LA-UR-23-28794

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Title:	Developing a holistic biosurveillance capability
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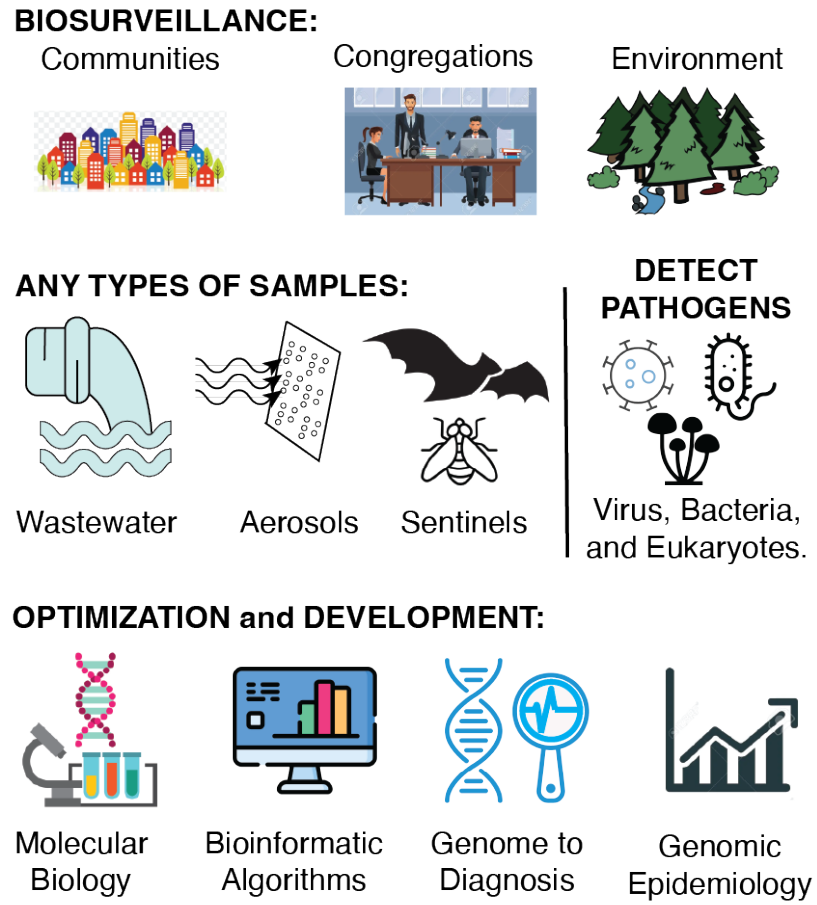
Intended for:	DOE requesed slide decks for external communications
Issued:	2023-08-01

Los Alamos
NATIONAL LABORATORY

Developing a holistic biosurveillance capability

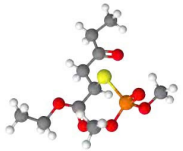
- Supporting the *National Biodefense Strategy for Countering Biological Threats, Enhancing Pandemic Preparedness and Achieving Global Health Security* to **develop a national roadmap for biosurveillance early warning**
- New methods to acquire, store, preserve and prepare all types of clinical, wastewater and environmental samples: **Any pathogen, any sample**
- New computational tools and web platforms for robust:
  - Identification of **any pathogen, known or unknown**
  - Characterization of pathogenic and **pandemic potential**
  - Linking genomics to **diagnostic and therapeutic assay design**
  - Feeding genomics data toward **forecasting and epidemiology**

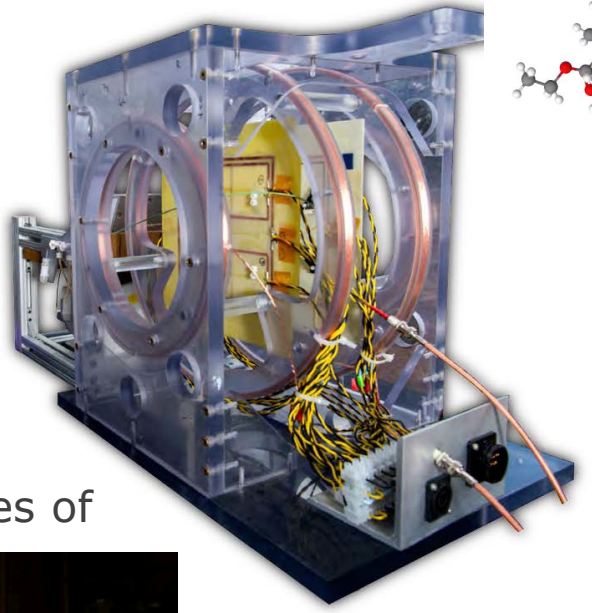


Positioning the US for routine environmental biomonitoring: toward environmental awareness, early warning and pandemic preparedness

Unique & portable biological and chemical threat detection

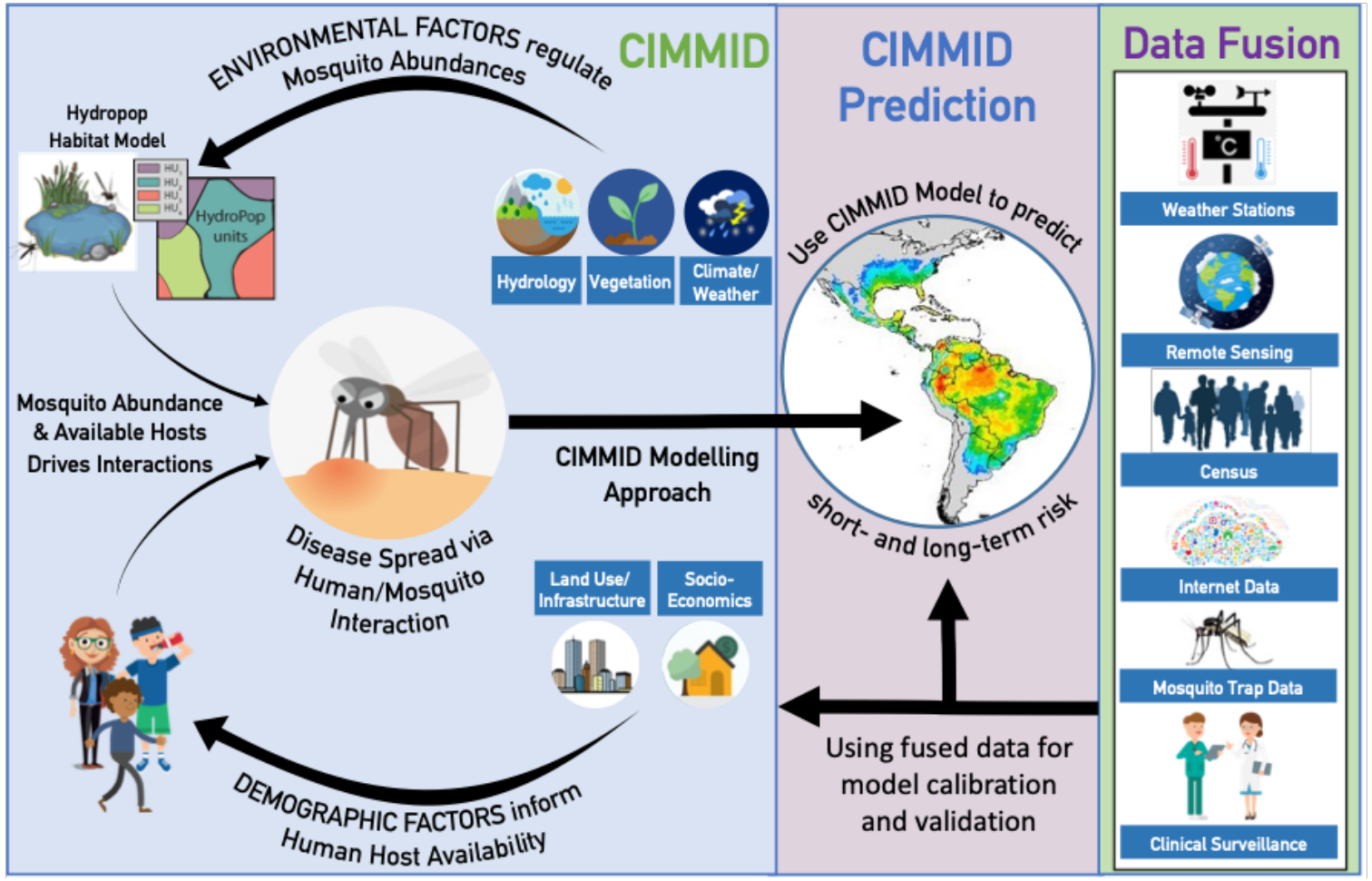
- **Earth's Field Resonance Detection and Evaluation devices (ERDE)**
  - Distinguishes chemical species via unique spectra
  - Provides lightweight, portable, battery-powered design
  - Measures small, contained liquid or solid samples automatically
  - Allows through-container chemical identification for many materials





- **Spectroscopic Detection of Nerve Agents (SEDONA)**
  - Screens for nerve agents through an unopened bottle using the principles of nuclear magnetic resonance spectroscopy
  - Easily moved to point of need such as airports or security checkpoints
  - Results available in 8 seconds
  - Extremely low false negative/false positive rate

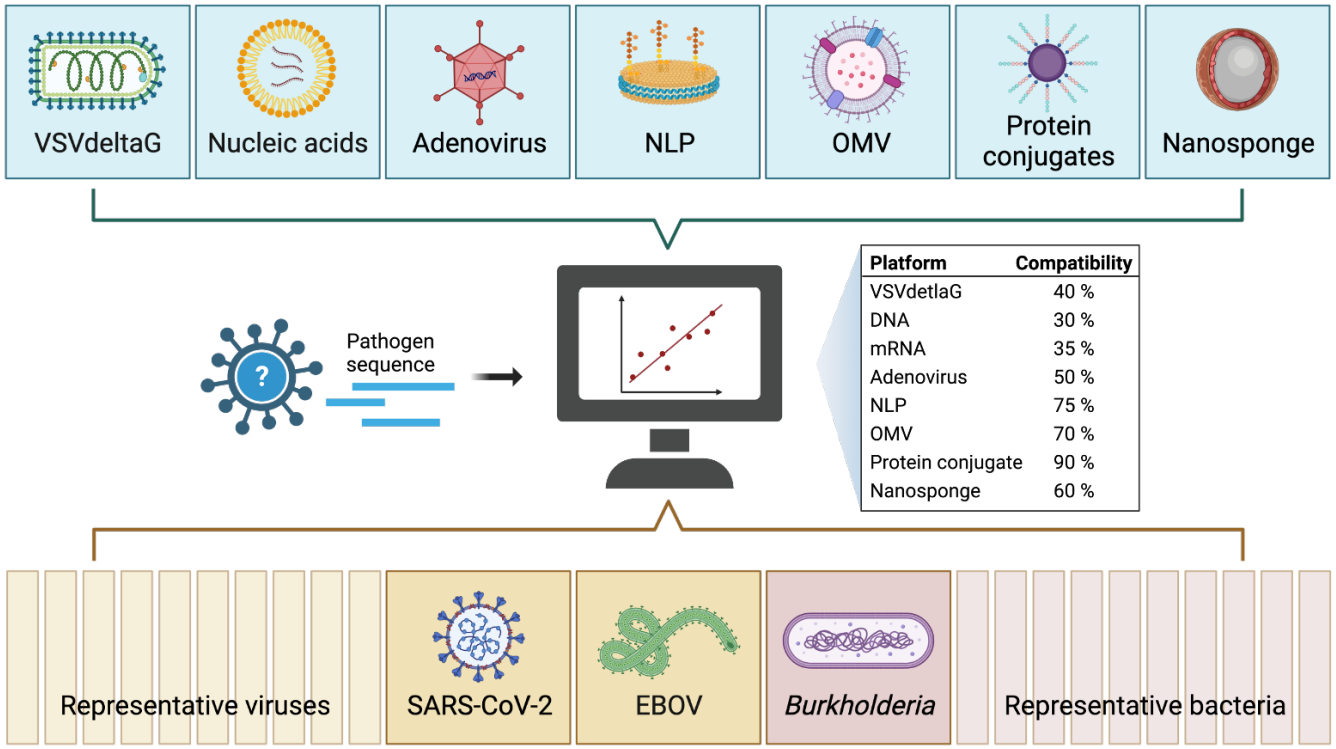
Climate-Informed Predictions: Vector Borne Disease Forecasting at Continental Scales



- LANL is an expert in integrating climate with disease models at scale to enable continental wide predictions at decadal time scales
- Climate Integrated Model of Mosquito-borne Infectious Diseases (CIMMID) is a modular framework that accurately represents key processes of disease risk and spread in the complex system of natural environment, vector, human, and pathogen under a changing climate
- Predicts mosquito/vector occurrence maps
- Informs mitigations, scenario planning, forecasting, risk assessments

DOE National Laboratories are developing a computational capability to rapidly select suitable vaccine platforms for any pathogen

- Highly interdisciplinary team of scientists from 11 DOE, DoD and University Institutions
- Combining expertise in machine learning/ artificial intelligence, computational biology, virology, bacteriology, and immunology
- Characterizing protective immune responses
- Developing a predictive capability for matching pathogens with the most appropriate vaccine platform
- Supports a rapid response to current, new, and emerging biological threats
- Minimize time-consuming vaccine design, testing, and manufacturing

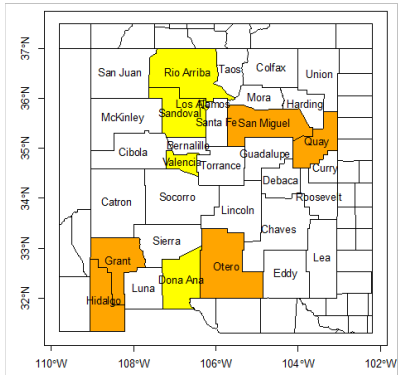


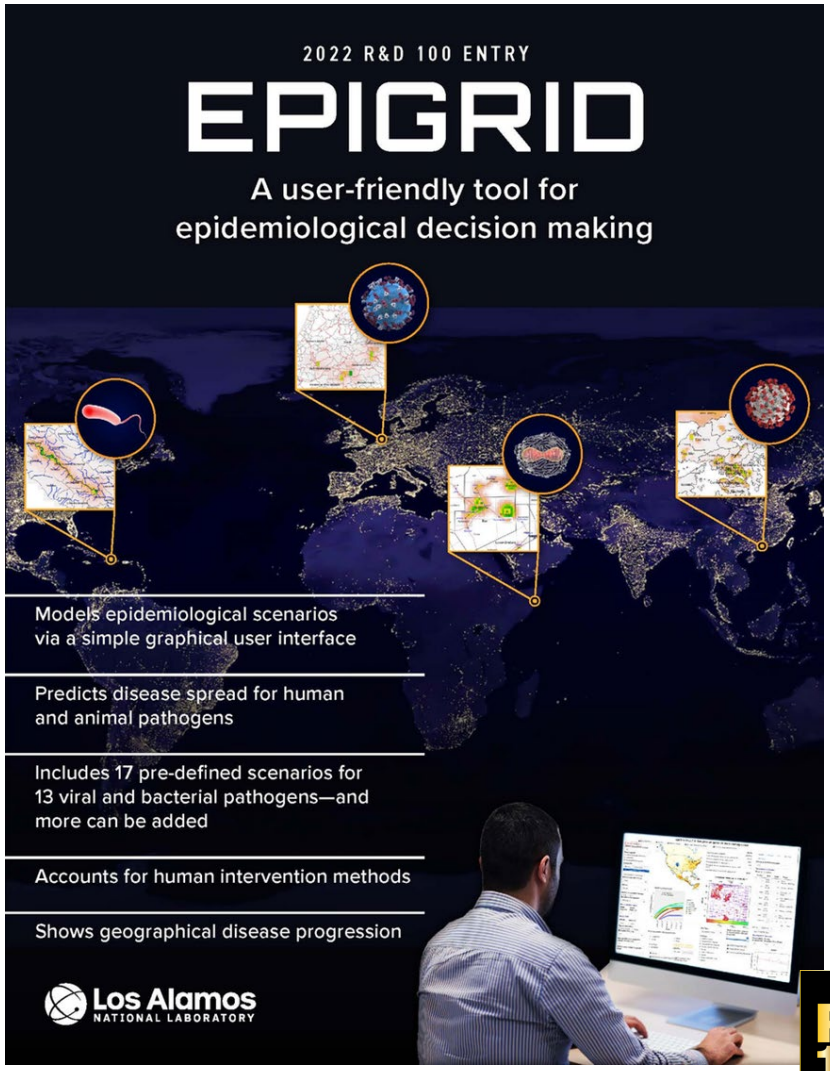
Epidemiological Decision Support and Analysis

EpiGrid

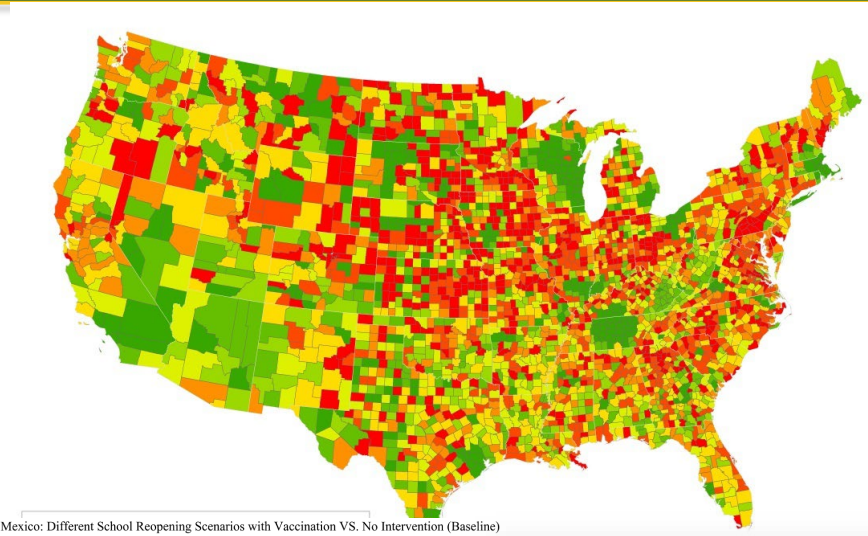
- Predicts disease spread for human and animal pathogens
- Includes 17 pre-defined scenarios for 13 viral and bacterial pathogens
- Accounts for human intervention methods
- Show geographical disease progression with resolution down to 1km

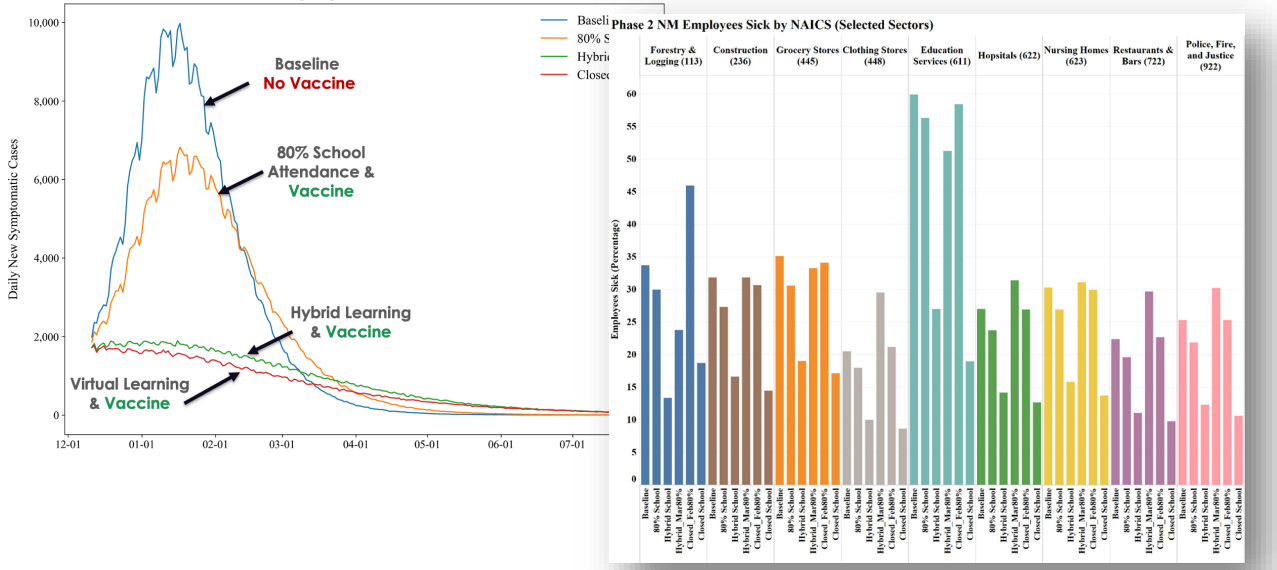
Situational Alerts: Flag Trends





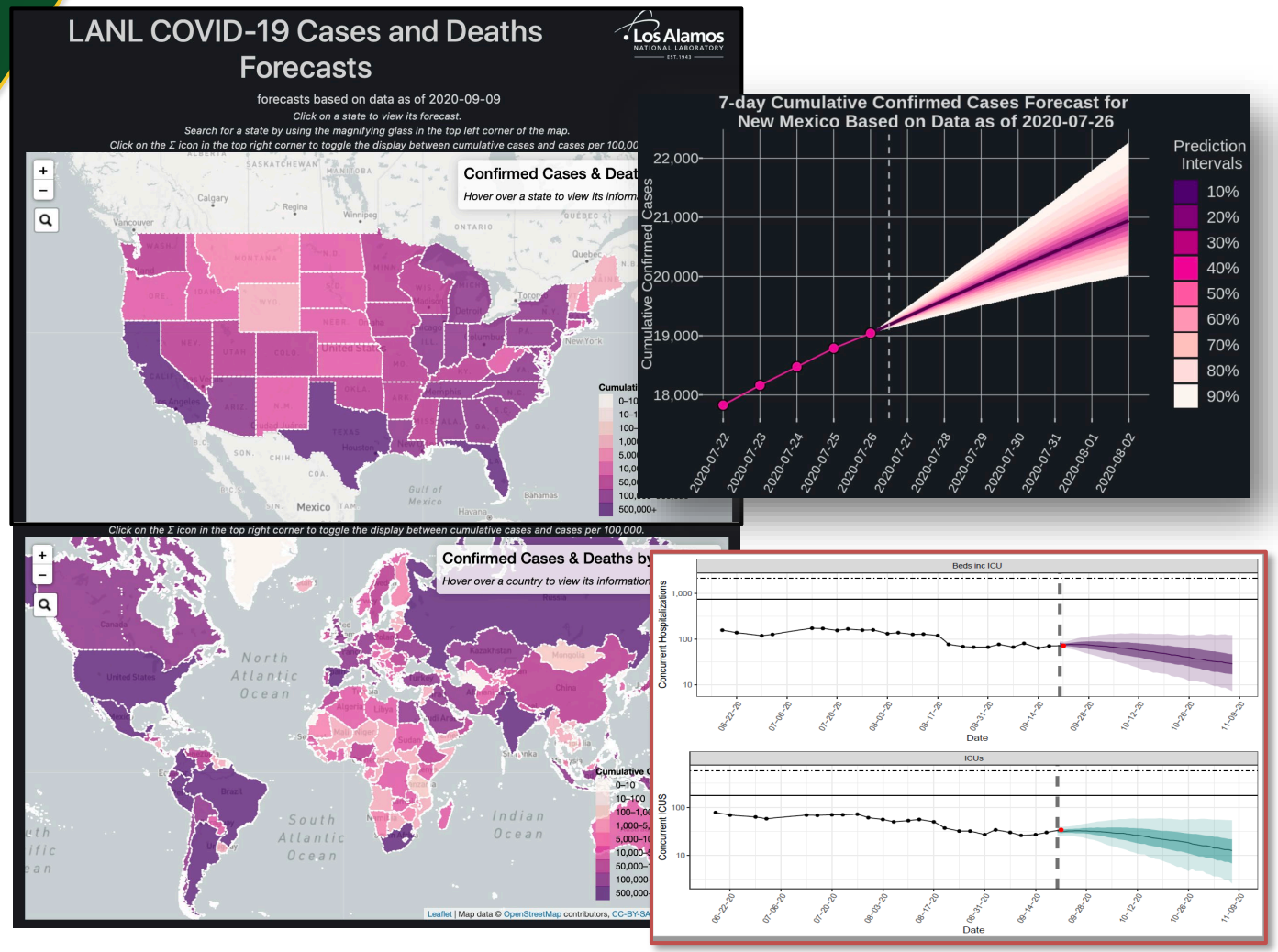
EpiCast: "What If" Modeling Capability





- EpiCast is an **agent-based model** used to simulate the spread of disease throughout the U.S. consisting of over 329 million synthetic people
- Explicit model of geography, demographics (age, gender, race/ethnicity), activities (school, work, household, neighborhood, community), and mitigations (vaccines, closures, travel restrictions, treatment, and human behavior))
- Captures workforce by 3-digit NAICS (North American Industry Classification System) and can assess ther impacts

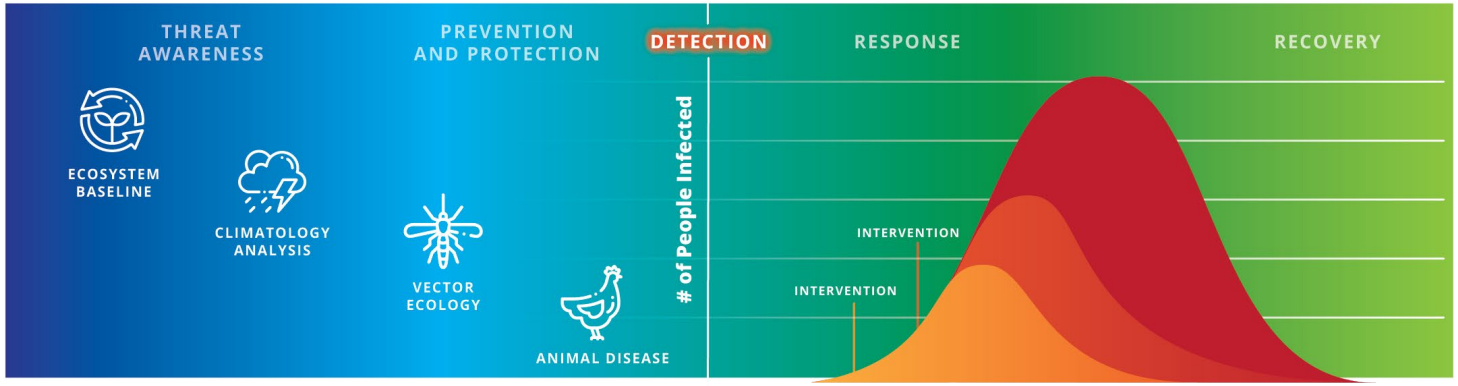
Global COVID-19 Forecasting

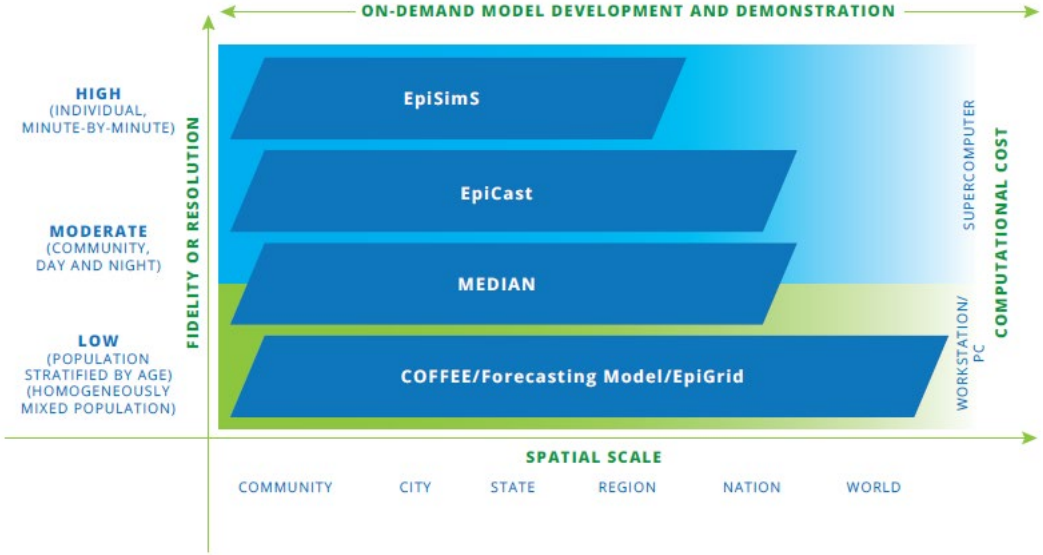


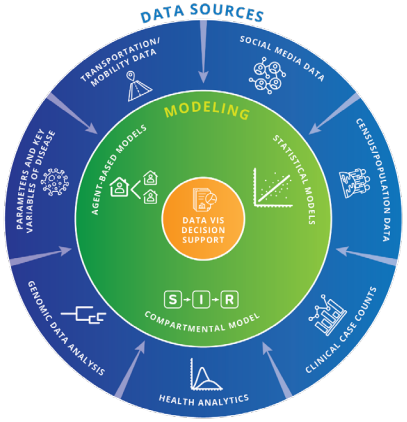
- The COVID-19 Forecasts using Fast Evaluations and Estimation (COFFEE) is a probabilistic model that **forecasts** daily reported cases and deaths
- **Geographic coverage**: Able to forecasts cases and deaths at the county, state, and national levels for the U.S. as well as at the regional level for 200 countries and territories
- **Short-term Healthcare Forecasts:** Ability to provide beds, ICUs, and ventilators needed for four weeks into the future and to identify moments where needs exceed capacity.

Multiscale Epidemiological Modeling

- Apply multi-scale modeling to detect, understand, forecast, prevent, and provide decision support in response to emerging and re-emerging disease outbreaks
- Mature capability to support operational decision making, scenario planning, forecasting







Integrated Plume Modeling in Complex Environments

- A first-of-its-kind ability to track bio-agent plume signatures between outdoor, subway, & indoor environments.
- Simulates transport and dispersion of agents (chemical, biological, or radiological) in the atmosphere
- Wildfire and smoke simulation
- Complex Terrain and Urban Areas
- Integrated with indoor and underground models
- Mature capability that can support technical reach back, training, scenario planning , and other operational uses