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Health Impacts from Climate Change & Zoonotic Spillover:

A Geospatial Model for Surveillance and Action

Agenda

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Capabilities & Clients

Disease Surveillance & Intervention Solutions

Health Equity & Risk Insights

Social Determinants of Health Data & Indices

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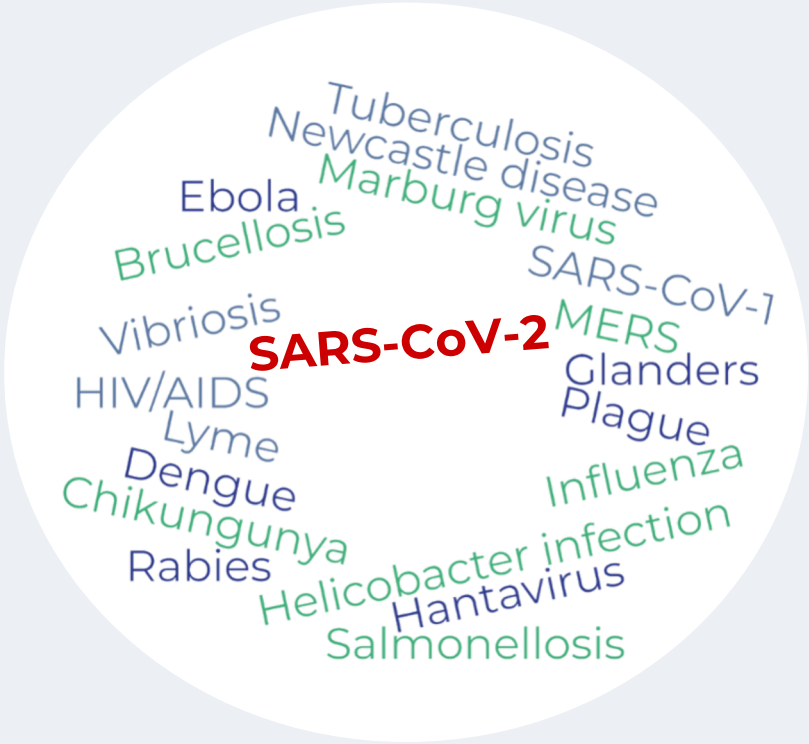
Zoonotic Spillover



A zoonosis is an infectious disease that has jumped from non-human animals to humans.[1]

- More than **6 out of every 10** known infectious diseases have zoonotic origins.[2]

- **3 out of every 4** new or emerging infectious diseases in humans come from animals.[2]

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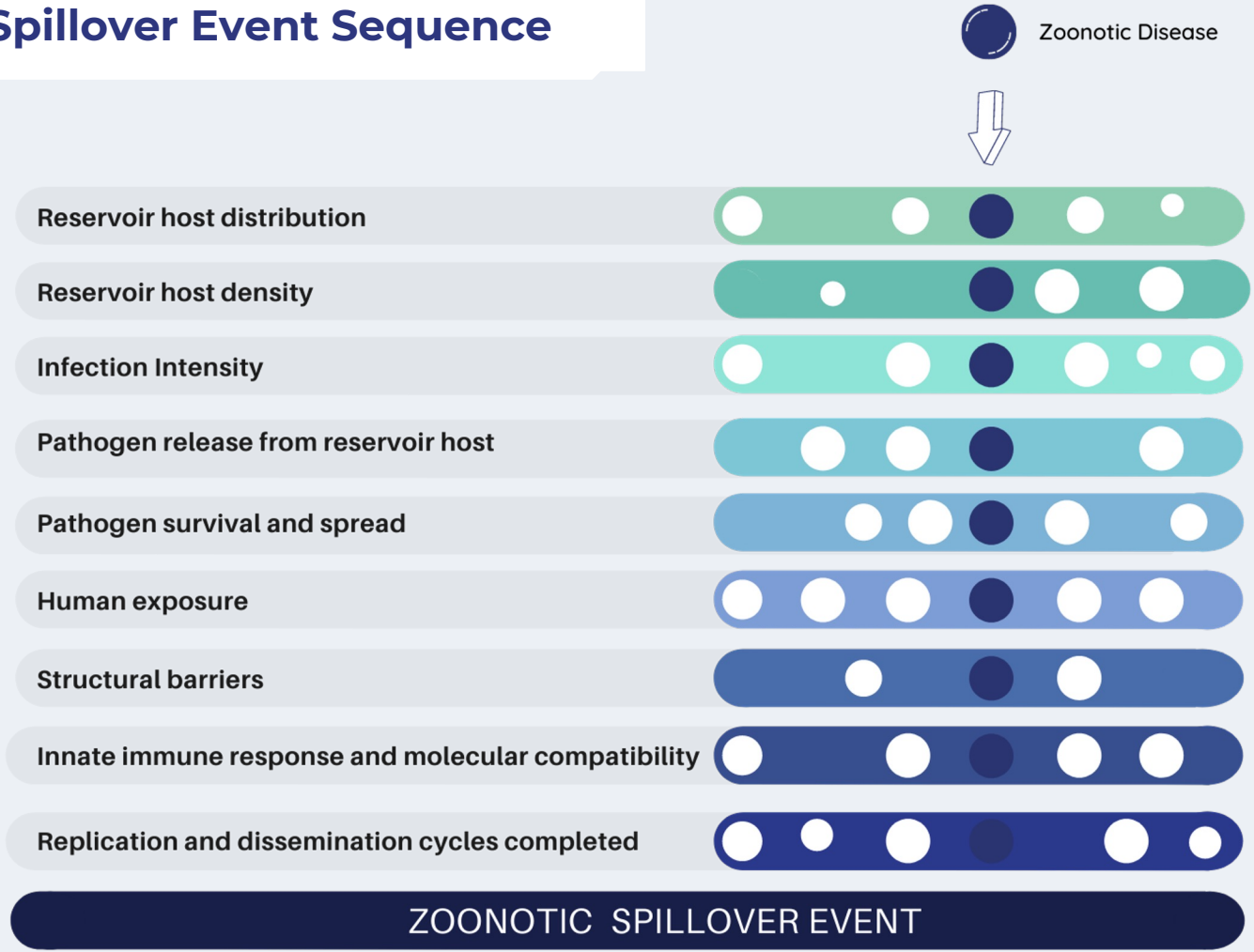
Zoonotic Spillover Event Sequence



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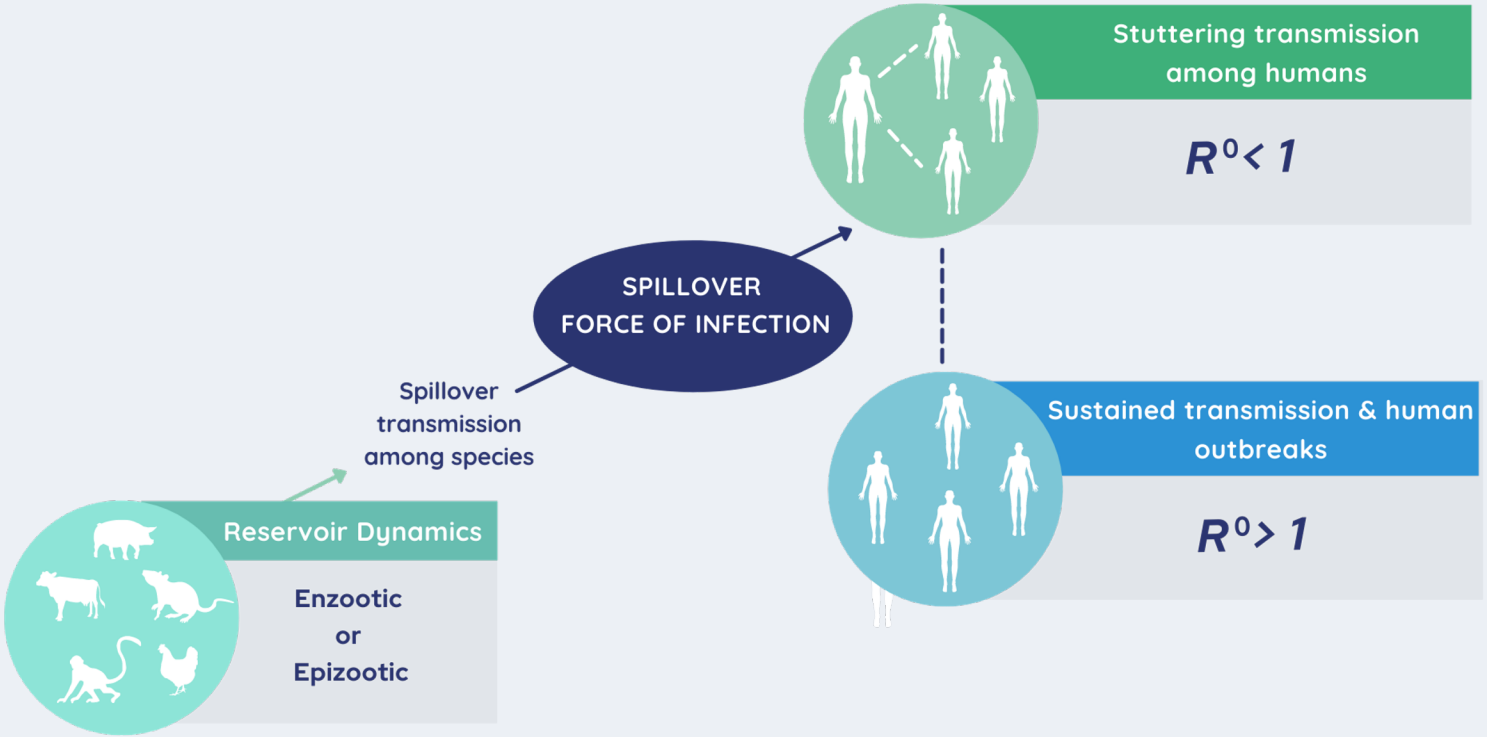
Zoonotic Spillover



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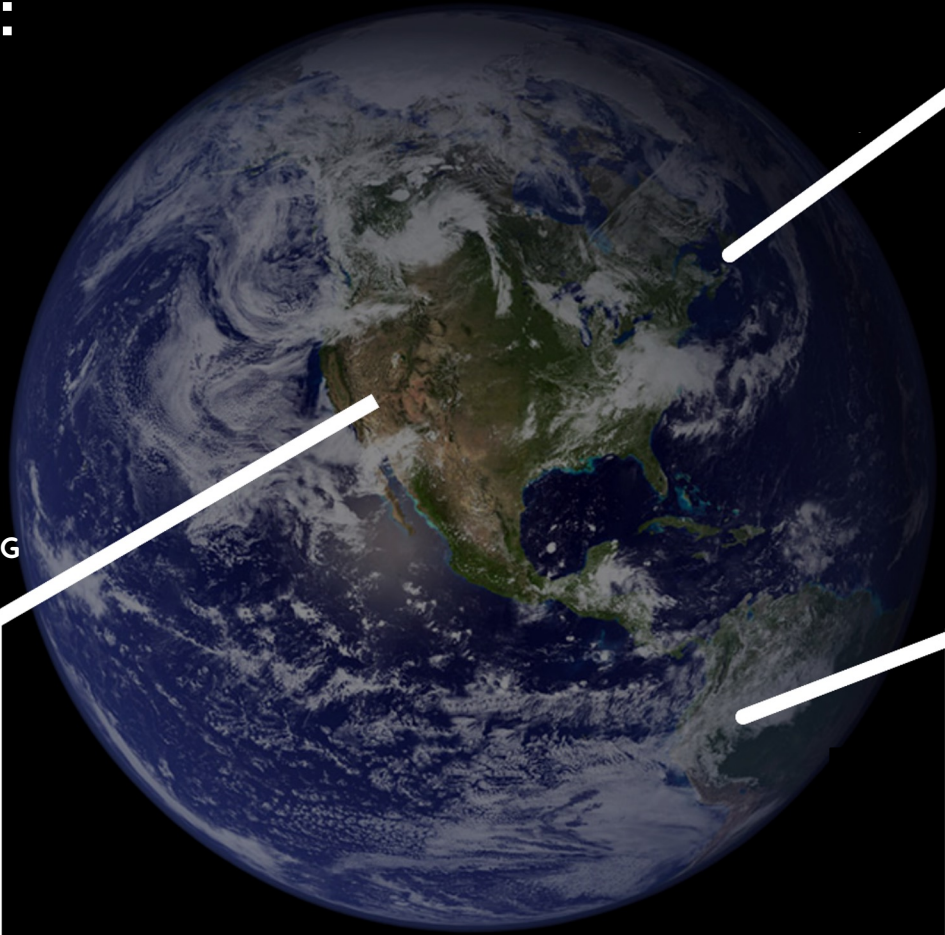
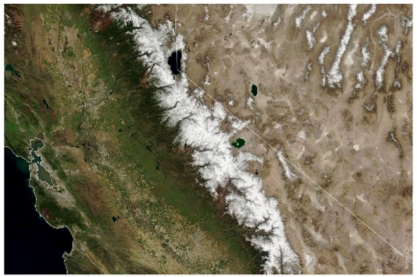
Climate Change:

Global Impact



BIODIVERSITY LOSS

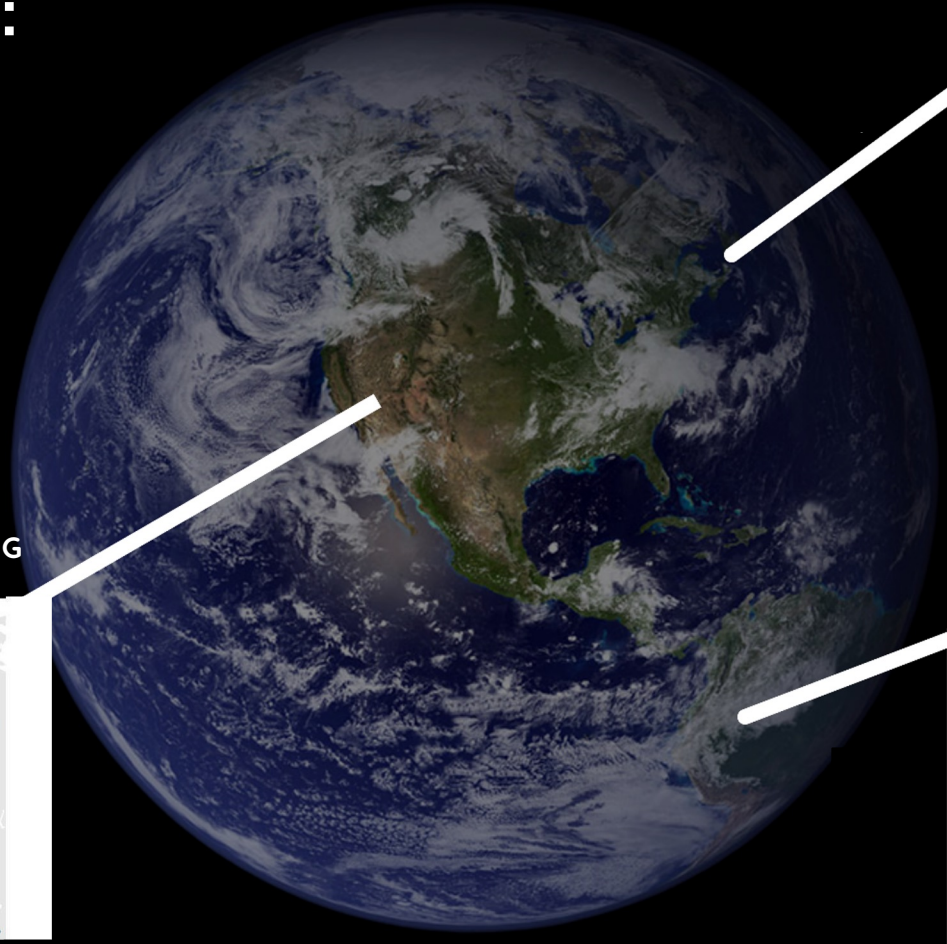
MELTING PERMAFROST EXPOSING ANCIENT VIRUSES



DEFORESTATION & HABITAT LOSS

Climate Change:

Global Impact



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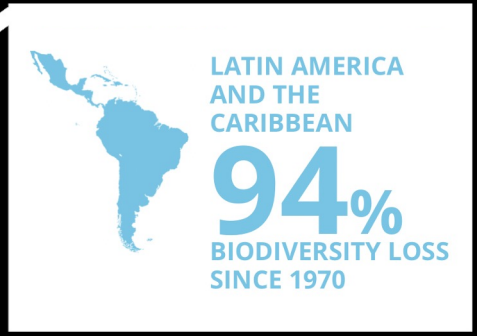

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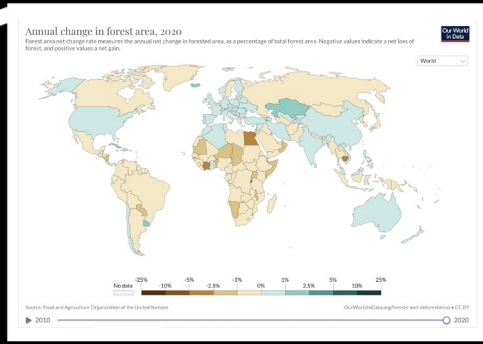
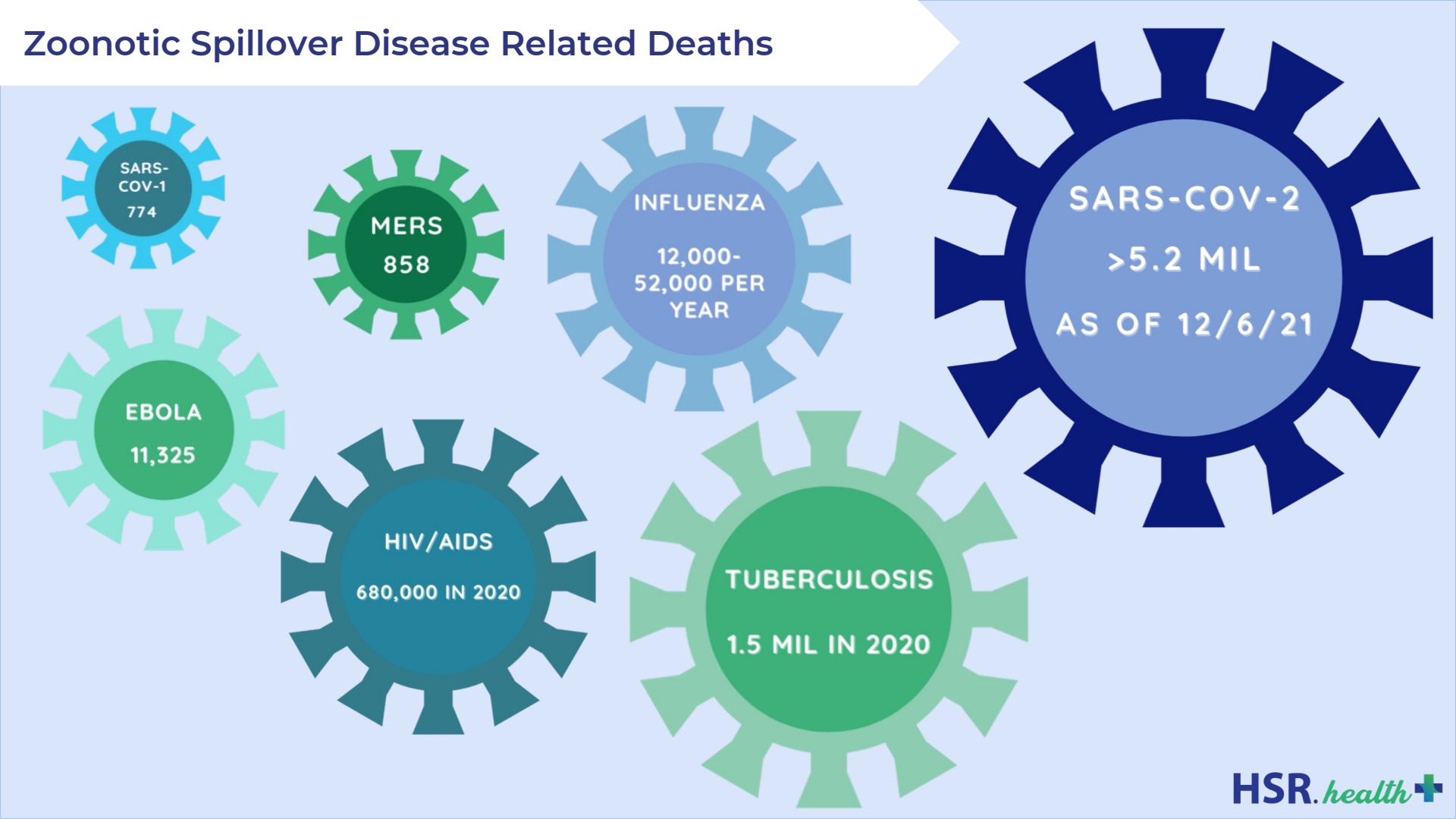


Zoonotic Spillover Disease Related Deaths



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Existing Systems

SAGES
Suite for Automated Global Electronic bioSurveillance

ESSENCE

OPEN DATA KIT

sormas

PODD
ผ่อดีดี

MedShr
Share knowledge
Save lives

epiinfo™

CommCare

KoBoToolbox

GoData

NSSP
National Syndromic Surveillance Program
BioSense Platform

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Our Approach

- Ingest models of climate change and its environmental and habitat impacts
- Geospatial mapping of high risk areas for zoonotic spillover
- Collaborate with public health decision makers to react and respond to emerging disease threats
    - Target surveillance capabilities to areas of highest zoonotic spillover risk

gideon

NASA

Food and Agriculture Organization of the United Nations

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Methods

Disease and Outbreak
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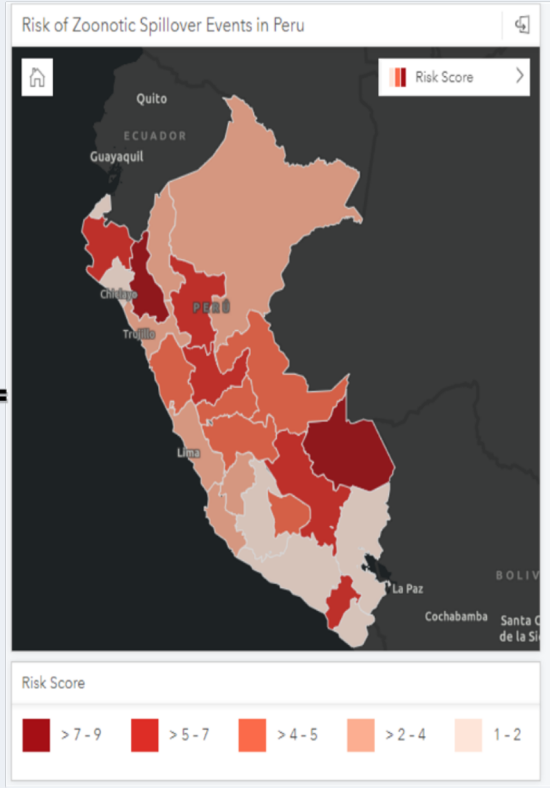
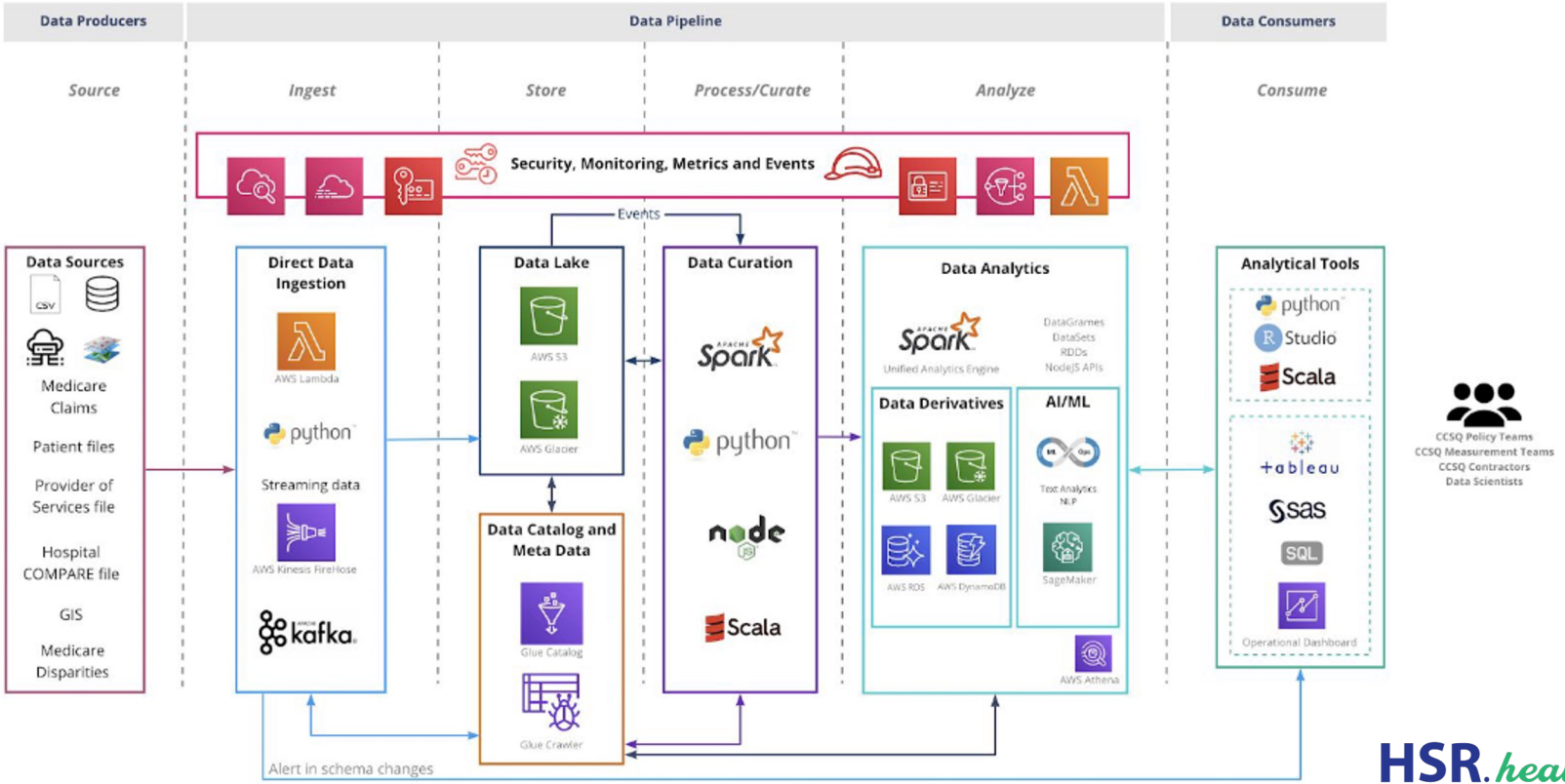
Earth Observation
Social Determinants of Health
Data Gathering
Cleaning, Preparation and Manipulation
Feature Extraction and Selection
Processed Data
ID
Year
Deforestation
SVI
EID events
1
2021
.54
.37
2
Machine Learning


Risk of Zoonotic Spillover Events in Peru
Risk Score
Quito
ECUADOR
Guayaquil
Chiclayo
Trujillo
Lima
La Paz
Cochabamba
Risk Score
> 7 - 9
> 5 - 7
> 4 - 5
> 2 - 4
1 - 2

Data Flow



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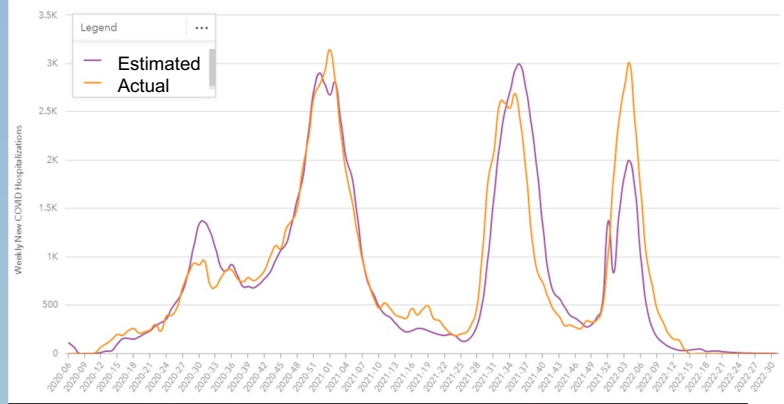
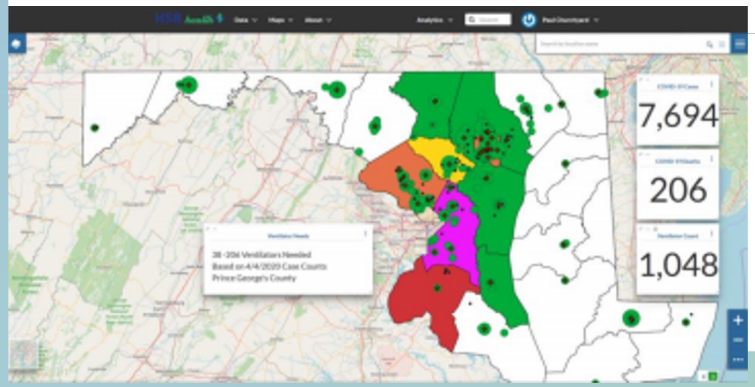
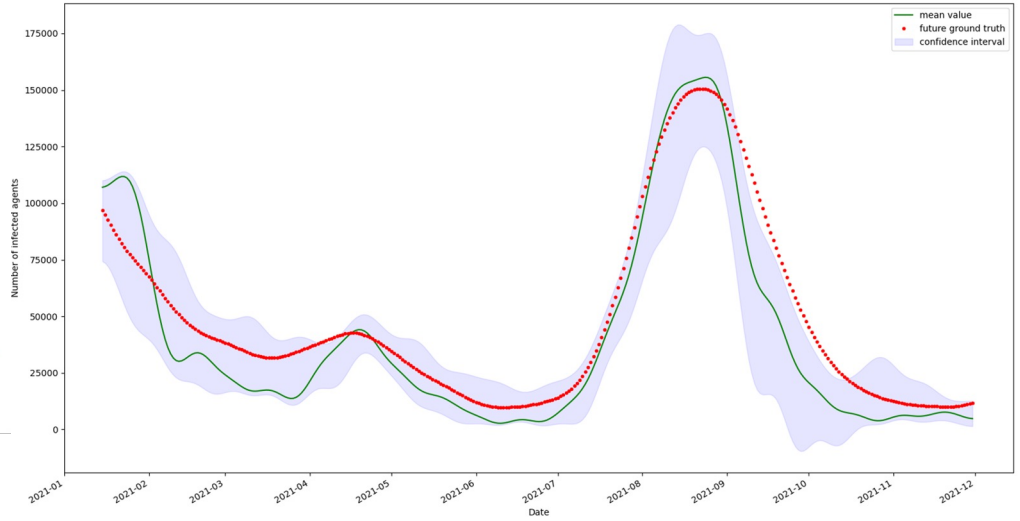
Experience in Predicting Health Resource Needs and Outcomes

Feb ‘20-’22 Weekly Estimated vs Actual FLU+COVID Hospitalizations, Alabama





January ‘21-’22 Prediction vs Actual COVID-19 Case Counts



“COVID-19 has forced us to think differently and leverage data in a more meaningful way,” says Kenneth T. Bellian, MD, MBA, Principal, Chief of Clinical Innovation, Jensen + Partners. “It has been paramount to determine the future demand for services and then have the ability to align the critical resources such as clinical space, staffing, and equipment like ventilators. Future forward applications like HSR.*health*’s Risk Indices are indispensable when aligning the supply of scarce resources with the pending demand for services.”

Call to Action:

Proof of Concept

- Criteria for Candidate Regions/Countries:
  - High risk animal populations
  - Climate change susceptibility
  - History of emerging zoonotic disease
  - Overall health burden
- Location: Sub-Saharan Africa, Peru, India
- Disease: Viral Hemorrhagic Fever (Africa)
- Timeline: 12 weeks
- Collaboration between public health systems, medical systems, and data providers (EO, mobility data)

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Benefits

- Preventing future pandemics and lowering local & global disease burden
- Developing faster & comprehensive techniques for disease surveillance
- Reduced economic impact of disease local & global
- Deployment of advanced technology
- Capacity building in GIS, AI, public health
- Opportunity for international collaboration
- Advancing the capacity of global public health

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Conclusion

- Global efforts to stem climate change are underway, yet planning for its potential impact remains urgent.
- Zoonotic spillover events have the potential to lead to new global pandemics.
- Current infrastructure and surveillance methods are built to respond after new emerging infectious diseases have already spread.
- Our approach will make accurate predictions on where a potential spillover event is likely to occur to aid in proactive measures.

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Careers :

https://hsr.health/careers/

esri THE SCIENCE OF WHERE	HSR.*health* leverages the broad, global reach of the Esri's ArcGIS Marketplace to market its GeoAI solutions for public health.
xentity corporation	Xentity and HSR.*health* collaborate on designing enterprise ready solutions responsive to the needs of the emergency response and public health communities.
gideon	Data curation and technical collaboration to develop and communicate global infectious disease risks.
Open Geospatial Consortium	A close and historied partnership focusing on broad industry collaboration to leverage geospatial technologies in addressing global public health challenges.
Portals LLC GLOBAL CONSULTING GROUP	Portals LLC and HSR.*health* are proud to have responded to the shifting needs of governments in addressing COVID-19 response needs.
aws	AWS provides promotional credits and technical cloud resources supporting the growth and expansion of our GeoAI suite of solutions.
skymantics	Skymantics and HSR.*health* collaborate on the extraction of health risk information from EO data in real time.
RSS-Hydro	RSS-Hydro and HSR.*health* collaborate on the extraction of health risk information from EO data in real time.

References

- Human encroachment on natural habitats account for 30.6% of all zoonotic emergences[3]
- The annual deforestation rate between 2015-2020 was estimated at 10 million hectares[4]
- Optimal rates of spillover occur once 40% of the forest cover disappears[5]
- Our World In Data tracking of deforestation on a national scale[7]
- World Wildlife Fund's 2020 Living Planet Report[8]
- Between 870-8,700 species will become extinct each year[5,6]
- Melting Permafrost releases unanticipated diseases[9]

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