



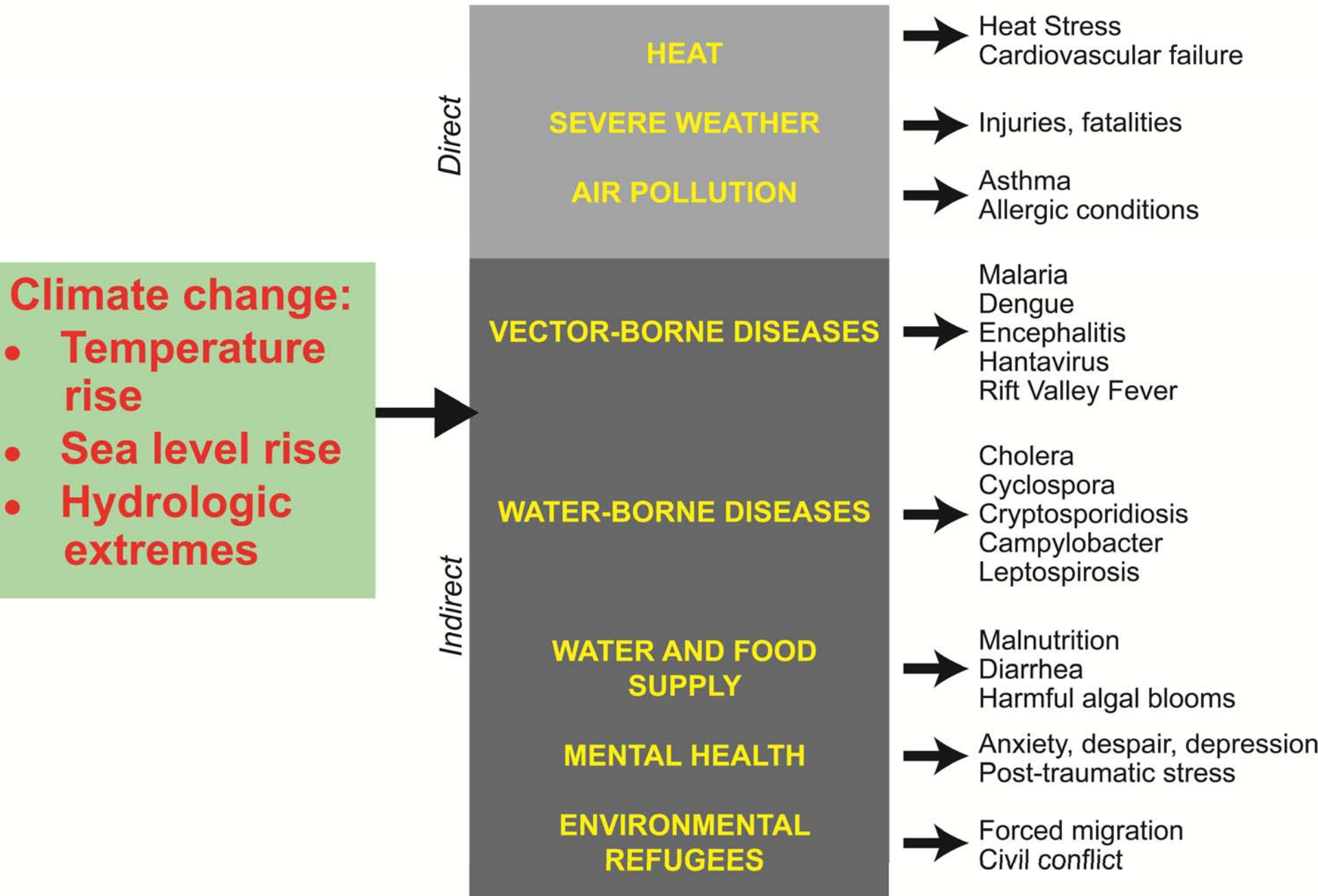
**Coupled Natural-Human Systems
and Emerging Infectious
Diseases: Anthropogenic
environmental change and avian
influenza in Vietnam**

Jefferson Fox and Nancy Lewis

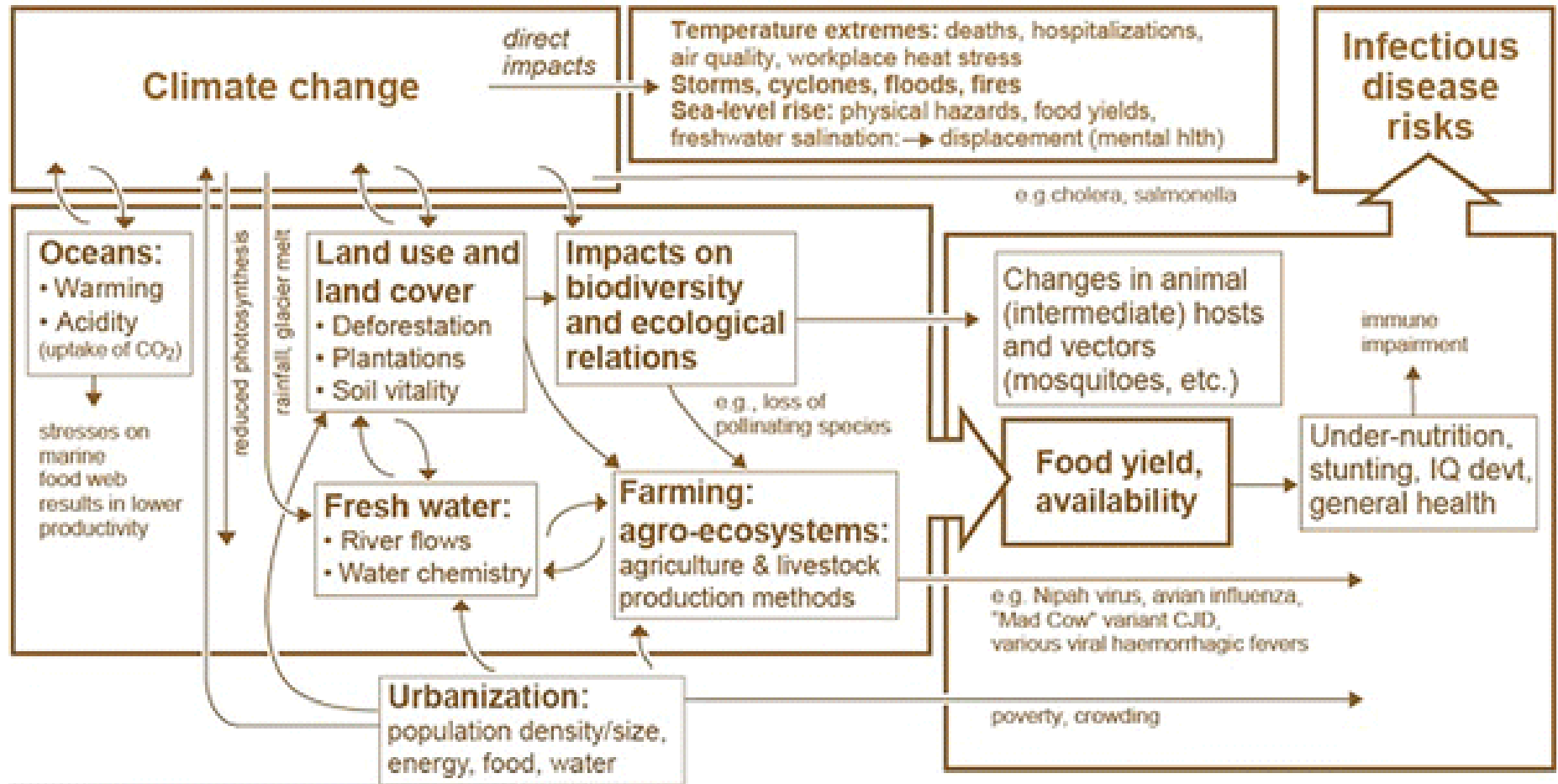
East-West Center

Potential Health Effects of Climate Change

Adapted from J Patz & H Frumkin



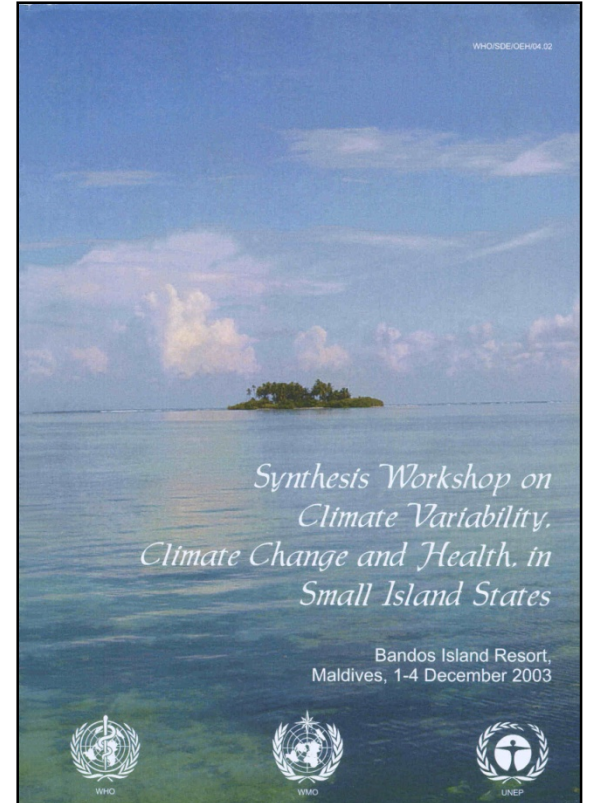
Climate Change and Health



McMichael, A and B Wilcox
EcoHealth 6 (2) 2009

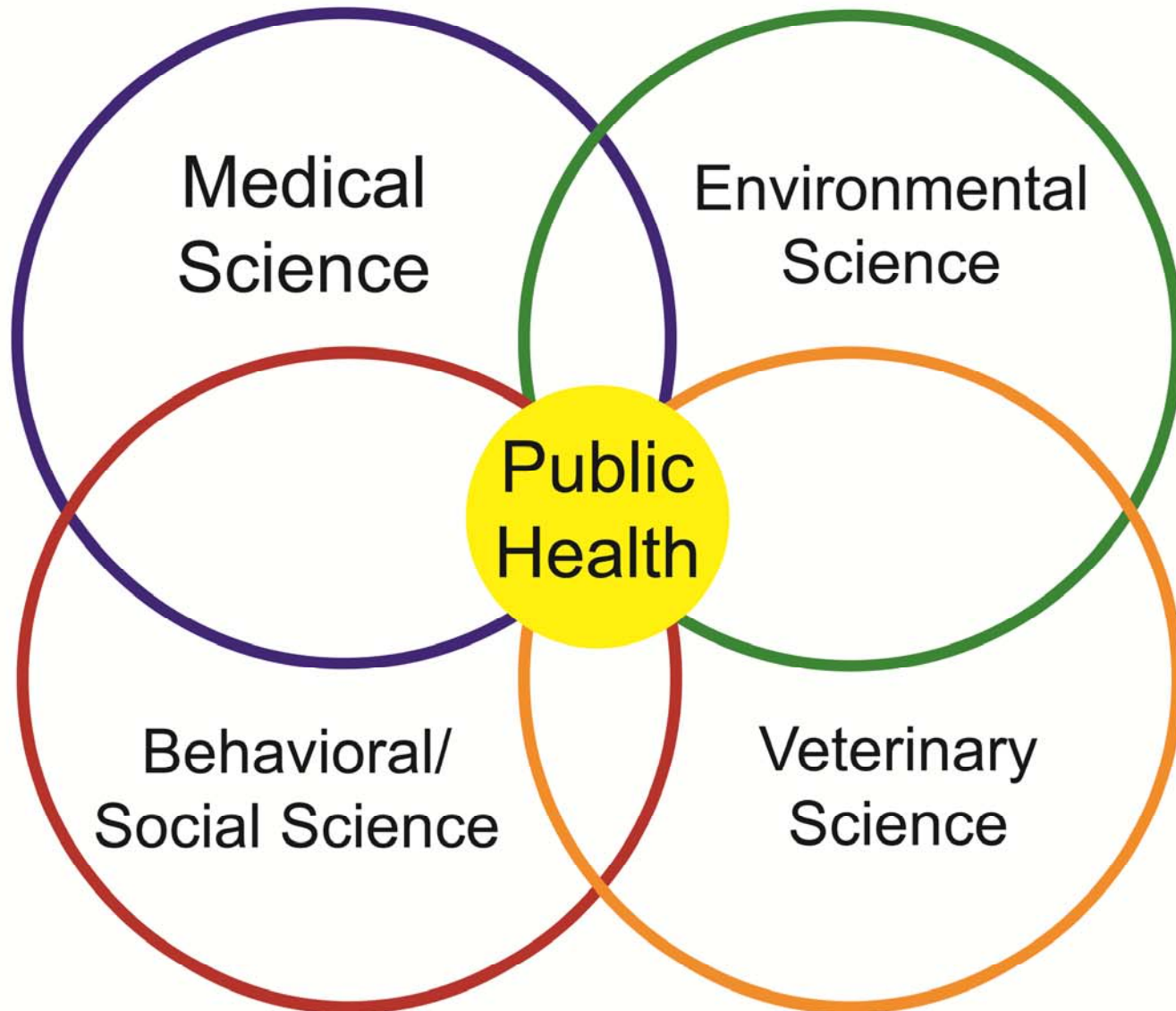
Climate Change and Health

*Synthesis
Workshop on
Climate Variability
and Change and
Health in Small
Island States*



EID - Interdisciplinary Collaboration

Coupled Human/Natural Systems



Coupled Natural-Human Systems and Emerging Infectious Diseases: Anthropogenic environmental change and avian influenza in Vietnam



Asia-Pacific Institute
of Tropical Medicine
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Hanoi Agricultural University
National Institute of Hygiene &
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Project Collaborators

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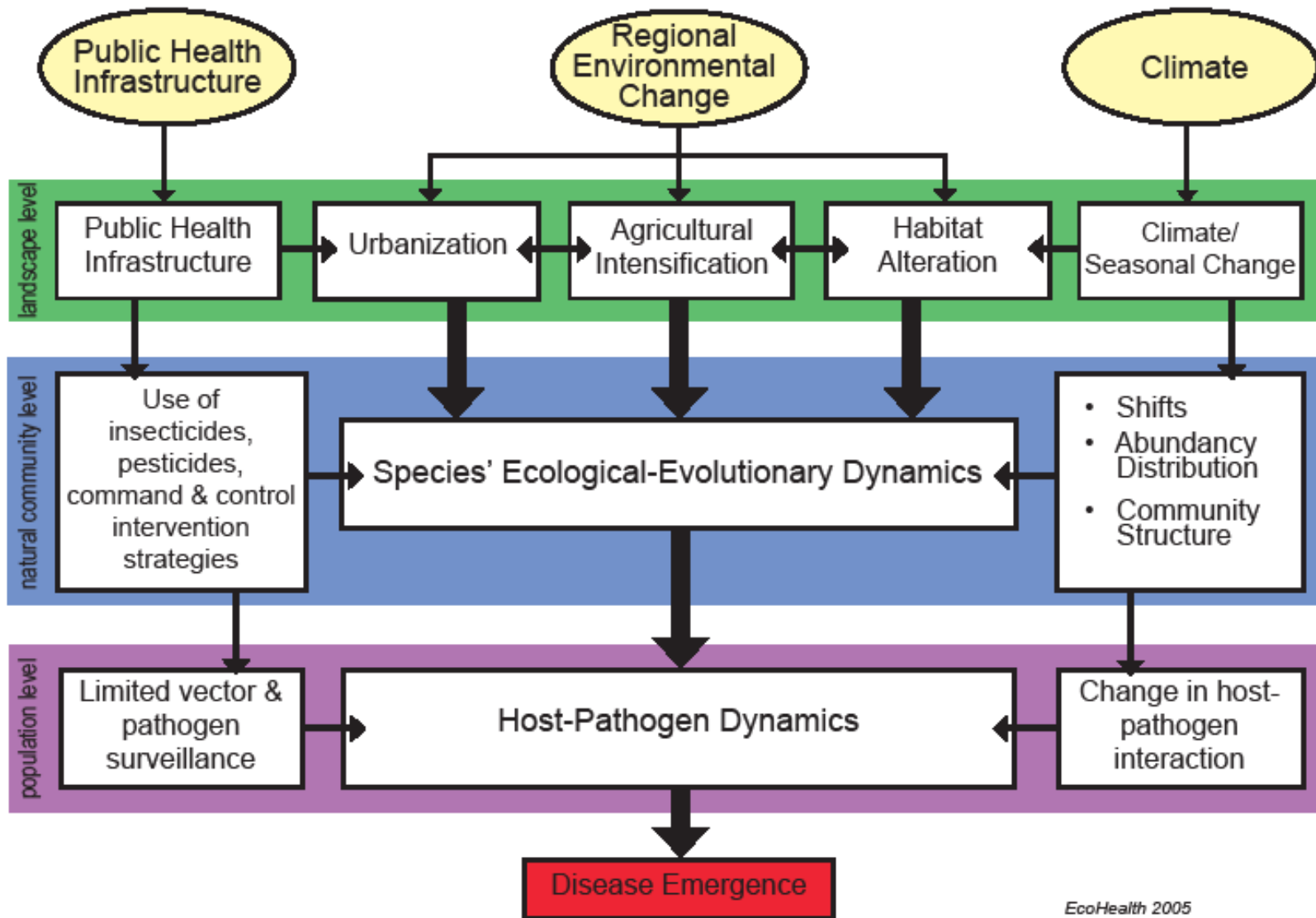
- **Swiss National Center of Competence in Research**

Michael Epprecht

Introduction

- Unraveling mechanisms that underlie new and reemerging infectious diseases (EID) requires exploring complex interactions within and among coupled natural and human (CNH) systems and poses one of the most difficult scientific problems facing society today (Wilcox and Colwell 2005).

Factors Involved in Disease Emergence



Question: Is the risk of AI is related to anthropogenic environmental changes?

- Smith (1990) proposed an environmental risk transition where the environmental factors leading to ill health were categorized as traditional or modern.
- Traditional diseases are problems at the household level (e.g., water, sanitation, food availability and quality, ventilation and indoor air pollution).
- Modern diseases tend to operate at the community level (i.e., urban air quality, occupational hazards, toxic chemicals and motorization) but also lifestyle diseases.

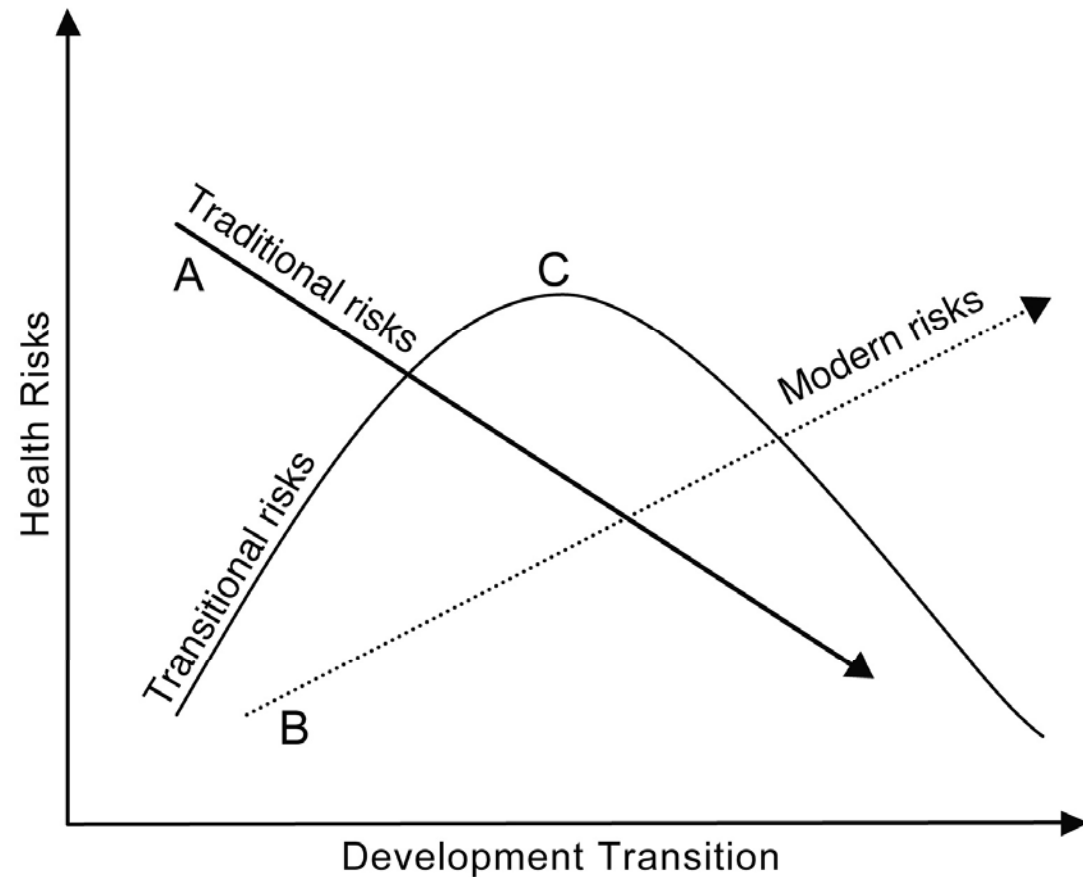


Fig. 1. Environmental Risk Transition Framework

Project Objectives

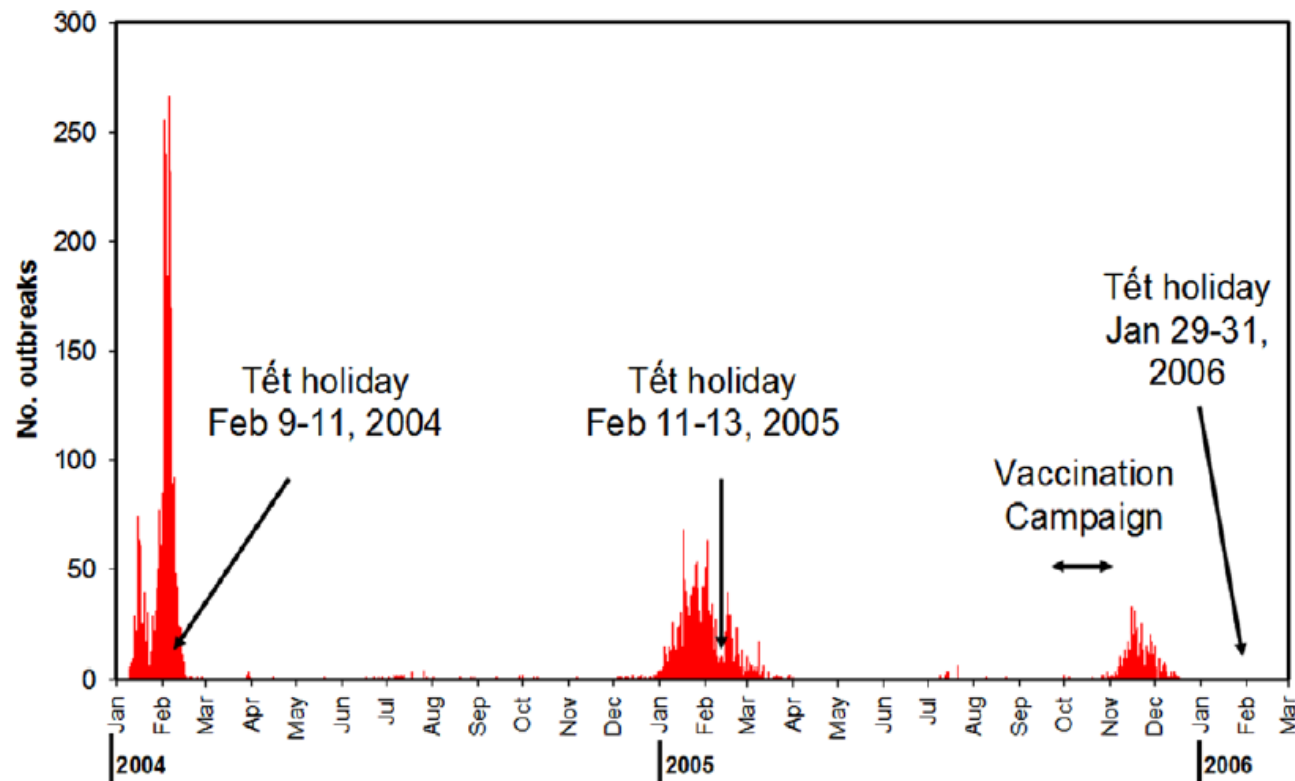
1. To test the Wilcox-Colwell hypothesis that anthropogenic transformations such as urbanization, agricultural change, and natural habitat alteration affect the emergence and reemergence of infectious diseases. We will test this model in Vietnam using data collected at national, commune, and household scales.
2. To examine the influence of socio-ecological and socio-psychological variables on individuals' perceptions of and responses to the risk of HPAI in traditional, transitional, and modern communes.

Objectives (continued)

3. To integrate this study with education programs at the University of Hawaii including the Integrative Graduate Education and Research Traineeship (IGERT) program that focuses on “Integrative Training in Ecology, Conservation and Pathogen Biology”.
4. To establish collaboration among scientists from multiple disciplines and among U.S. institutions and partners from Vietnam and other countries in the Asia Pacific region. To develop activities that ensure research opportunities and mentoring for large numbers of students.

Emergence of AI in Vietnam

- First reported at the end of 2003
- Three major epidemic waves
- 45 million birds culled between Dec 2003 and August 2005
- As of 5/2010, 119 confirmed human cases, 59 deaths
- Massive, repeated vaccination campaigns



Anthropogenic environmental transformations alter host-pathogen relationships

- Spillover into new hosts
- Rapid pathogen adaptation
- More frequent novel variants
- Range expansion
- What are the mechanisms underlying EIDs?
 - Need to examine CNHS interactions



Chickens and ducks prominent in livestock sector

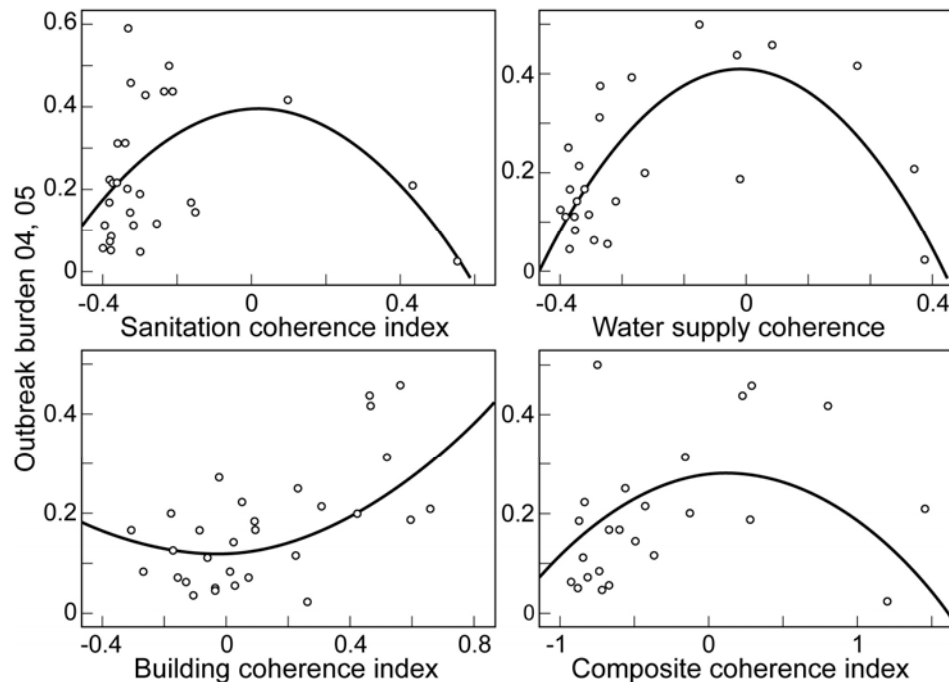
- Integrated agriculture-aquaculture system
- Poultry traded at live bird markets, involving mixing and frequent movement of live animals
- Opportunities for interaction with both infected domestic and wild water birds



Phase I: Kuznet's Curves and Transition Index

- Vietnam's 1999 Census of Population and Housing provides counts of households by housing construction materials (traditional/temporary or modern), water supply (stream, rain, well, piped), and sanitation infrastructure (none, pit, composting, flush).
- Converted each of these 4-category, ranked urbanization measures into four distinct measures of settlement "coherence".
- For each coherence measure, greater mixing (i.e. incoherence) of the four categories was set to center on a value of zero, with more "traditional" settlements dominated by the least sophisticated (e.g. no toilet) category valued at (-1), and the most "modern" settlements dominated by the most sophisticated (e.g. running water) valued at (+1).

Transition Index (TI)



Urbanization - Settlement
Coherence/Agricultural
Change/Habitat Alteration

- This suggests that for the urbanization measure, at least those measures centered on water supply and sanitation, the basic function may be a Kuznets curve.
- We intend to conduct similar exercises for agricultural change and habitat alteration.
- We will develop transition indices for agricultural change and habitat alteration, plot them against the probability of HPAI outbreak, and choose the curve that best fits the data.

Phase II: Commune and Households

- Once we have explored the relationship between HPAI and urbanization, agricultural change, and habitat alteration at the national level, we will examine whether this relationship exists at commune and household scales using focus groups, interviews, and a structured household survey.

Sampling methodology

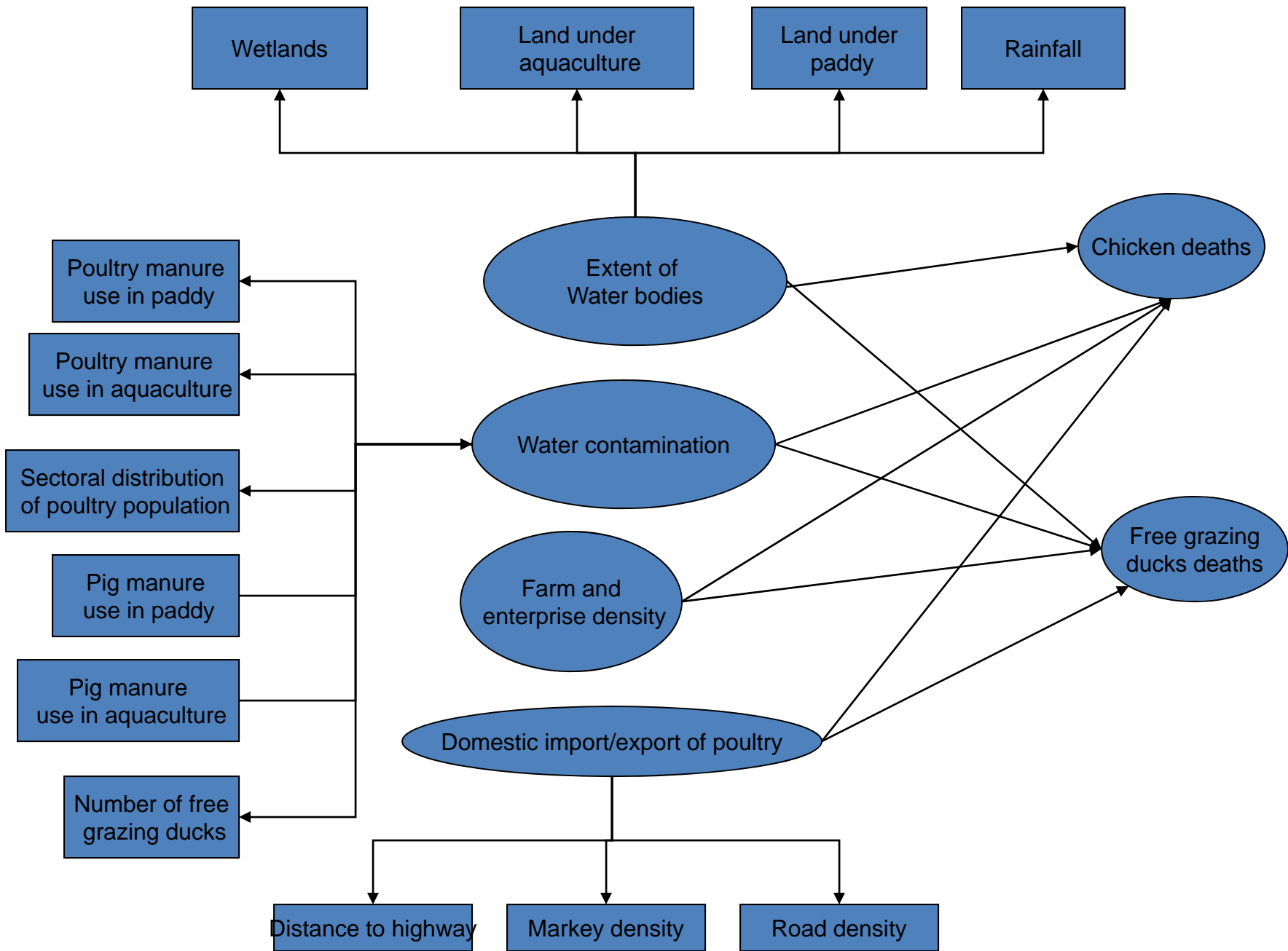
- In each of 4 agroecological zones in the North, sample 3 communes in each stage of transition (36 communes), limited to communes where birds have died from AI
- In each commune, randomly choose 30 households to administer a survey to heads of households (1080 total respondents).

Urbanization and peri-urbanization

- Items measuring urbanization and peri-urbanization:
 - household-level infrastructures (i.e., water supply, sanitation, building materials) in basic counts.
 - residents' daily commute radii, frequency of visits to major urban centers, and changes in social and community-level interactions.
 - roads, urban-designated areas, and agriculturally zoned areas.
- Our hypothesis is that households with intermediate forms of household infrastructure are more likely to be associated with HPAI outbreaks.
- We also hypothesize that more complex mosaics of urban and agriculturally zoned areas, and greater daily access to urban centers and markets are independently associated with higher HPAI outbreaks.

Agricultural change and habitat alteration

- We hypothesize that at the commune and household level outbreaks of HPAI can be modeled as a function of four constructs representing a well defined coupling of natural and human factors:
 - extent of water bodies,
 - water contamination (through livestock wastes),
 - density of farms and households,
 - domestic import and export of poultry



Perceptions of risk and ecological, social and psychological variables in Household Survey

- Items measuring perceived risk and related constructs:
 - Perceived risk
 - Protective behaviors
 - Efficacy
 - Knowledge
 - Worldviews, values, trust

Risk Perception Hypotheses

- H0: Perceived risk not related to setting.
- H1a: Perceived risk correlated with setting (à la Kuznets: highest in transitional setting).
- H1b: Perceived risk correlated with setting (à la risk society: highest in most modern setting) because feelings of trust and control are eroded.
- H2: A significant amount of setting-related RP variance can be accounted for by socio-ecological and socio-psychological (efficacy, affect, worldviews, etc) factors

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Cảm ơn bạn

Mahalo!

