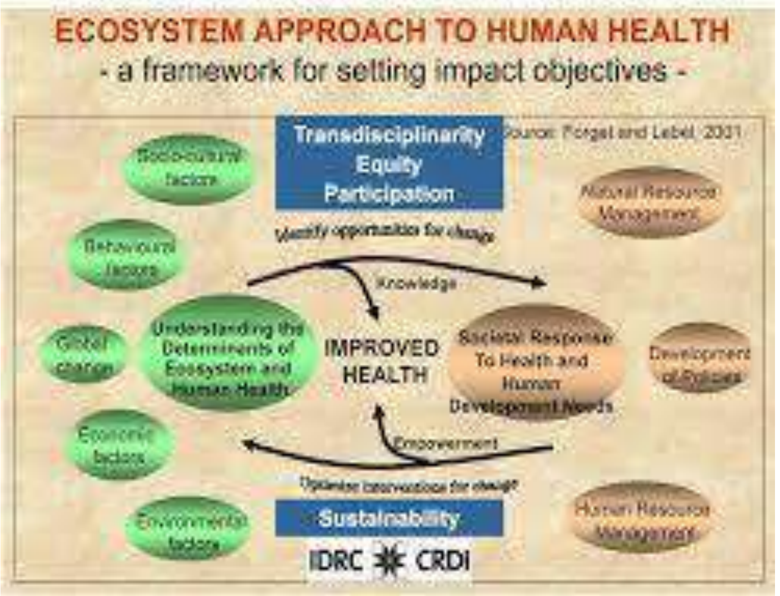
B. A. Wilcox, D.J. Gubler, and H. Pizer. 2008. Urbanization and the social ecology of emerging infectious diseases. In K. Mayer and H. Pizer (Eds.), *The Social Ecology of Infectious Diseases*, Elsevier. Pp.115-137.

THREE ELEMENTS REQUIRED FOR INTERVENTION TO BE EFFECTIVE (WILCOX & GUBLER, 2005)



- EcoHealth is a holistic approach to human health that integrates humans, animals, and the environment as one. This approach aims towards understanding risks on animal health through coordination of the human-animal-ecosystem interface applied at the national and regional levels.

ECOHEALTH



Transdisciplinary approach to adress public health issues attributable **to environmental conditions** and leaning **rather on social conditions than on biomedical variables**

- Initially designed by disease ecologists
- linkages between **ecosystems, society and health** of animals and humans (Rapport, 1998)
- 3 key principles (Charron, 2012): **transdisciplinarity, participation and equity**
- More pragmatic level and local scale
- **Bottom-up** (health issues identified by communities)

- As a theory, EcoHealth recognizes that there are several factors that affect health and well-being, and these factors relate to each other in a complex and multi-dimensional web.
- Unger (2015) presented its key principles: ***systems thinking; knowledge to action; transdisciplinarity; participation; equity; and sustainability.***

SYSTEMS THINKING

- Understanding and examining the linkages and interactions between the elements that make up the system.
- Scale is important in a systems perspective
  - E.g. time-scale, seasons, climate change
- Challenges in systems thinking include:
  - Defining the boundaries of the system
  - Choosing between inclusivity and feasibility based on time, skills, and capacity

Adapted from Unger (2015)

KNOWLEDGE-TO-ACTION

- Knowledge to action refers to the idea that knowledge generated by research is then used to improve health and well-being through an improved environment.
- Knowledge moves both ways
  - Researchers pushing new knowledge into policies.
  - Policy makers gaining new knowledge from research.

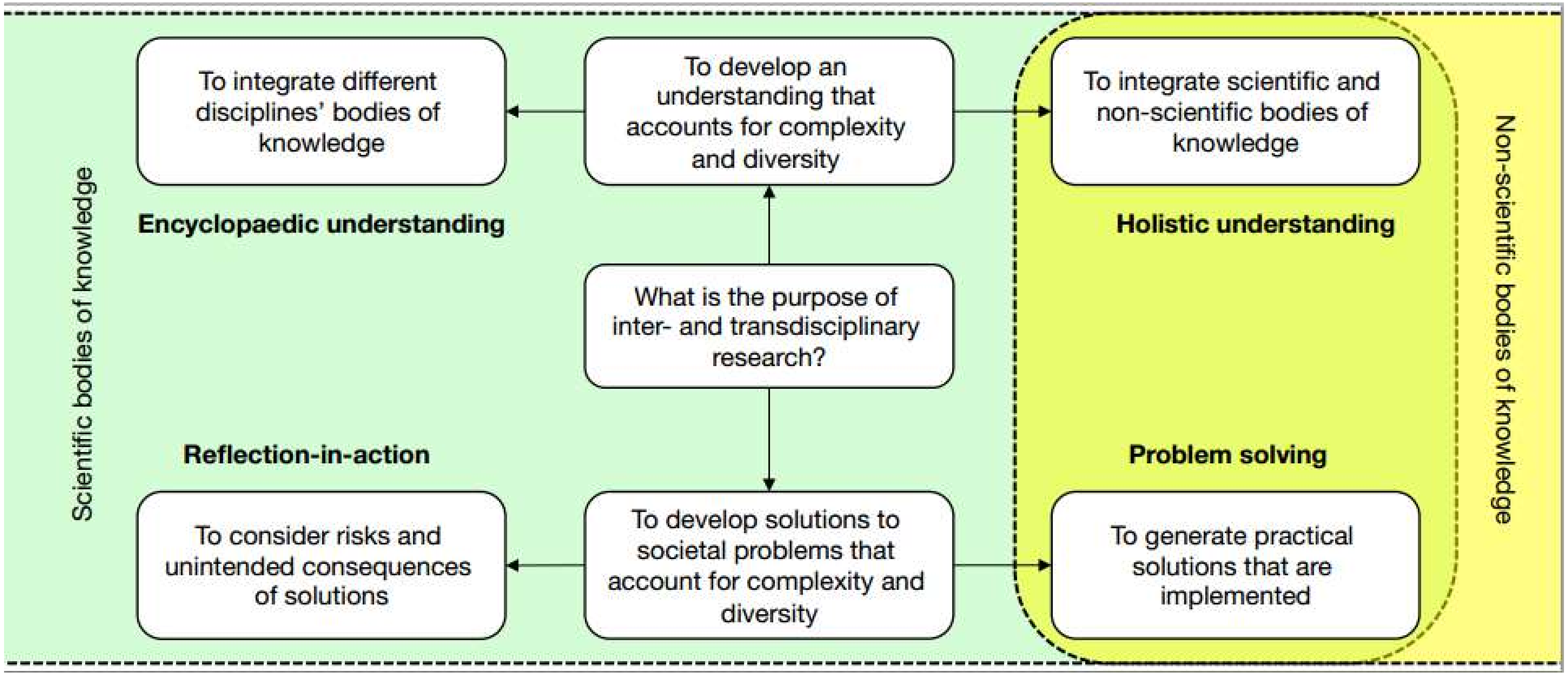
Adapted from Unger (2015)

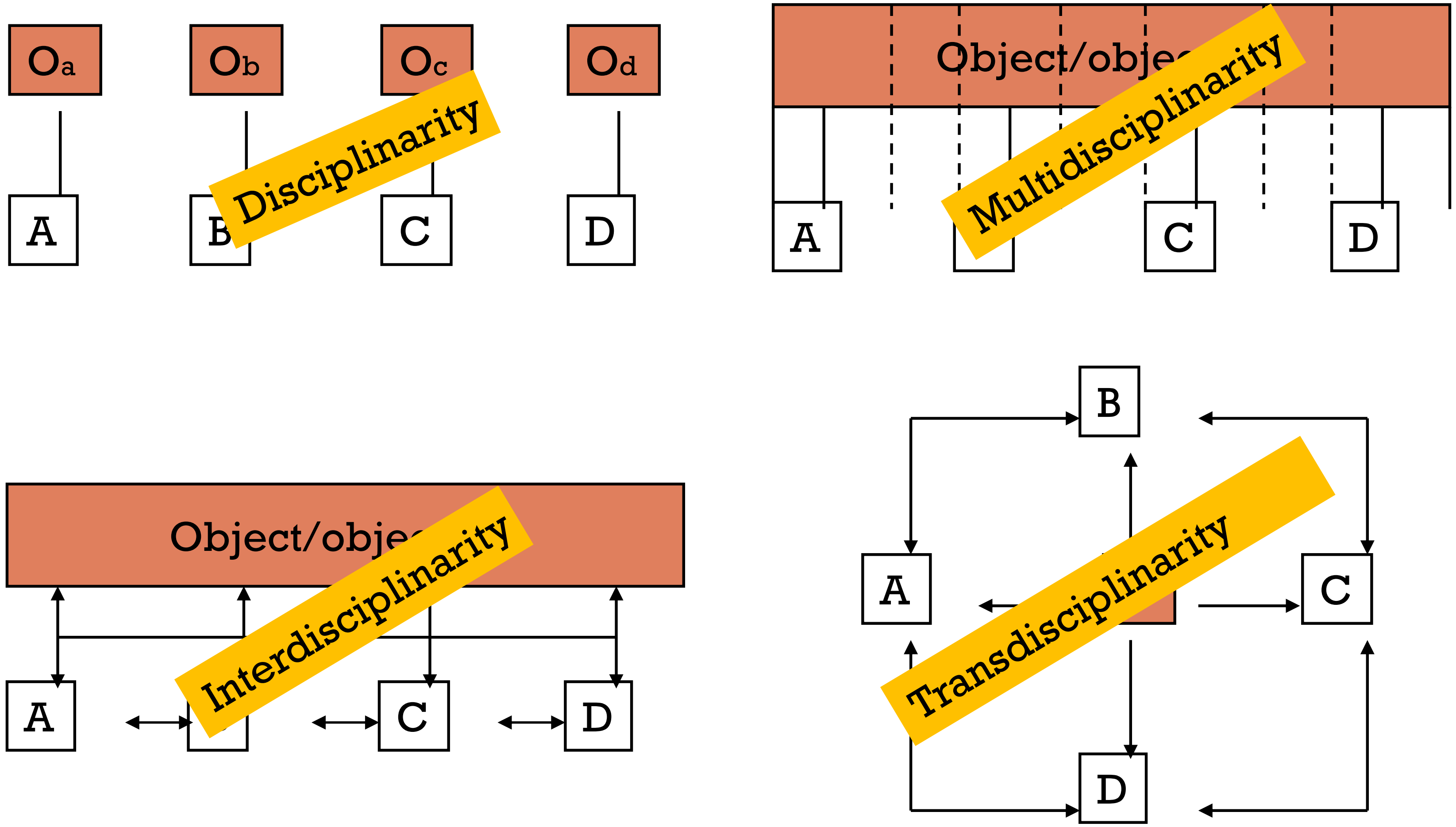
TRANSDISCIPLINARITY

- This refers to a comprehensive vision of health issues by scientists from multiple disciplines together with stakeholders and policy actors.
- Evolves the integration of research methodologies and tools across disciplines including non-academic perspectives and local knowledge.
- Wide range of skills sets are needed which are usually not part of academic training (e.g. consensus building, facilitation, and communication).

Adapted from Unger (2015)

HOW TO OPERATIONALIZE TRANSDISCIPLINARITY?

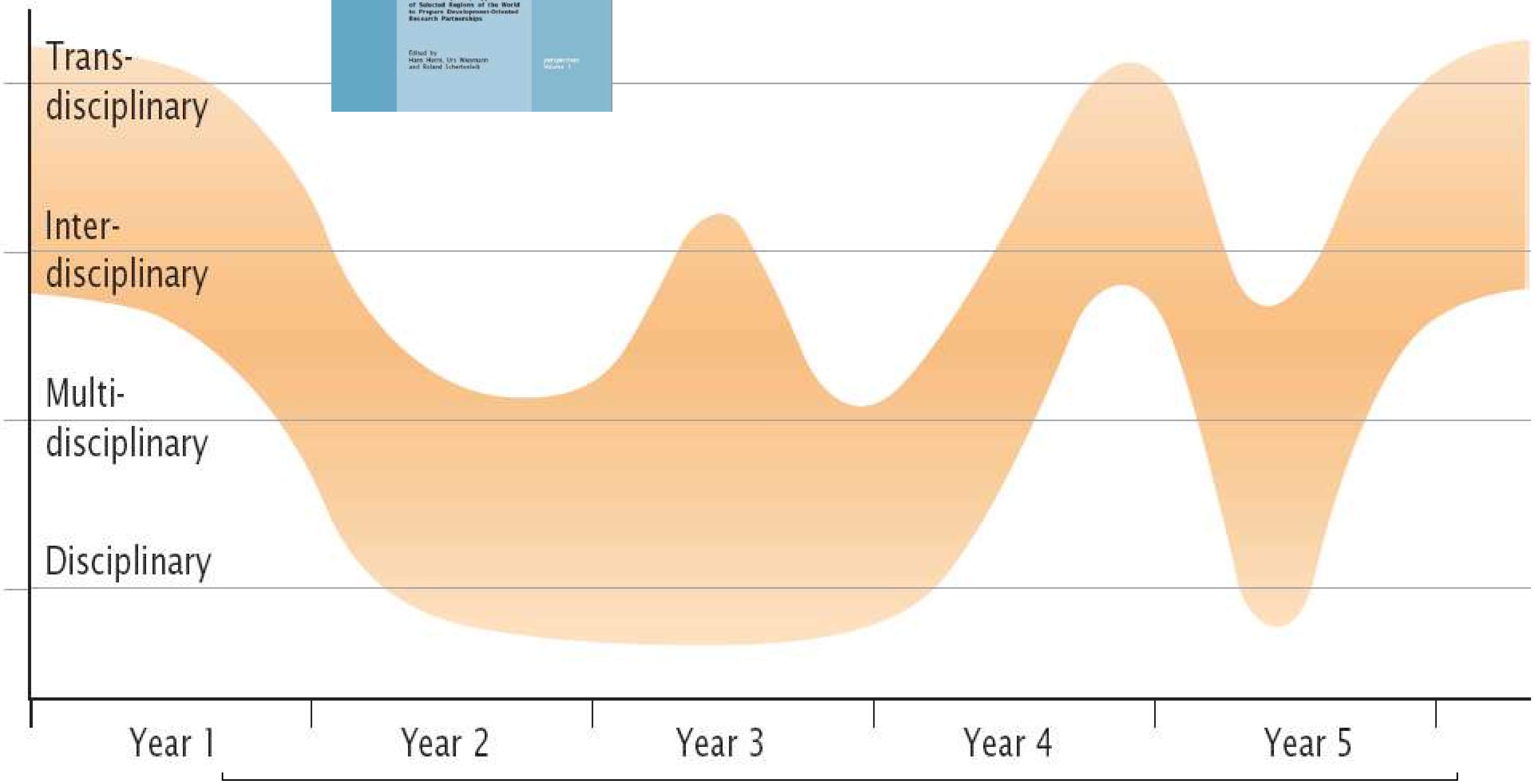




Source: Schelling et al (n.d) presentation titled "**From One Health research to training and practical implementation". Human and Animal Health Research Unit. SWISS TPH.**

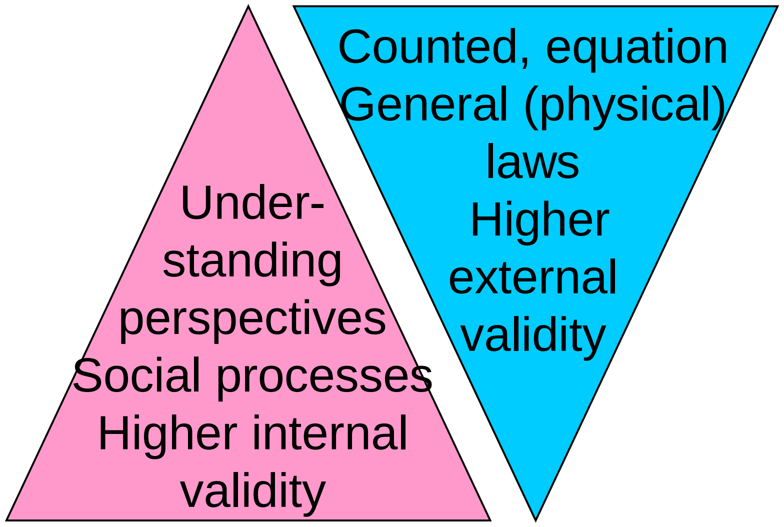
www.transdisciplinarity.ch

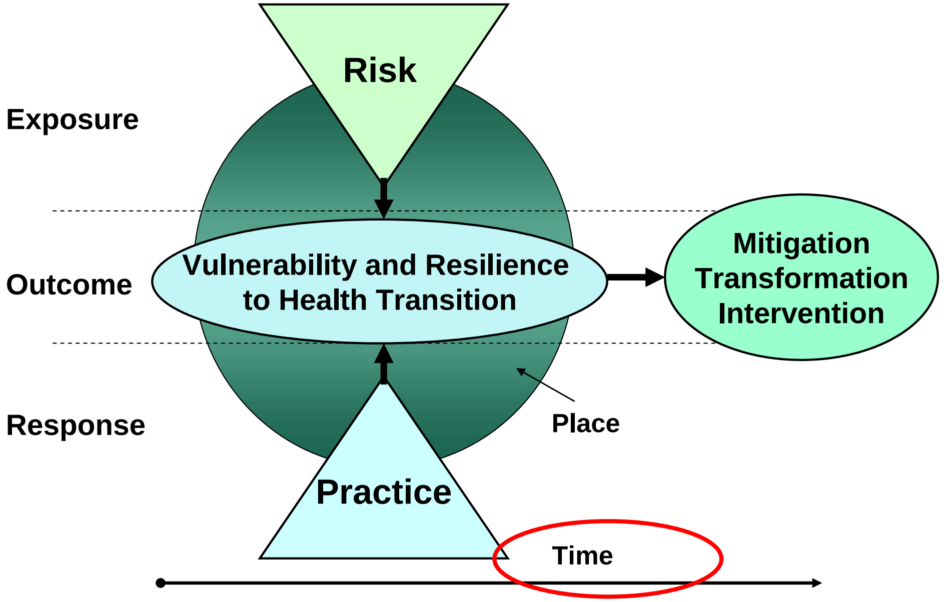
Brewer 1999, «The challenges of interdisciplinarity», Policy Sciences



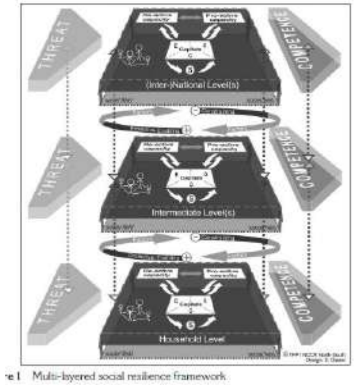
NCCR North-South, 2000

QUALITATIVE AND QUANTITATIVE APPROACHES





- We need a range of methods, if we are to understand the subject of study, by taking an external observational (etic) and internal perceptional (emic) perspective
- Both quantitative and qualitative approaches enrich our knowledge
- Not a question of “either-or” but “when-which”.



Vulnerability and resilience framework - multi-layered social resilience framework, Obrist et al. 2011

PARTICIPATION

- Participation aims to achieve consensus and cooperation among scientific community, stakeholders, and decision-making groups.
  - Define on who should participate and what will be their role
  - Mapping and analysis of potential actors, stakeholders, or groups
  - These will help to:
    - Identify boundaries
    - Recognize existing barriers to change
    - Provide options to move forward

Adapted from Unger (2015)

GENDER AND SOCIAL EQUITY

- Involves analyzing the respective roles of men and women, and various social groups.
  - Gender and age
  - Social, cultural, and economic class
  - Ethnic minorities and marginalized groups
- Why is it important?
  - Inequity in access to health care
  - Women held major responsibilities on health of their families
  - However, women have little power on household income allocation decision-making

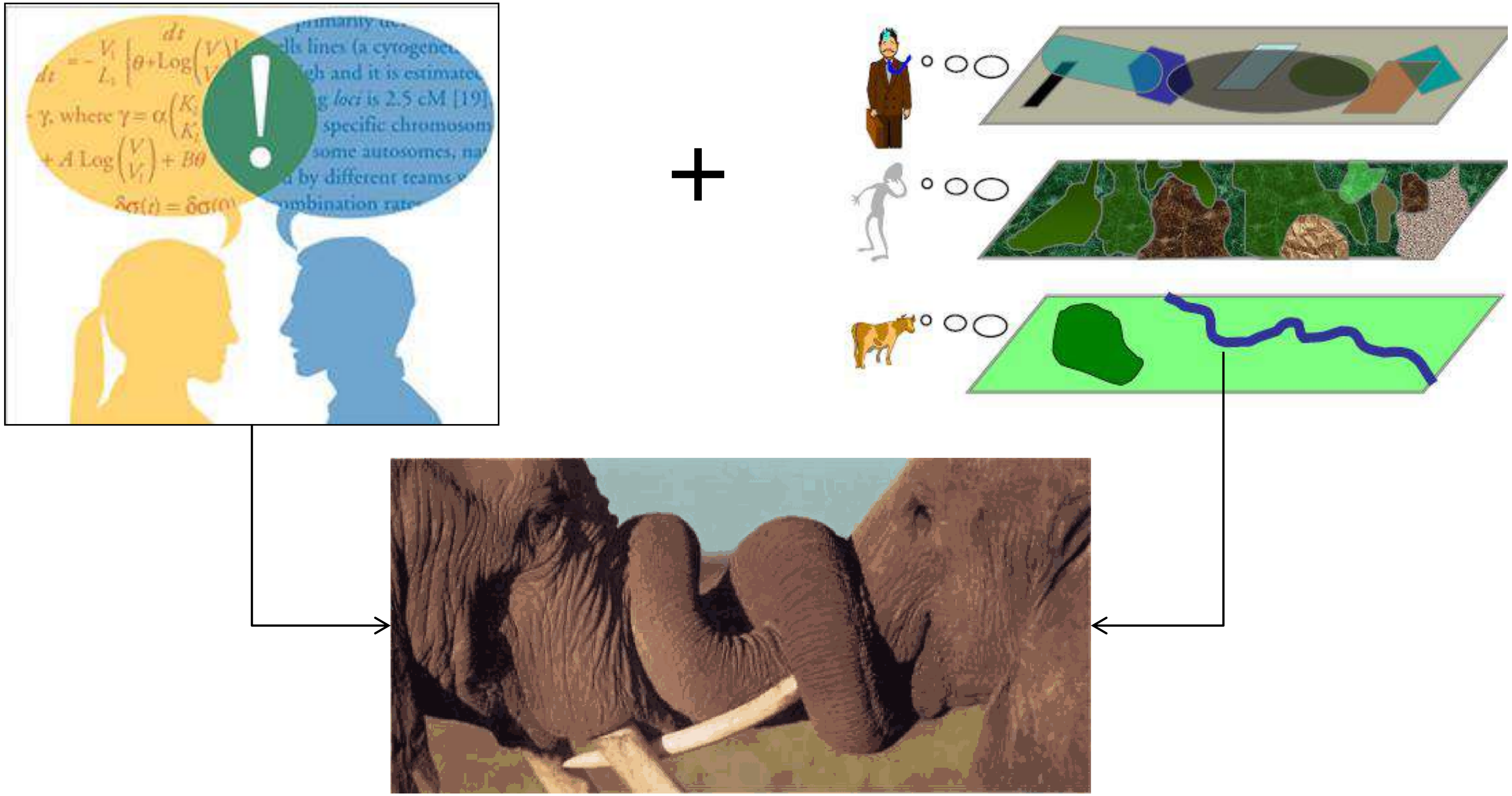
Adapted from Unger (2015)

SUSTAINABILITY

- EcoHealth research should aim towards sustainability wherein every action is ethical, efficient, environmentally sound, and socially acceptable.
- Short-term needs might not be consistent with long-term process for health improvement.

Adapted from Unger (2015)

SAME CHALLENGES!!

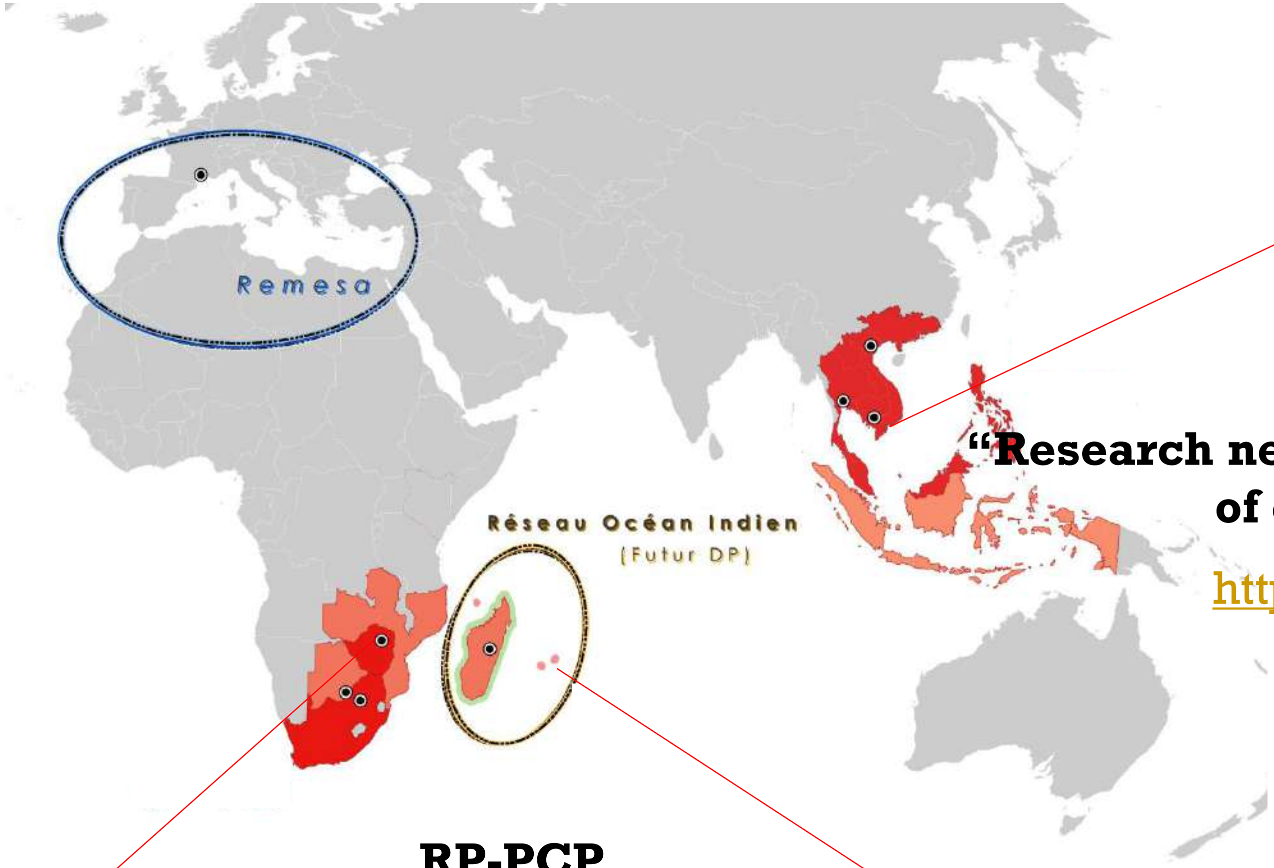


How to merge together different points of view ?

How to demonstrate the benefits ?

SOME CASE STUDIES

IN PRACTICE?



GREASE

"Research network for the management of emerging risks"

http://www.grease-network.org

RP-PCP

"Production and Conservation in Partnership"

http://www.rp-pcp.org

DP-F&B

"Forests and biodiversity".

http://www.forets-biodiv.org


News facebook Search

Research Network • GREASE

Management of Emerging Risks in Southeast Asia

About the network | Research topics | Main projects | Training & Meeting | Publications

Objective

GREASE is a regional network to support Research Activities for a better Management of Emerging Epidemic Risks in Southeast Asia. It responds to the challenge of **emerging transboundary animal infections and zoonotic diseases** by producing a theoretical and operational framework in the framework of the "One Health" approach. Therefore, every disciplines linked to the Management of Emerging Epidemic Risks are involved: **Veterinary medicine, Public Health, Ecology, Economics, Sociology, Geography, Modelling Sciences, Biostatistics**, etc.

GREASE provides scientific and institutional support to facilitate interactions between various stakeholders including:

- **Scientists** from Southeast Asia and worldwide
- **Decision-makers:** National veterinary services and Institutes, International agencies (OIE, FAO, WHO, etc.)
- **Local actors:** Farmers, market chains operators, local authorities, NGOs, communities' representatives, etc.

Partnership

"GREASE is research and training platform in partnership implemented by Cirad and its partners in Southeast Asia".

The core members of this regional network coordinated by Cirad are: Kasetsart University (KU) in **Thailand**, the National Institute for Veterinary Research (NIVR) in **Vietnam**, the National University of **Laos** (NUOL), the National Veterinary Research Institute (NAVRI) in **Cambodia**, Central Mindanao University (CMU) in the **Philippines** and **Cirad**, a French agricultural research center.

Associated partners also participate in the network for the implementation of projects or workshops and for trainings organization: IPC, HKU-PRC, MU-A, AVSF, IRD, CNRS, OIE, FAO-RAP, AIT. An extension of this regional network's activities to **China**, **Hong Kong**, **Malaysia** and **Indonesia** is under development.

Contact

Dr. Aurélie Binot
GREASE Network
Coordinator
Cirad Bangkok, Thailand

Prof. Dr. Apinun Suprasert
GREASE Network
President

News

Epidemics 4
04/10/2013
Nov. 19-22, 2013 in Amsterdam, The Netherlands
Read more

Biting Insects as Vectors of Trypanosomes in South East Asia (Workshop / Training on BIVTSEA); from field to laboratory
03/10/2013
Nov. 18-22, 2013 at Veterinary Research Institute in Ipoh, Malaysia
Read more

2nd GRF One Health Summit 2013
03/10/2013
Nov. 17-20, 2013 in Davos, Switzerland
Read more

5th World Waterfowl Conference (WWC)
03/10/2013
Nov. 6-8, 2013 at the Sheraton Hotel in Hanoi, Vietnam
Read more

All the news

See also

Cirad in Southeast Asia:

- Continental Southeast Asia
- Southeast Asian islands

… Development of a multidisciplinary approach through research/training projects and scientific networking

Objective :

STRENGHTENING SYNERGIES AMONG RESEARCH INSTITUTIONS

Focus on producing a theorical and operationnal framework for analysis and integration of disciplines and stakeholders

http://www.grease-network.org/

KASETSART UNIVERSITY

COMPANION APPROACH FOR CROSS-SECTORAL COLLABORATION IN HEALTH RISK MANAGEMENT IN SEA

ComAcross

2014-2018

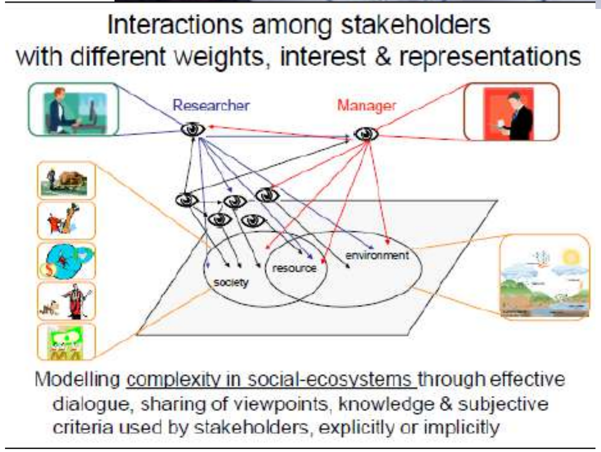
COMACROSS SPECIFIC GOALS

- **Improve awareness on OH/ EcoHealth best practices**
  - Frameworks and mechanisms for improved "dialogue" and routine collaboration : companion modeling and participatory mapping

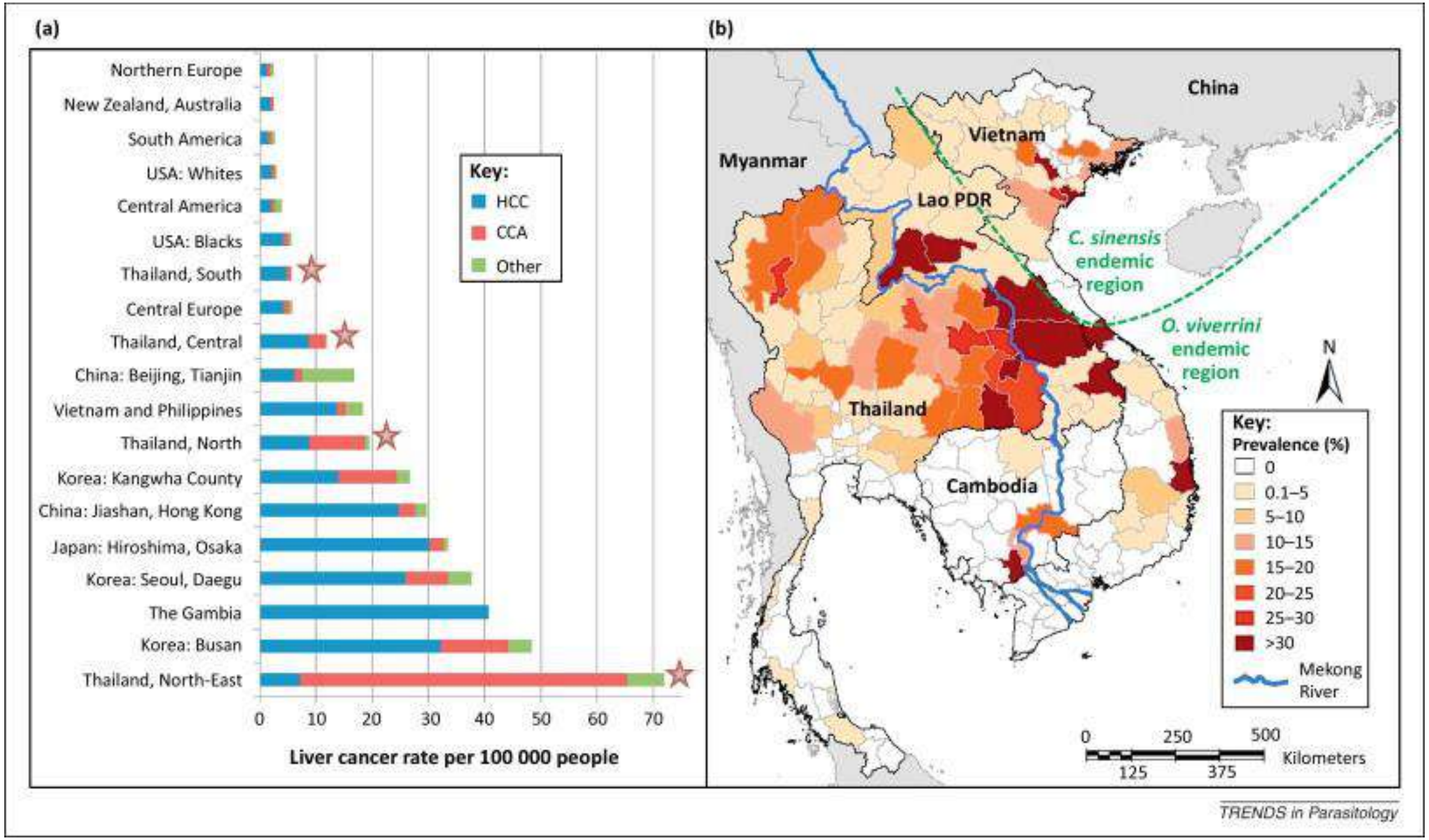
- **Improve vocational competencies**
  - Eco-epidemiological studies,

  participatory field work, various training

- **Raise postgraduate students' capacities on "Assessment and management of risks at the H/A/E interface**
  - InterRisk Master degree (Kasetsart Un./ ENVT)



LIVER FLUKE (*OPISITHORCHIS VIVERRINI* AND *CLONORCHIS SINENSIS*) INFECTION AND LIVER DISEASE IN SOUTHEAST ASIA



From Spripa et al 2012

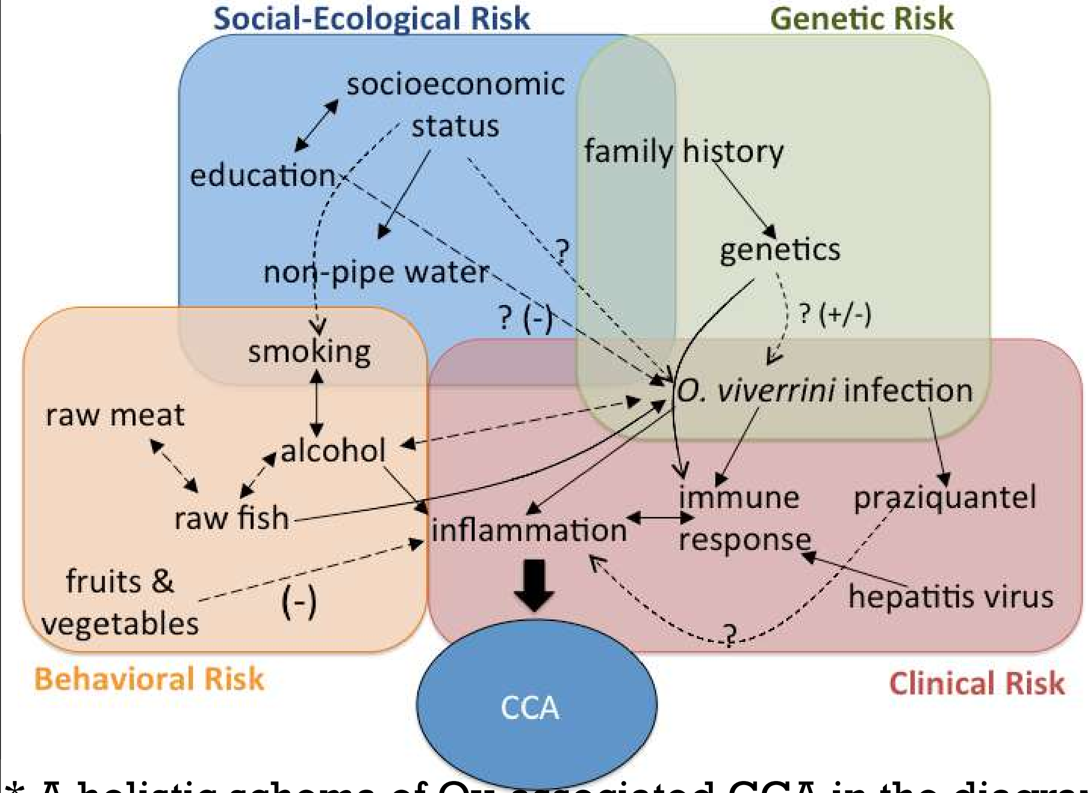
TWO VIEWS OF LIVER FLUKE INFECTION AND CCA RISK

Reductionistic View of CCA Risk*

*The biomedical model-based depiction of CCA causation, informing clinical diagnostic and treatment; historically employed by government "health education" campaigns.

(Steele et al, In prep).

A Holistic View of CCA Risk*



* A holistic schema of Ov-associated CCA in the diagram to the right represents a synthesis of risk factors from an extensive literature review of published epidemiological, clinical and laboratory research.

COUPLED NATURAL-HUMAN SYSTEMS AND EMERGING INFECTIOUS DISEASES: ANTHROPOGENIC ENVIRONMENTAL CHANGE AND AVIAN INFLUENZA IN VIETNAM

National Science Foundation
WHERE DISCOVERIES BEGIN

"…a conceptual framework for examining the Wilcox-Gubler-Colwell hypothesis in the context of … risks, and perceptions of risk, associated with highly pathogenic avian influenza (HPAI) caused by the H5N1 virus…

…poultry deaths, can be associated with anthropogenic environmental changes produced by urbanization, agricultural change, and natural habitat alterations

…suggesting these risks are not an accident of time and place, but rather are the product of the modernization and urbanization transitions.

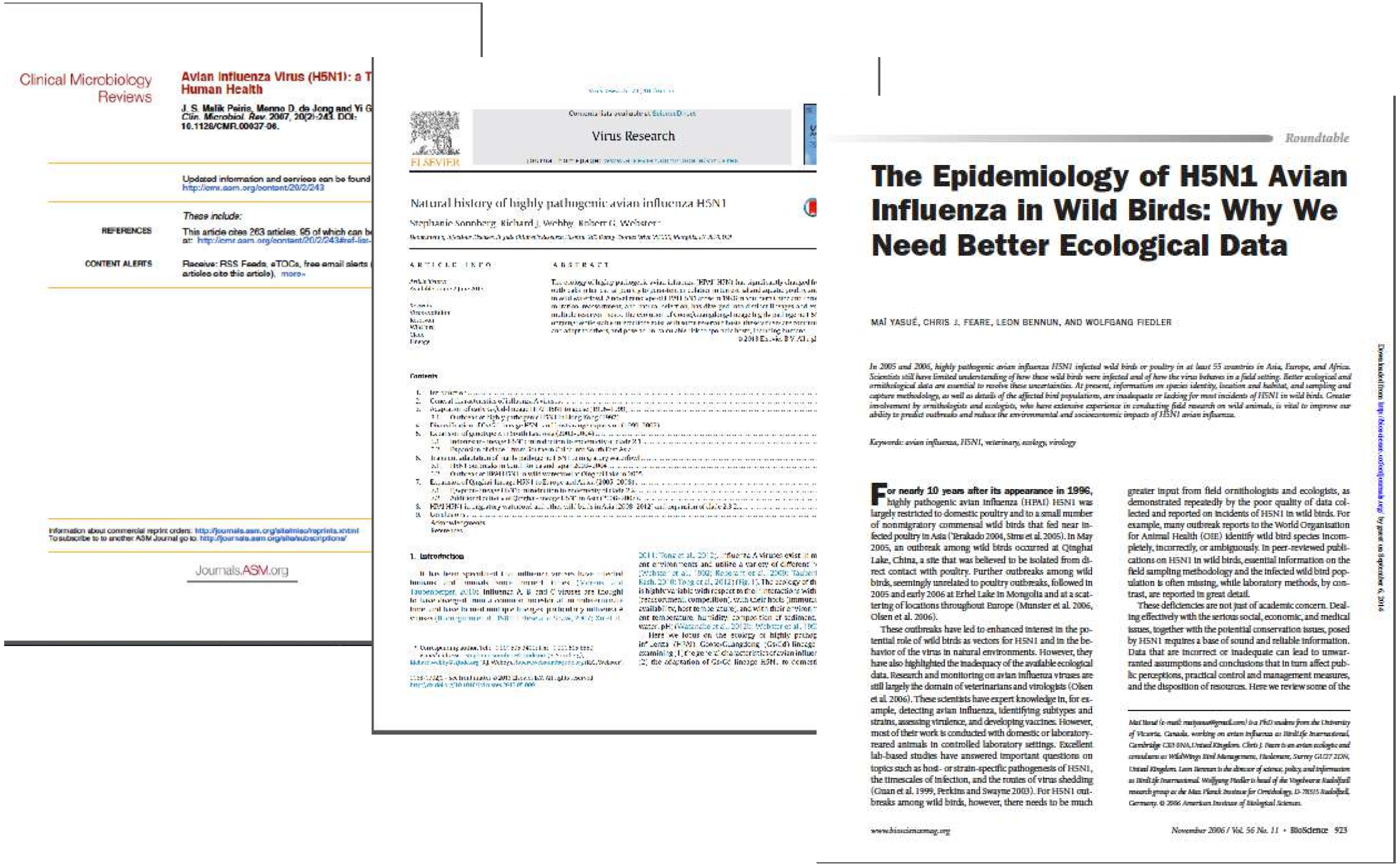
M. L. Finucane, J. Fox, S. Saksena and J. H. Spencer. 2014. A Conceptual Framework for Analyzing Social-Ecological Models of Emerging Infectious Diseases.In M. J. Manfredo, J. J. Vaske, A. Rechkemmer and E. A. Duke, Understanding Society and Natural Resources: Forging New Strands of Integration Across Social Sciences. Springer

ECOLOGICAL MIXING AT HOST POPULATION, COMMUNITY AND LANDSCAPE LEVELS

	GLMM			BRT		
	Coefficient	p	s.e	Relative Influence (%)	s.e	Rank
Intercept	-8.511	0.206	6.729			
Urbanicity: rural	0			0.5	0.1	14
Urbanicity: peri-urban	0.273	0.124	0.178			
Urbanicity: urban	0.228	0.696	0.582			
Percentage land under rice*	6.046	0.000	1.400	5.22	0.04	1
Percentage land under aquaculture*	1.024	0.724	2.904	3.17	0.04	6
Land-use diversity (Gini-Simpson index)	2.212	0.001	0.646	2.22	0.1	9
Chicken density*	-0.525	0.003	0.178	4.21	0.1	4
Duck-rice area density	0.203	0.041	0.099	3.77	0.08	5
Chicken flock size diversity (Gini-Simpson Index)	1.837	0.020	0.788	4.6	0.08	3
Duck & goose flock size diversity (Gini-Simpson Index)	1.986	0.000	0.480	5.09	0.1	2
Annual precipitation*	-4.698	0.000	1.323	2.64	0.1	7
Compound Topographical Index*	14.627	0.000	3.661	2.56	0.08	8
Shortest distance to nearest national highway*	-0.040	0.271	0.036	1.96	0.08	10
Shortest distance to nearest provincial highway*	-0.119	0.001	0.035	0.75	0.08	13
Shortest distance to nearest town*	-0.127	0.053	0.066	1.52	0.1	12
Shortest distance to nearest lake*	0.940	0.021	0.408	1.75	0.04	11
Autoregressive term				60.04	0.08	
AUC-ROC	0.951			Trg = 0.944, Eval = 0.914		

"Surrogate measures, flock size and land use diversity of communes, significantly improve predictive power" – Saksena et al, in preparation

HIGHLY PATHOGENIC AVIAN INFLUENZA (H5N1) AND THE MISSING ECOLOGICAL LINKS



Clinical Microbiology Reviews

Avian Influenza Virus (H5N1): a T
Human Health

J. S. Malik Peiris, Menno D. de Jong and Yi G
Clin. Microbiol. Rev. 2007, 20(2):243. DOI:
10.1128/CMR.00037-06.

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Virus Research

ELSEVIER

Natural history of highly pathogenic avian influenza H5N1

Stephanie Sonnberg, Richard J. Webby, Robert G. Webster

ARTICLE INFO

ABSTRACT

Contents

1. Introduction

Roundtable

The Epidemiology of H5N1 Avian Influenza in Wild Birds: Why We Need Better Ecological Data

MAÏ YASUÉ, CHRIS J. FEARE, LEON BENNUN, AND WOLFGANG FIEDLER

In 2005 and 2006, highly pathogenic avian influenza H5N1 infected wild birds or poultry in at least 55 countries in Asia, Europe, and Africa. Scientists still have limited understanding of how these wild birds were infected and of how the virus behaves in a field setting. Better ecological and ornithological data are essential to resolve these uncertainties. At present, information on species identity, location and habitat, and sampling and capture methodology, as well as details of the affected bird populations, are inadequate or lacking for most incidents of H5N1 in wild birds. Greater involvement by ornithologists and ecologists, who have extensive experience in conducting field research on wild animals, is vital to improve our ability to predict outbreaks and reduce the environmental and socioeconomic impacts of H5N1 avian influenza.

Keywords: avian influenza, H5N1, veterinary, ecology, virology

For nearly 10 years after its appearance in 1996, highly pathogenic avian influenza (HPAI) H5N1 was largely restricted to domestic poultry and to a small number of nonmigratory commensal wild birds that fed near infected poultry in Asia (Terakado 2004, Sims et al. 2005). In May 2005, an outbreak among wild birds occurred at Qinghai Lake, China, a site that was believed to be isolated from direct contact with poultry. Further outbreaks among wild birds, seemingly unrelated to poultry outbreaks, followed in 2005 and early 2006 at Erhel Lake in Mongolia and at a scattering of locations throughout Europe (Munster et al. 2006, Olsen et al. 2006).

These outbreaks have led to enhanced interest in the potential role of wild birds as vectors for H5N1 and in the behavior of the virus in natural environments. However, they have also highlighted the inadequacy of the available ecological data. Research and monitoring on avian influenza viruses are still largely the domain of veterinarians and virologists (Olsen et al. 2006). These scientists have expert knowledge in, for example, detecting avian influenza, identifying subtypes and strains, assessing virulence, and developing vaccines. However, most of their work is conducted with domestic or laboratory-reared animals in controlled laboratory settings. Excellent lab-based studies have answered important questions on topics such as host- or strain-specific pathogenesis of H5N1, the timescales of infection, and the routes of virus shedding (Guan et al. 1999, Perkins and Swayne 2003). For H5N1 outbreaks among wild birds, however, there needs to be much greater input from field ornithologists and ecologists, as demonstrated repeatedly by the poor quality of data collected and reported on incidents of H5N1 in wild birds. For example, many outbreak reports to the World Organisation for Animal Health (OIE) identify wild bird species incompletely, incorrectly, or ambiguously. In peer-reviewed publications on H5N1 in wild birds, essential information on the field sampling methodology and the infected wild bird population is often missing, while laboratory methods, by contrast, are reported in great detail.

These deficiencies are not just of academic concern. Dealing effectively with the serious social, economic, and medical issues, together with the potential conservation issues, posed by H5N1 requires a base of sound and reliable information. Data that are incorrect or inadequate can lead to unwarranted assumptions and conclusions that in turn affect public perceptions, practical control and management measures, and the disposition of resources. Here we review some of the

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SOME PROSPECTS AND CHALLENGES

- Appropriate ecosystem scale --- to better understand drivers of diseases, its emergence, transmission, spread, etc
- Testing and developing innovative research approaches, frameworks and tools
- Strengthened support for academic and public services engagements in research, extension work, policy
- Improved coordination and communication system among relevant stakeholders
- More capacity building programs in research activities particularly in linking epidemiology and the social ecology of diseases
- Understanding of the economic costs of the diseases as basis for decisions
- Linking EcoHealth with other food security concerns such as food safety, etc.

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