



Emerging Pandemic Threats Program

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The Rising Threat of Zoonotic Diseases

The Use of “Risk-Based” Strategies to Build a Global “One Health” System for Surveillance and Response

Dennis Carroll. PhD

Director, Emerging Threats Program

U.S. Agency for International Development

Advances in Geospatial Technologies for Health

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The Rise of Zoonotic Diseases



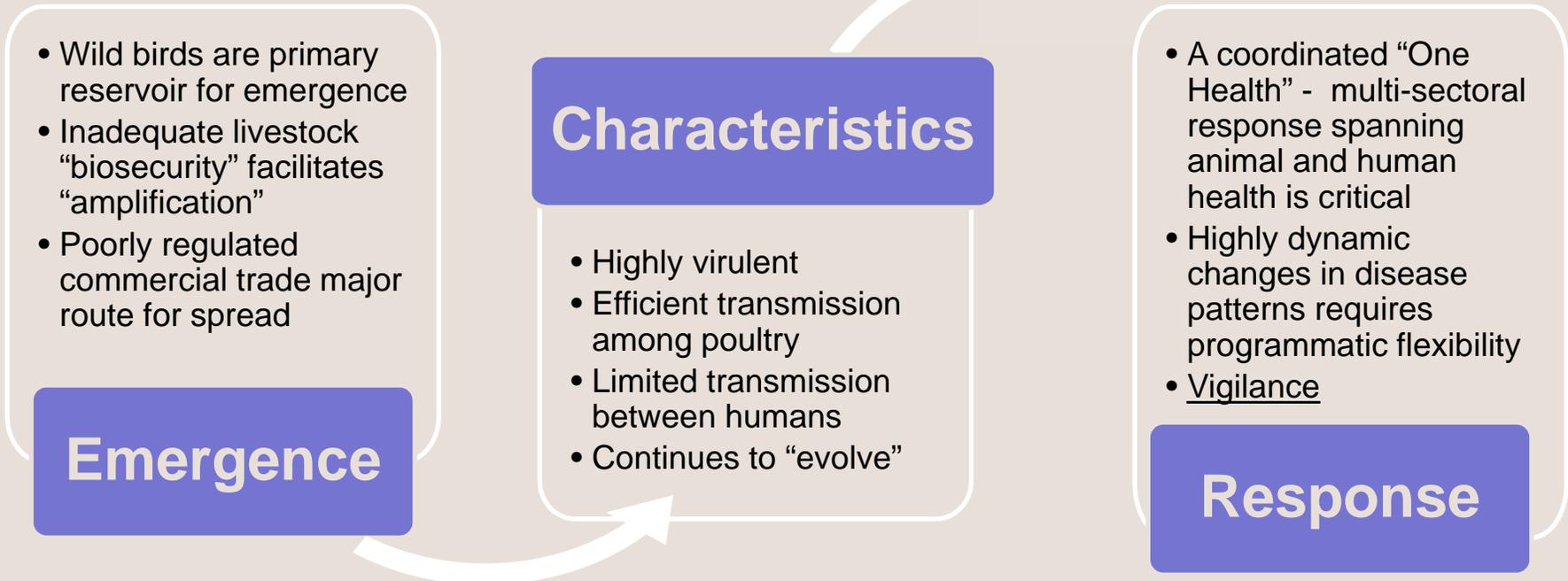
- The emergence of the HPAI H5N1 virus and the more recent H1N1 pandemic virus are part of a broader dynamic that has given rise to a stream of new and increasingly deadly zoonotic diseases.
- Of these new zoonotic diseases, nearly three-quarters have been caused by pathogens originating in wildlife
 - SARS emerged in *civet cats* in Guangdong Province, China;
 - Nipah virus in *bats* in Perak State, Malaysia; and
 - HIV in *non-human primates* in Central Africa.
- The threat from zoonotic diseases is not new but is intensifying
 - Many long-standing diseases in humans (e.g. hepatitis, malaria, measles) caused by microbes originally from animals
 - The rate of pathogen emergence is projected to increase 5 fold between 2000 - 2030 as animal-human interactions intensify



Avian Flu

has proven a critical window for understanding the forces driving the emergence of new infectious diseases and what's needed for their control

Specific lessons from H5N1 Influenza

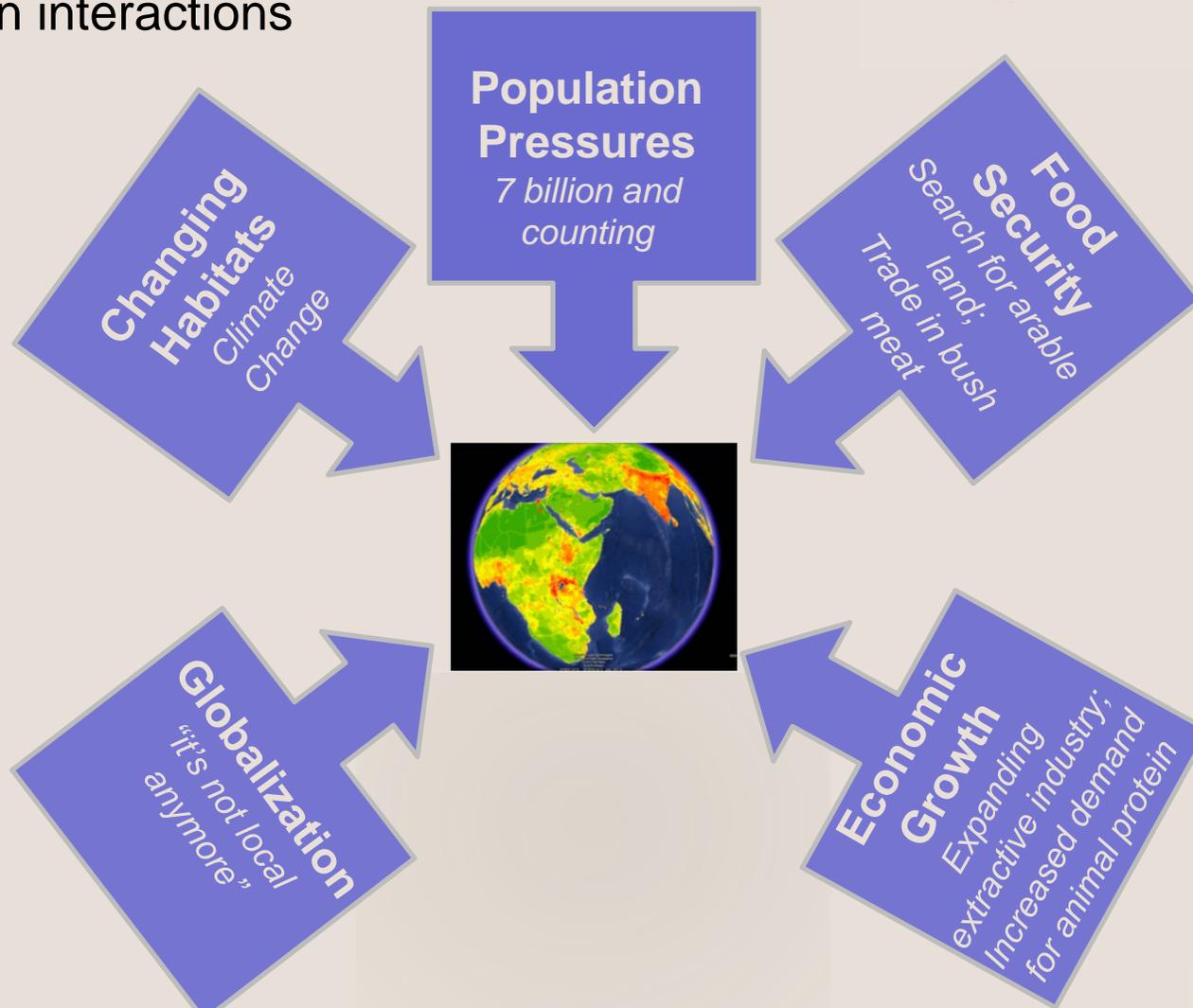


Overall Lessons learned

- Effective control of H5N1 and other zoonotic diseases is dependent on:
 - Early detection in animals
 - Local capacities for outbreak investigation and response
 - Reduction of human behaviors and practices that enable the spread of and exposure to the virus

The “Drivers” Behind the “Rising Threat”

Disease emergence is closely linked to factors that intensify animal-human interactions



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Emergence is a “Rare” Event



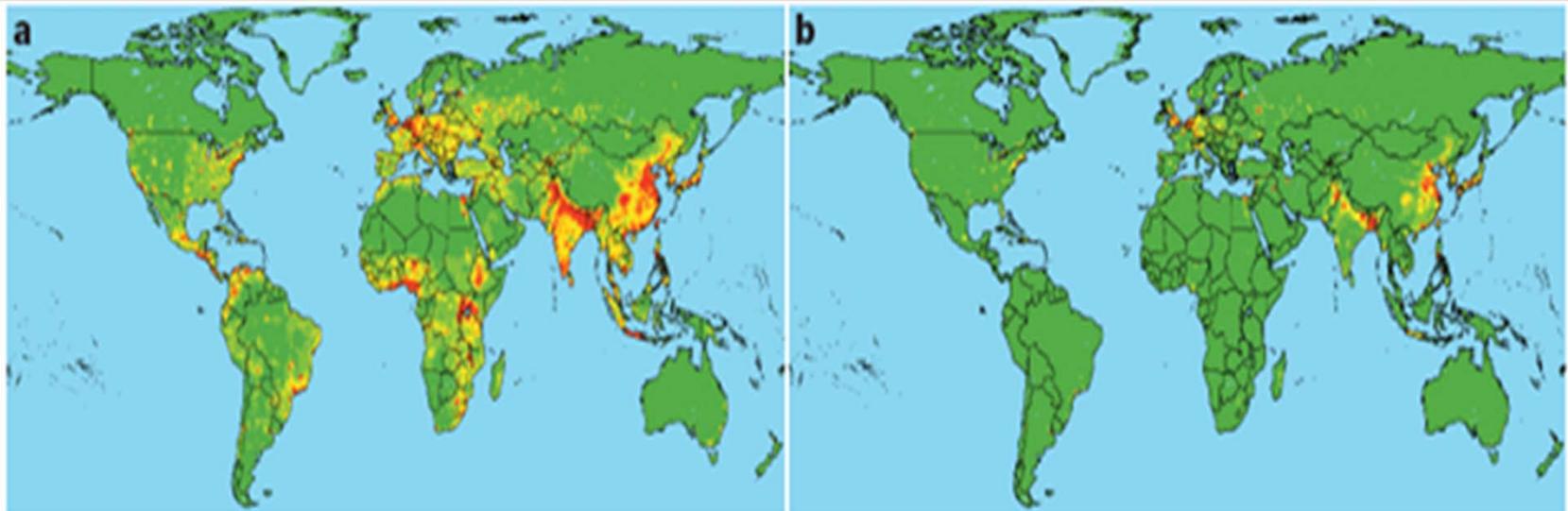
- Even as the risk of new zoonotic diseases is increasing, their emergences remain relatively rare events that occur at unpredictable times and places.
- One of the biggest challenges to early detection of these diseases is the lack of sufficient, sensitive surveillance capacity geared toward rapid and reliable detection of highly unusual pathogens.

Using “Risk-Based” Strategies to Target Interventions



- Recent advances in the understanding of factors that drive the emergence of zoonotic diseases have led to new risk-based models for forecasting new zoonotic diseases - opening opportunities to bring greater focus to emergent-disease surveillance.
- The origins of newly emergent diseases have been found to strongly correlate with specific:
 - **geographic areas**
 - **animal hosts**
 - **microbial agents**
 - **“high risk” human populations.**

Geographic “Hot Spots”



Kate Jones et al (2008): *Global trends in emerging infectious diseases*: Nature, Vol 451.21

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Identifying New Threats “Before” They are Diseases



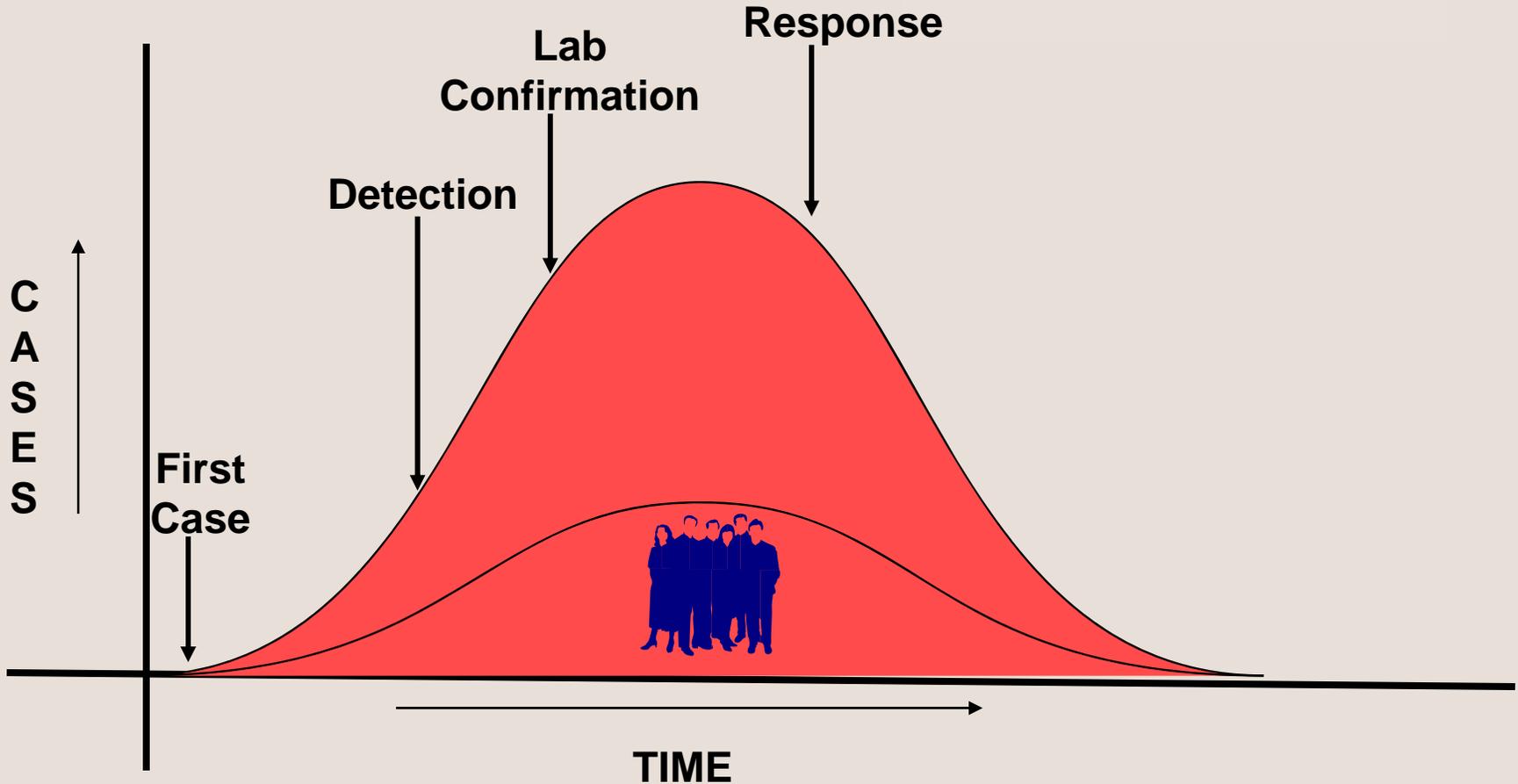
The Challenge

- H5N1 highlights the importance of not “waiting” for human infections. Monitoring for new zoonotic threats in animals is critical for an “early” detection.
- HIV illustrates the challenge of early identification of emergent zoonotic diseases whose primary infection is not closely linked temporally to clinical symptoms

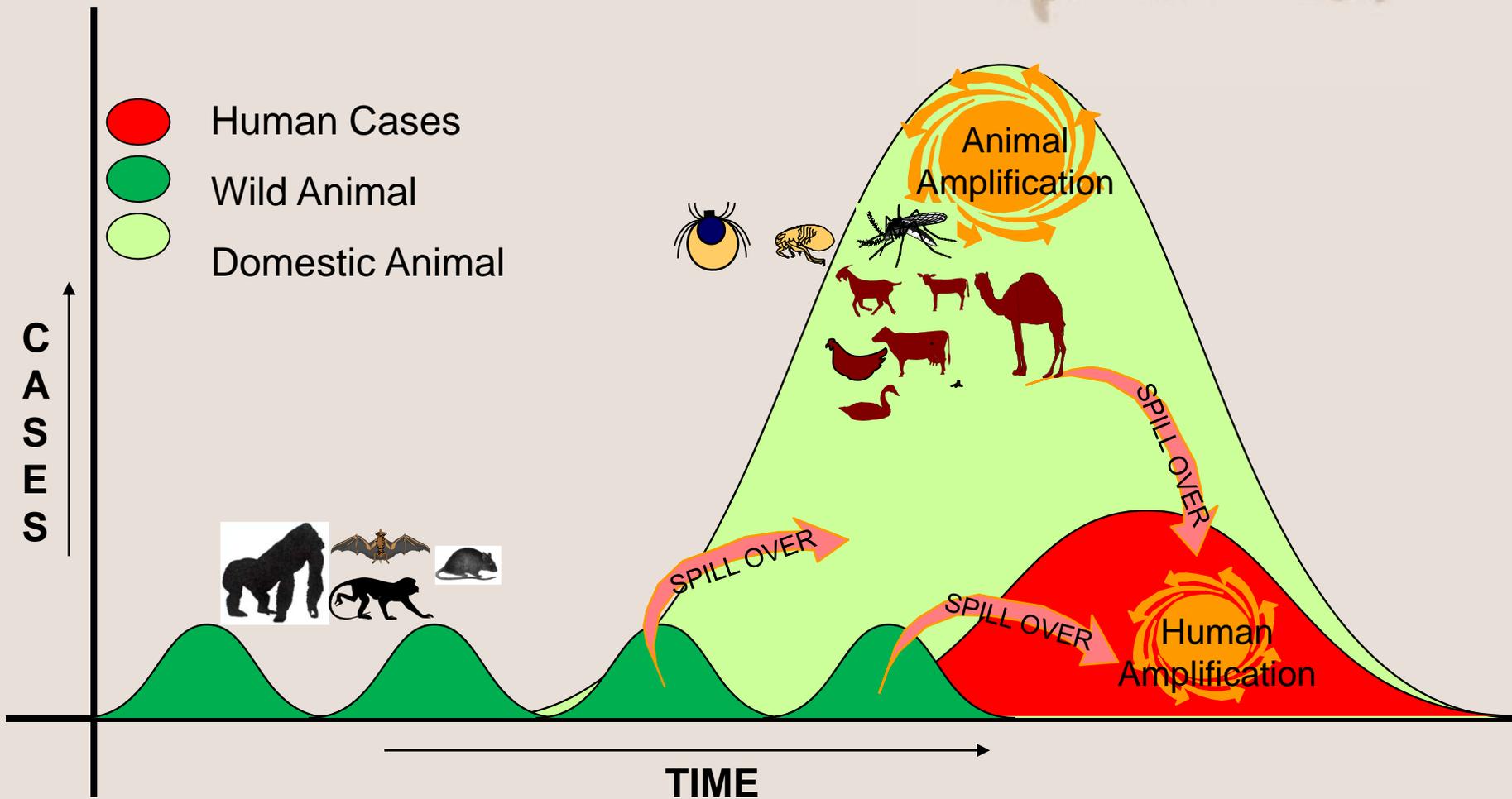
The Opportunity

- Early detection will require both strengthening “syndromic surveillance” and the development of novel surveillance models that exploit advances in genomics and informatics to identify microbial threats before they fully emerge as infectious diseases.
- With most new diseases coming from animal reservoirs these new surveillance “models” will need to be able to characterize microbes on their potential for “jumping” the species barrier and posing future threats to humans
- “Predictive” surveillance would be intended to complement “syndromic” surveillance to build a comprehensive surveillance model for early detection of new emergent threats

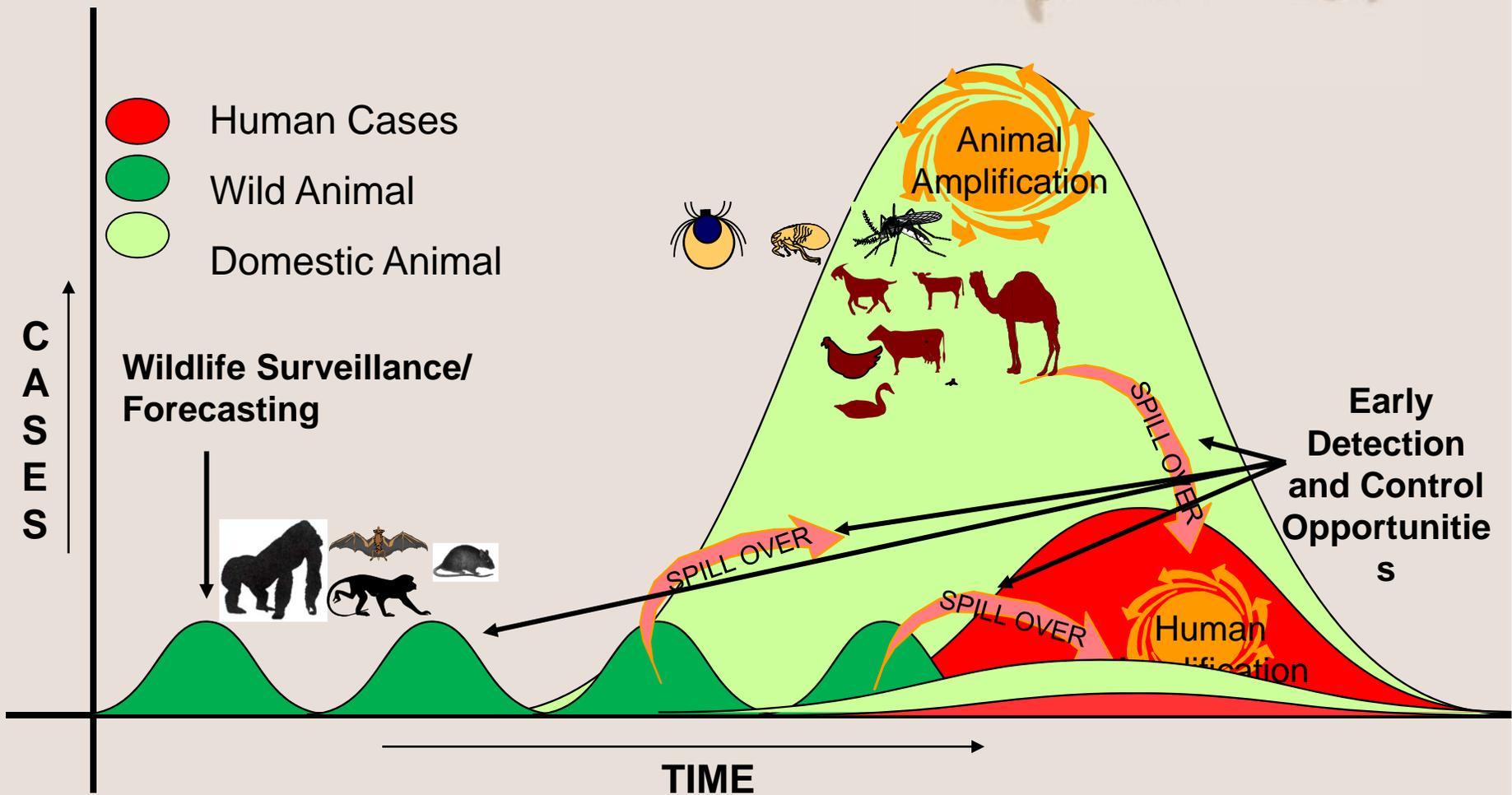
Standard Model for Outbreak Detection and Response



One Health – Public health as part of the “ecosystem”



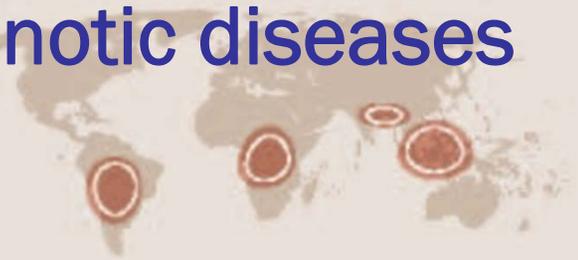
One Health – Public health as part of the “ecosystem”



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Pre-empting the threats from zoonotic diseases



Wildlife pathogen detection

- Surveillance to identify specific microbes that may cause serious disease in humans

Risk determination

- Characterize risk that a microbe may pose to humans and its method of transmission from animals to humans

Outbreak response capacity

- Strengthen country capacity to detect and respond to outbreaks in animals and humans

Risk reduction

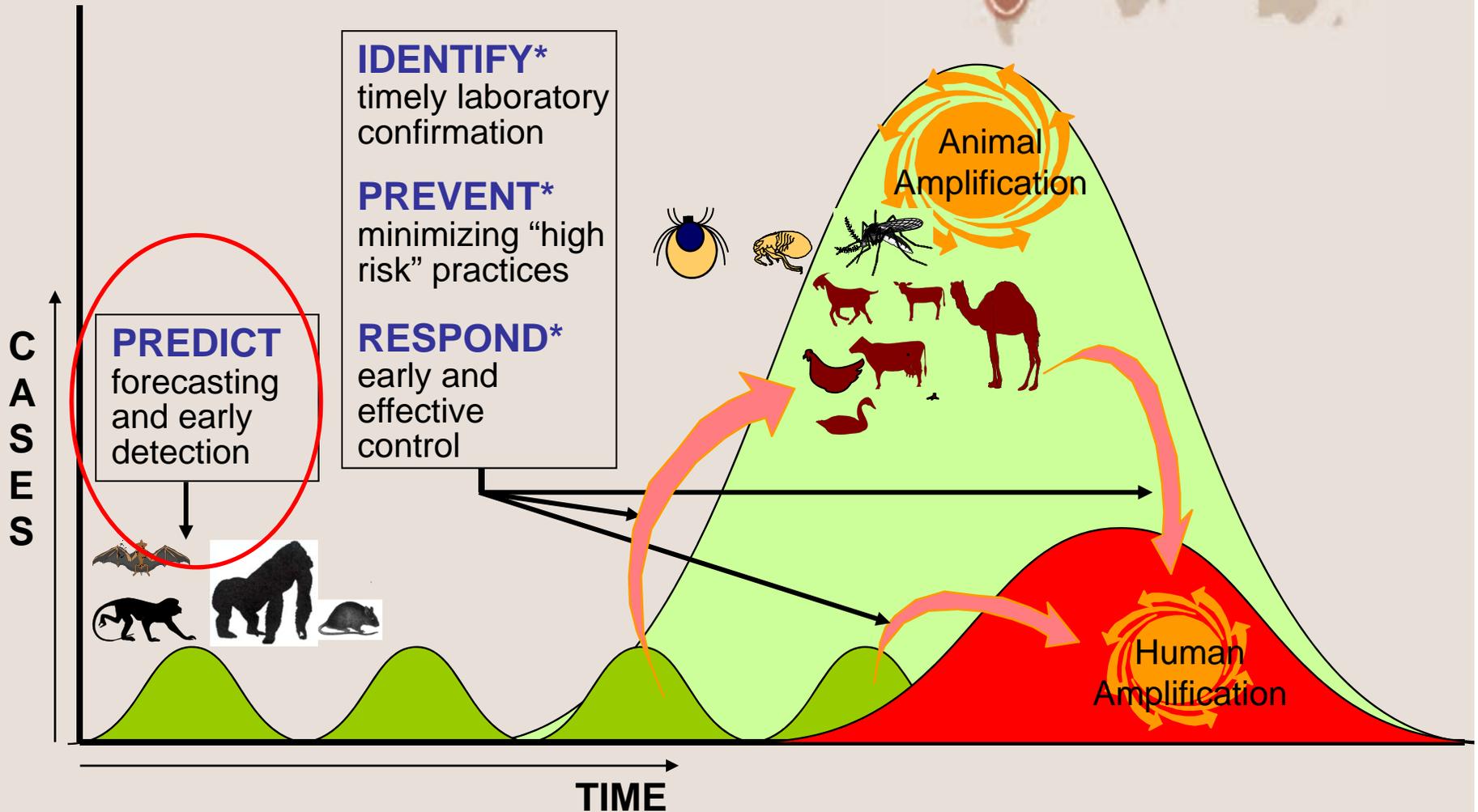
- Develop and implement behavior change interventions to minimize disease threat for specific high-risk populations

Two important aspects of the EPT strategy

- Promotes a “One Health” approach that builds first on existing platforms
- Focus on strengthening country capacities – consistent with IHRs and OIE standards

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Contribution of EPT Program to Disease Detection and Control



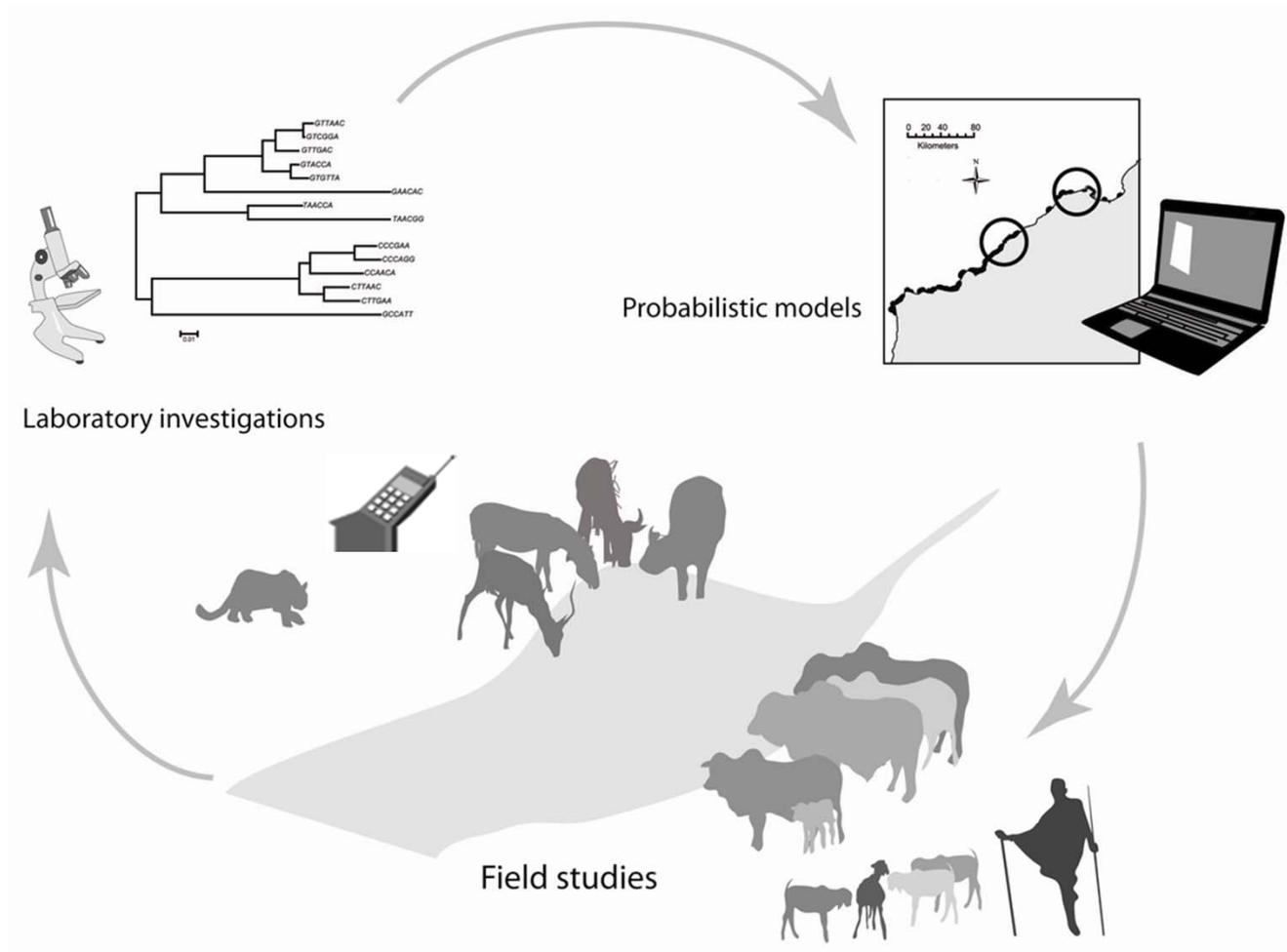
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PREDICT

SMART Surveillance

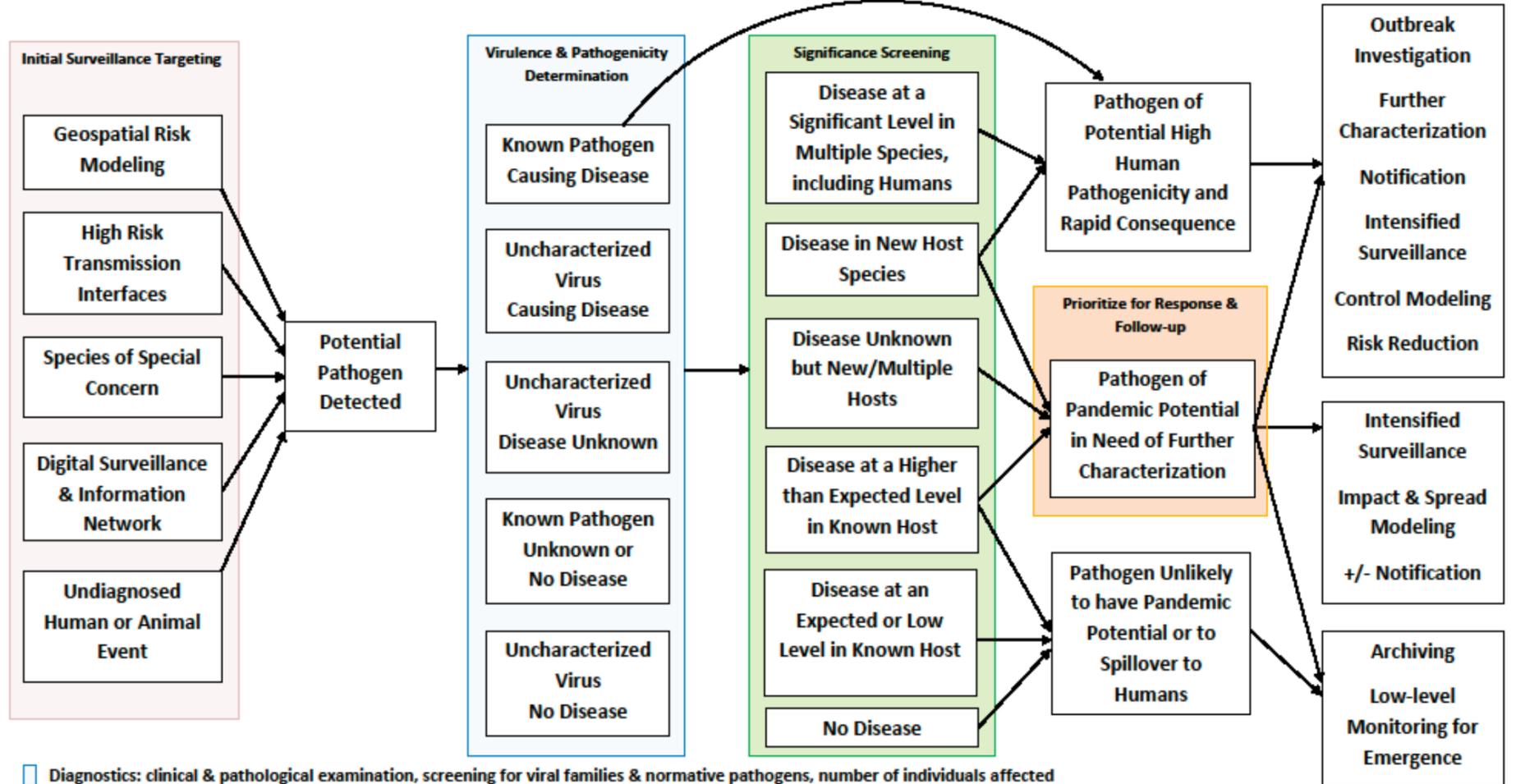




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Wildlife SMART Surveillance



□ Diagnostics: clinical & pathological examination, screening for viral families & normative pathogens, number of individuals affected

□ Rapid Epidemiologic Analysis & Modeling: incidence, host & number of species affected, demographics, location & spread

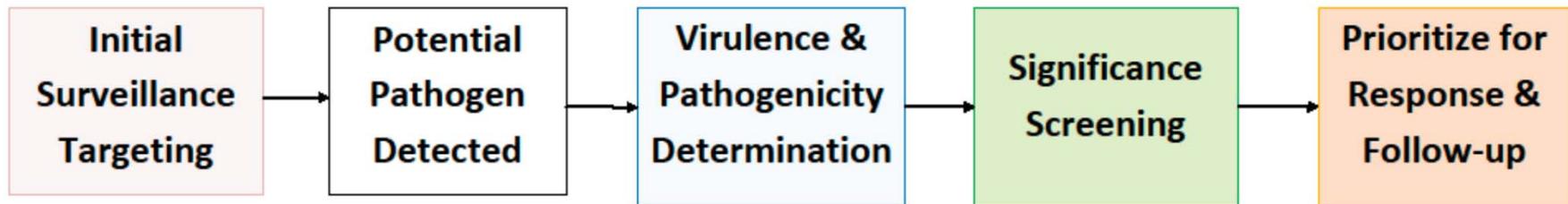
□ Molecular Characterization & Modeling: relatedness to human pathogens, transmissibility factors, opportunity for spillover & spread, pathogenic potential in new hosts & ability to counteract host defenses, emergence & evolutionary history



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PREDICT

Wildlife SMART Surveillance



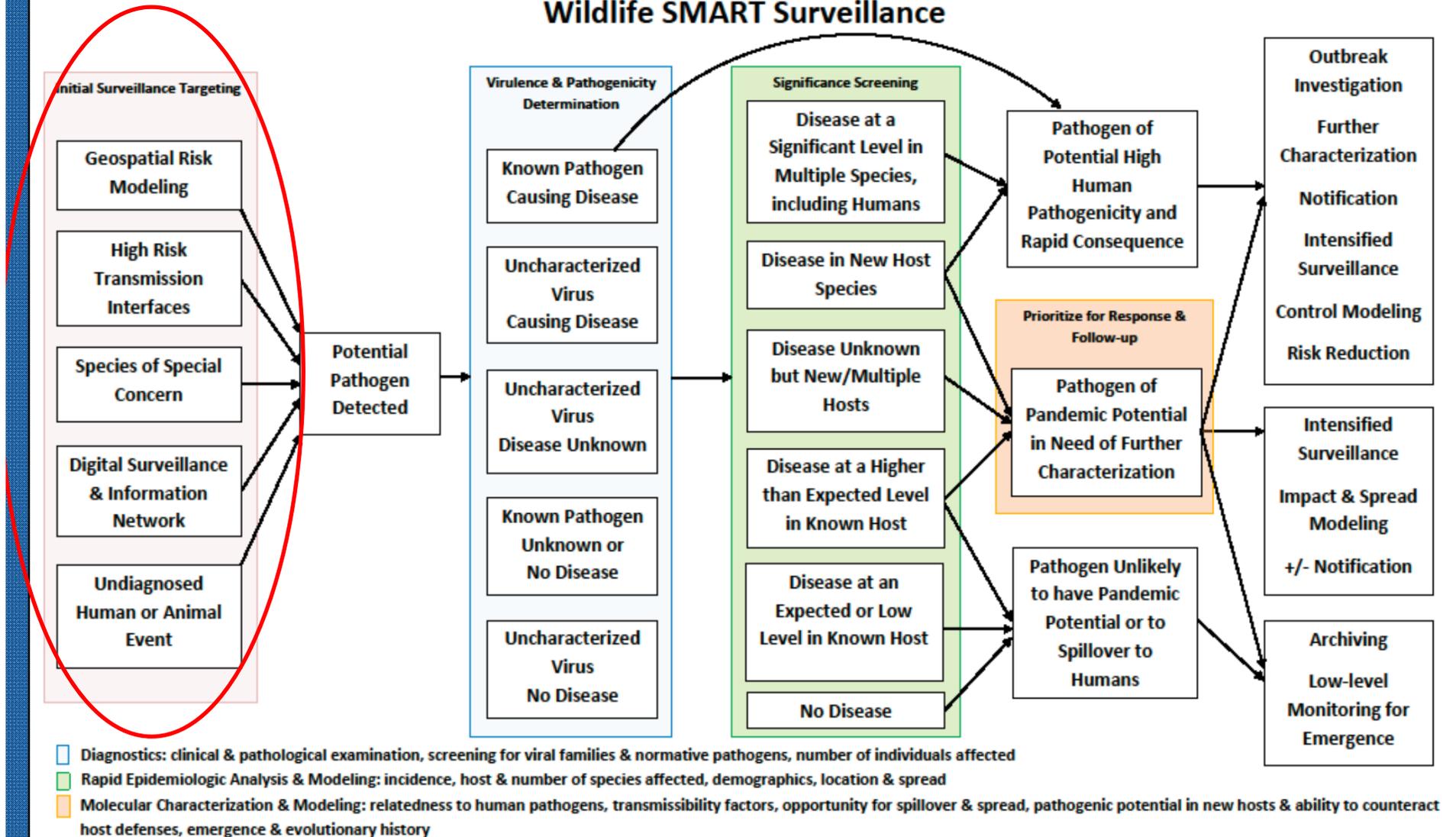
-  **Targeting Surveillance:** risk modeling, identifying interfaces, species considerations, remote sensing, situational analysis
-  **Diagnostics:** clinical & pathological examination, screening for viral families & normative pathogens, number of individuals affected
-  **Rapid Epidemiologic Analysis & Modeling:** incidence, host & number of species affected, demographics, location & spread
-  **Molecular Characterization & Modeling:** relatedness to human pathogens, transmissibility factors, opportunity for spillover & spread, pathogenic potential in new hosts & ability to counteract host



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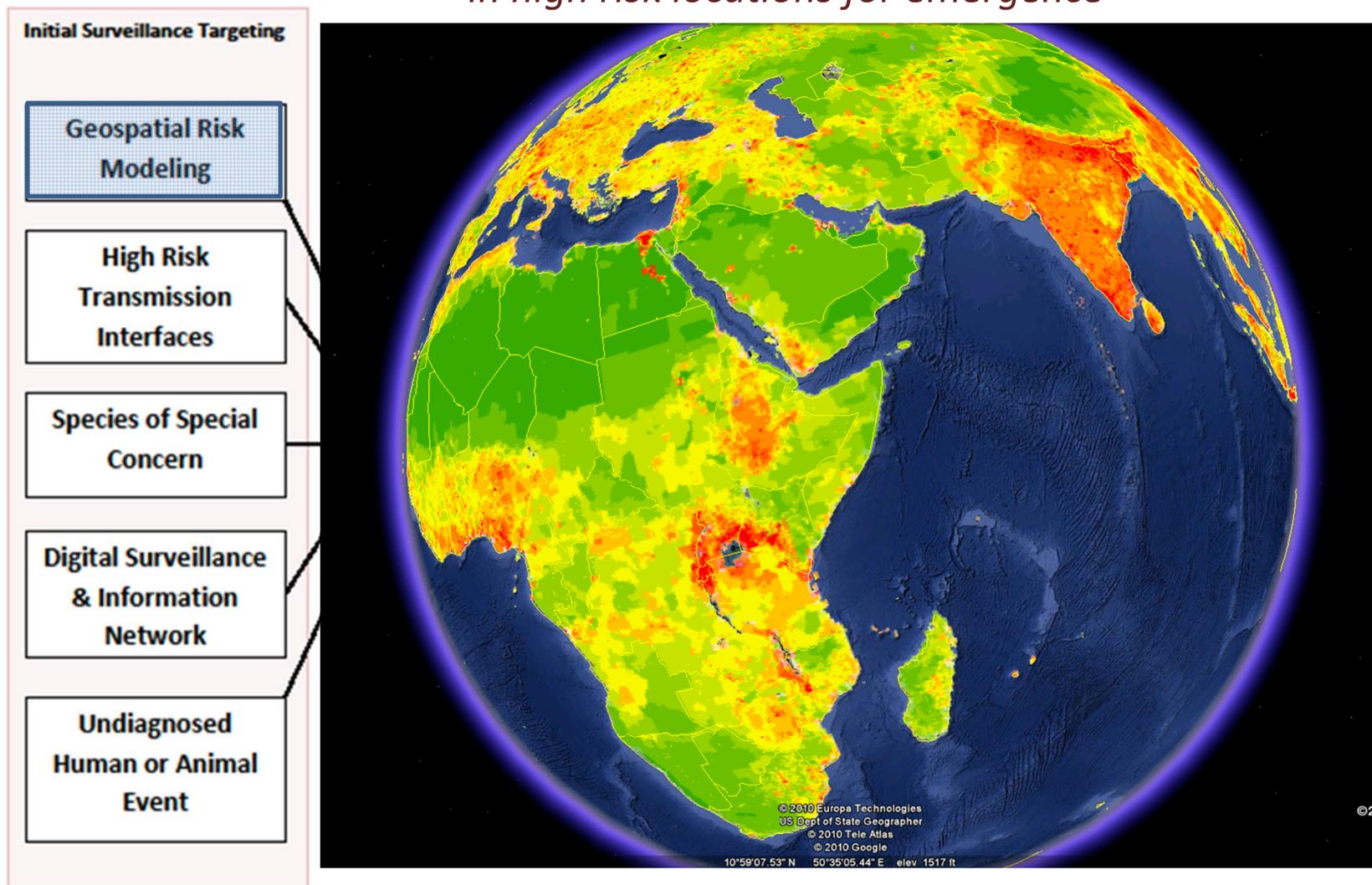
PREDICT

Wildlife SMART Surveillance



Developing a Targeted Surveillance Strategy

in high risk locations for emergence

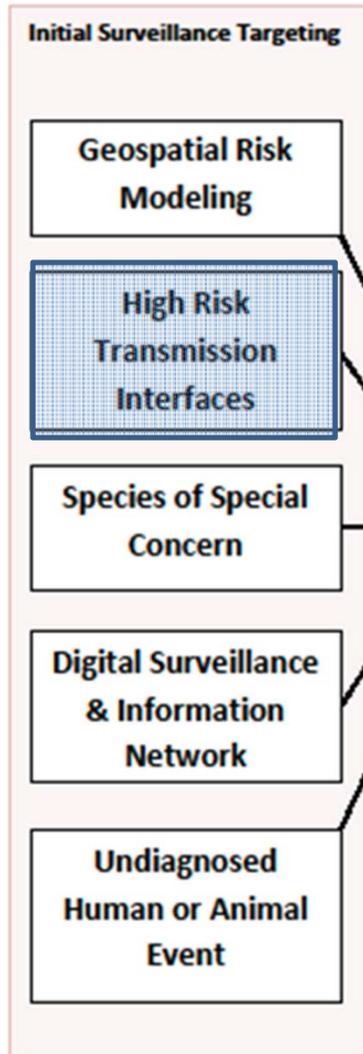


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Developing a Targeted Surveillance Strategy

along high risk disease transmission interfaces



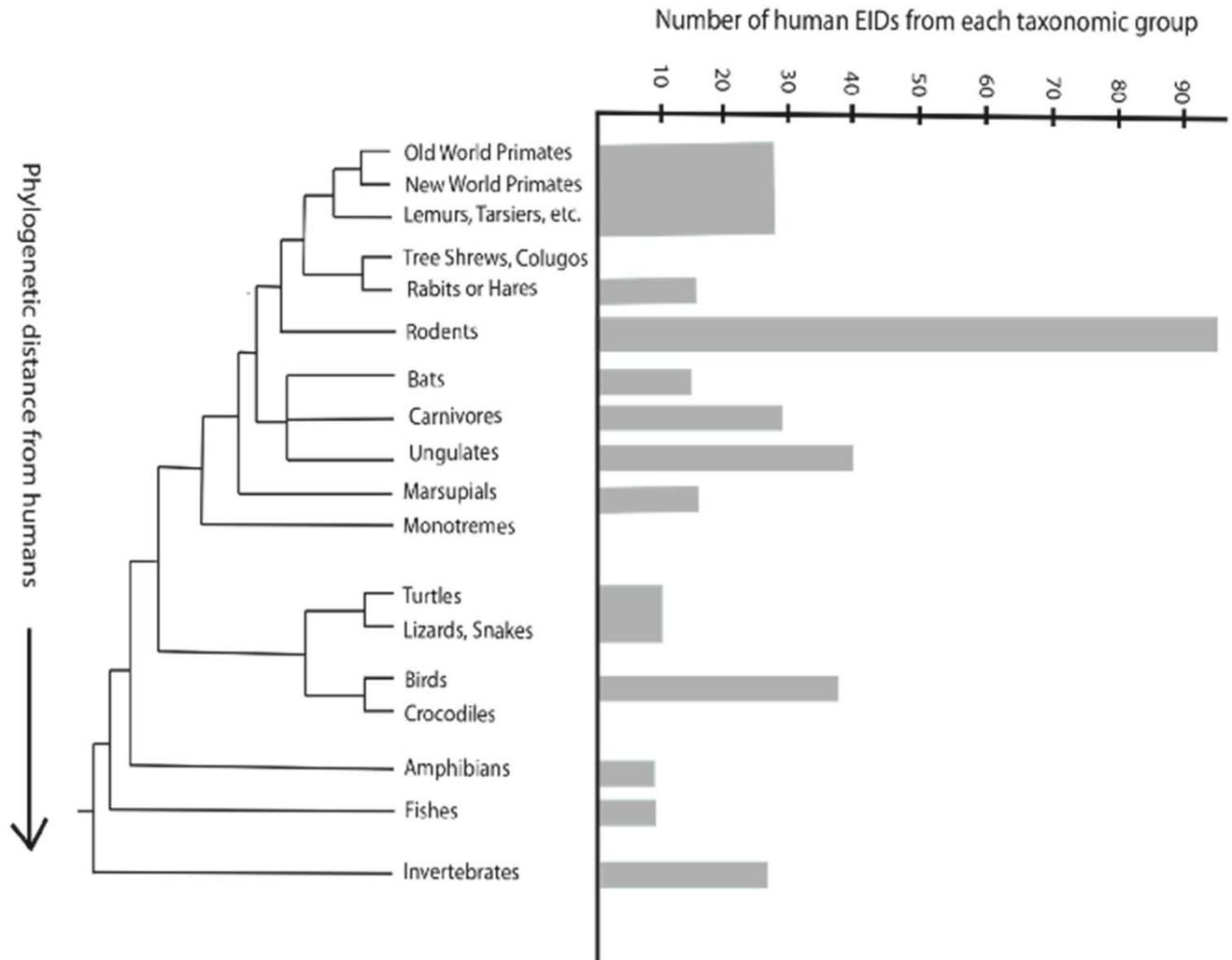
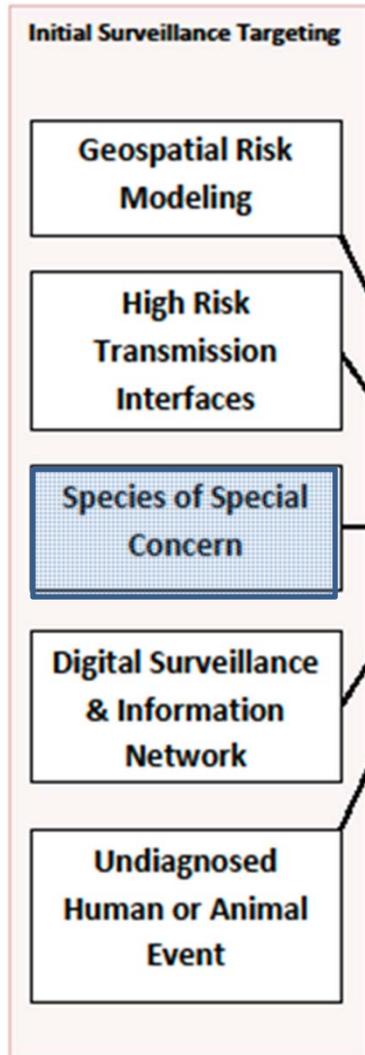
- Hunting
- Markets/trade
- Wildlife/livestock conflict
- Extraction
- Land use change
- Water availability
- Global transportation



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Developing a Targeted Surveillance Strategy for wildlife species of highest risk

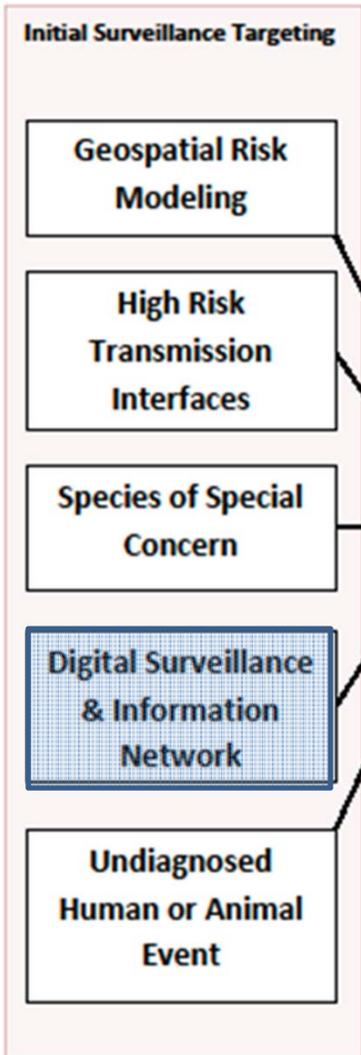


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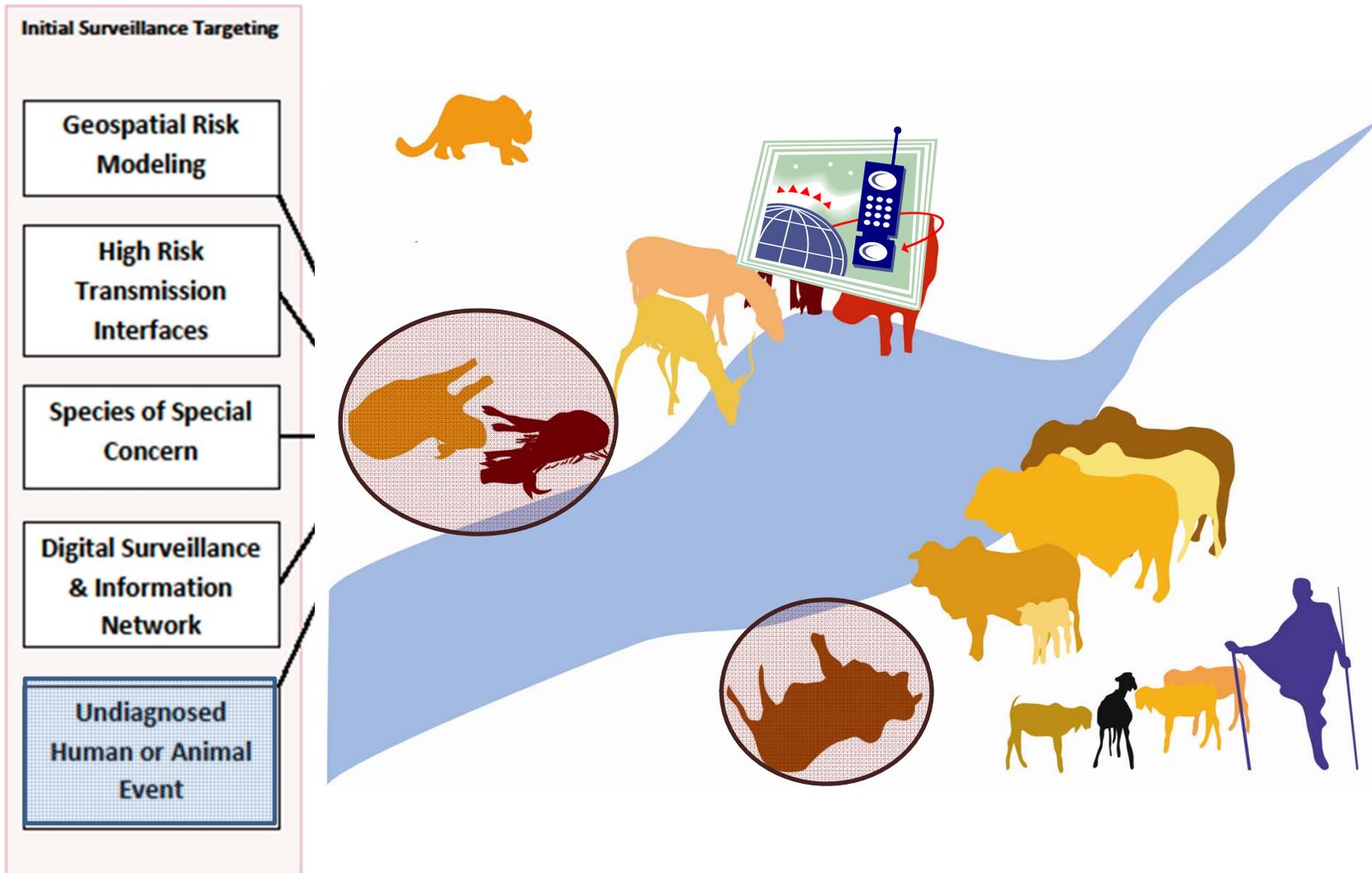
Developing a Targeted Surveillance Strategy

using global information real-time



Developing a Targeted Surveillance Strategy

responsive to potential pathogen emergence



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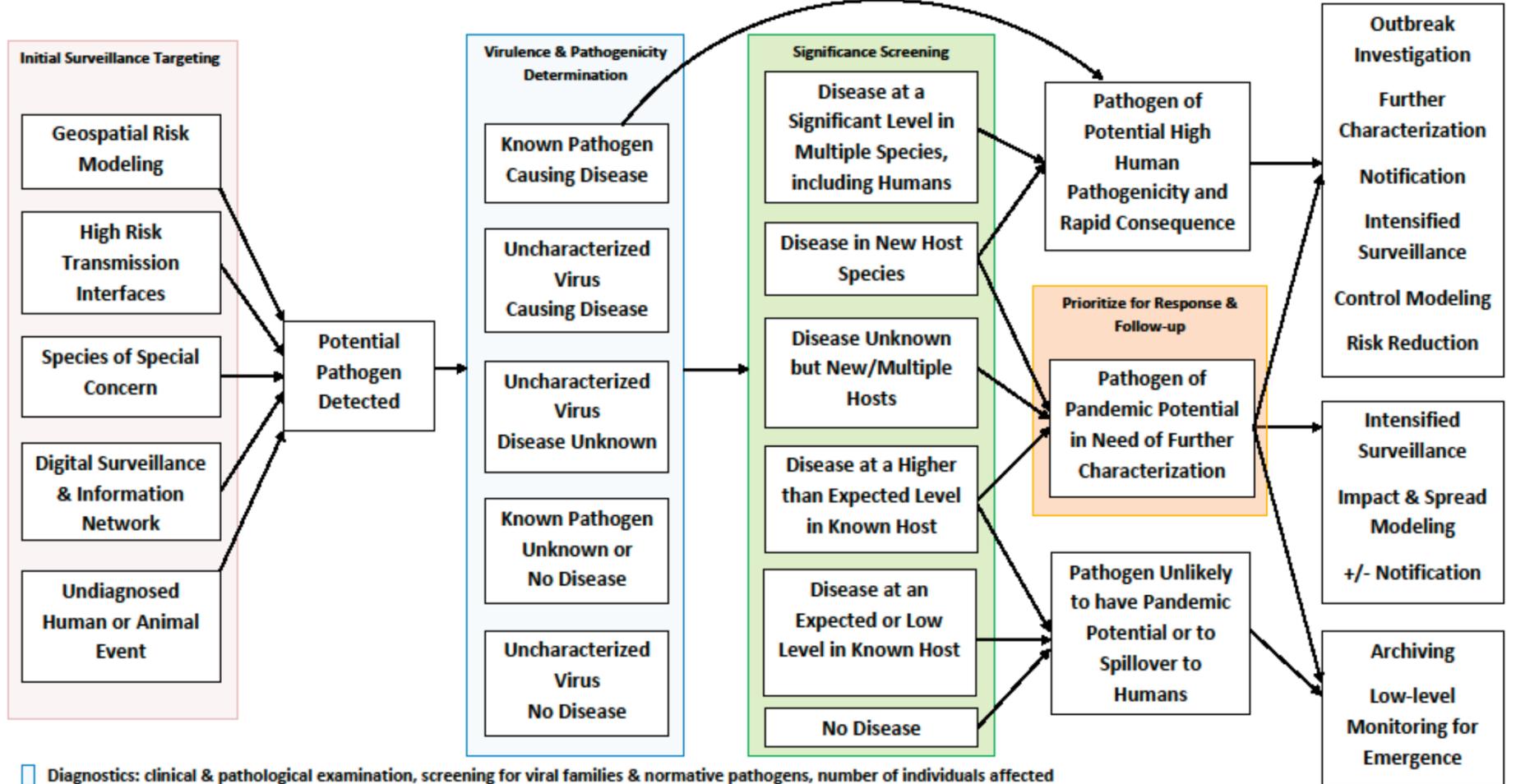
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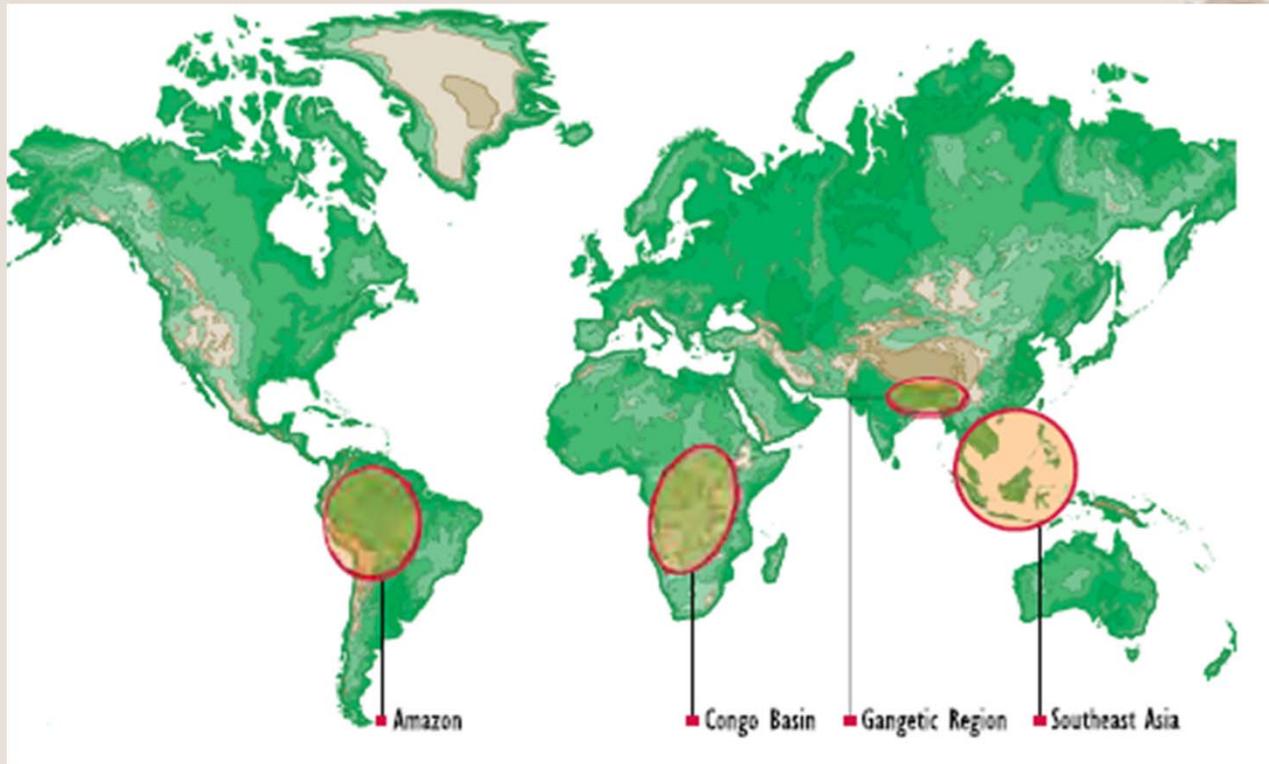
PREDICT

Wildlife SMART Surveillance



- █ Diagnostics: clinical & pathological examination, screening for viral families & normative pathogens, number of individuals affected
- █ Rapid Epidemiologic Analysis & Modeling: incidence, host & number of species affected, demographics, location & spread
- █ Molecular Characterization & Modeling: relatedness to human pathogens, transmissibility factors, opportunity for spillover & spread, pathogenic potential in new hosts & ability to counteract host defenses, emergence & evolutionary history

EPT: Targeting “Hot Spots”



Southeast Asia

Cambodia
China
Indonesia
Laos
Malaysia
Philippines
Thailand
Vietnam

Amazon

Bolivia
Brazil
Colombia
Ecuador
Mexico
Peru

Congo region

Angola	Eq. Guinea
Burundi	Gabon
Cameroon	Rwanda
CAR	Tanzania
Congo	Uganda
DR Congo	

South Asia

Bangladesh
India
Nepal