

Biosurveillance: A National Strategy for All-Hazards

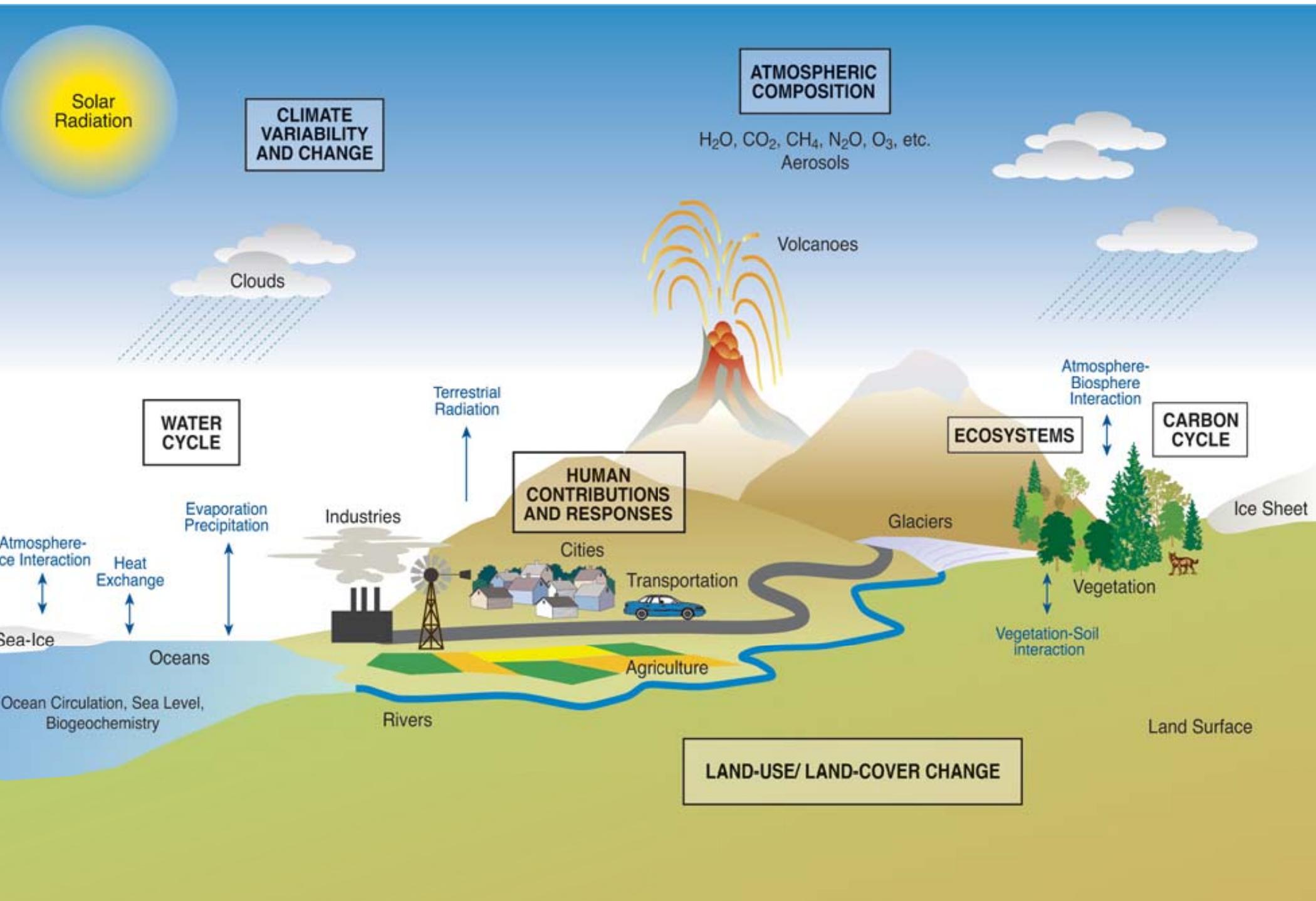
Aaron T Fleischauer, PhD, MPH
Centers for Disease Control and Prevention
North Carolina Division of Public Health



Biosurveillance:
A National Strategy for All-Hazards
*Even those that may or may not be related to
Climate Change*

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Solar Radiation

CLIMATE VARIABILITY AND CHANGE

ATMOSPHERIC COMPOSITION

H_2O , CO_2 , CH_4 , N_2O , O_3 , etc.
Aerosols

Clouds

Volcanoes

WATER CYCLE

Terrestrial Radiation

HUMAN CONTRIBUTIONS AND RESPONSES

ECOSYSTEMS

CARBON CYCLE

Atmosphere-Biosphere Interaction

Evaporation
Precipitation

Industries

Cities

Transportation

Glaciers

Ice Sheet

Atmosphere-Sea-Ice Interaction

Heat Exchange

Sea-Ice

Oceans

Vegetation-Soil Interaction

Vegetation

Ocean Circulation, Sea Level, Biogeochemistry

Rivers

Agriculture

LAND-USE/ LAND-COVER CHANGE

Land Surface



CLIMATE CHANGE CHOCOLATE™



terra^{pass}

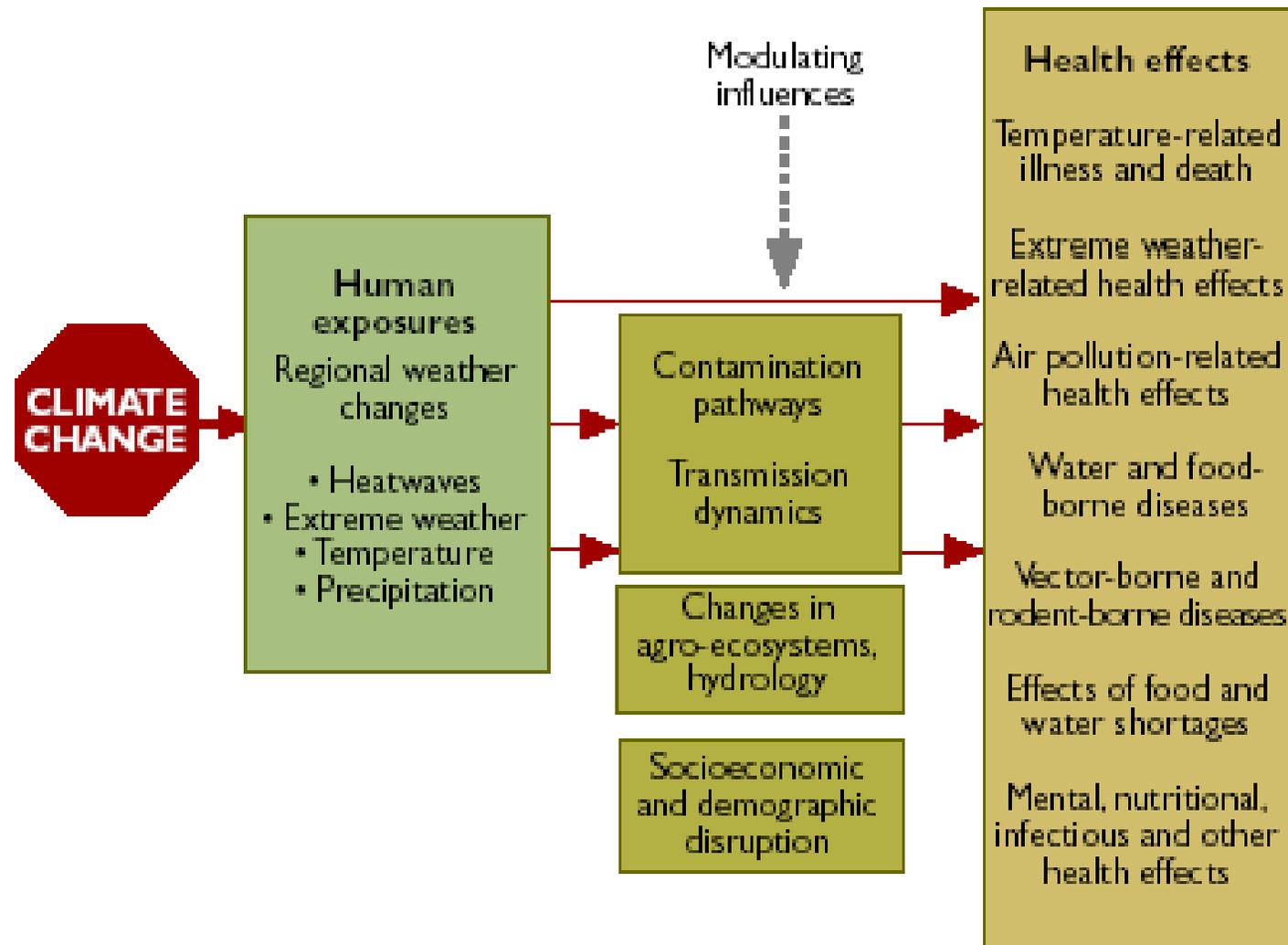
REDUCING YOUR CARBON FOOTPRINT JUST GOT A WHOLE LOT TASTIER!

Put your feet up and treat yourself while treating our planet better. After all, it's the only one with chocolate on it.

CONTAINS: 3.5oz of feel good all natural premium DARK CHOCOLATE (55% cocoa) plus TerraPass™ verified carbon offsets to balance one's average daily contribution to climate change.*

UN Intergovernmental Panel on Climate Change

Figure 3.1. Pathways by which climate change affects human health (modified from reference 2)



Outline

- 🕒 National biosurveillance strategy for human health
- 🕒 Biosurveillance in North Carolina
- 🕒 Application of biosurveillance to climate changes issues



National Biosurveillance Strategy for Human Health



Homeland Security Presidential Directive HSPD-21

Calls on HHS to "establish a national **biosurveillance** system for human health, with international connectivity where appropriate, that is **predicated on State, regional, and community-level capabilities** and creates a networked system to allow for two-way information flow between and among Federal, State, and local public health authorities and clinical health care providers."

*Strategy submitted to
Homeland Security Council
October 31, 2008*



HSPD-21 Definition of Biosurveillance

Biosurveillance

“Active data-gathering, analysis, and interpretation of biosphere data related to disease activity and threats to human and animal health to achieve early warning, detection, and situational awareness”



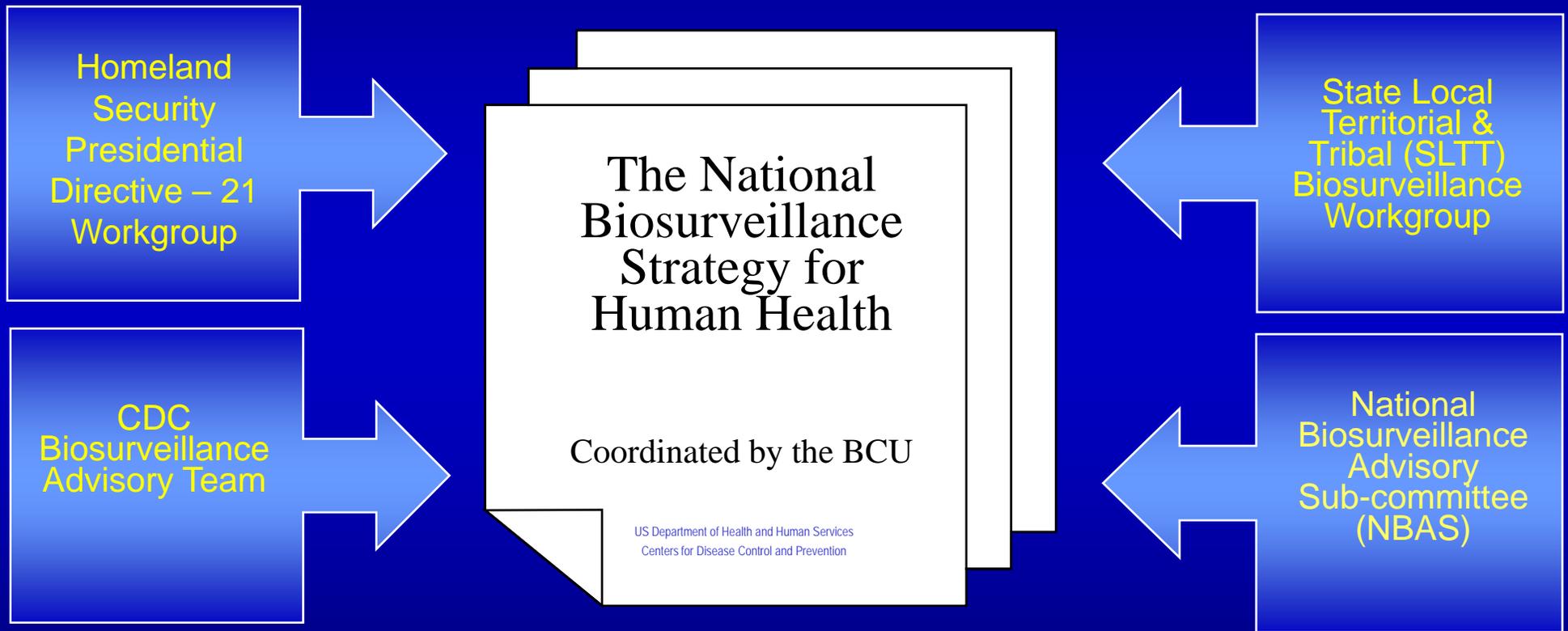
Scope of Biosurveillance in the National Strategy

Biosurveillance encompasses all hazards of public health significance including :

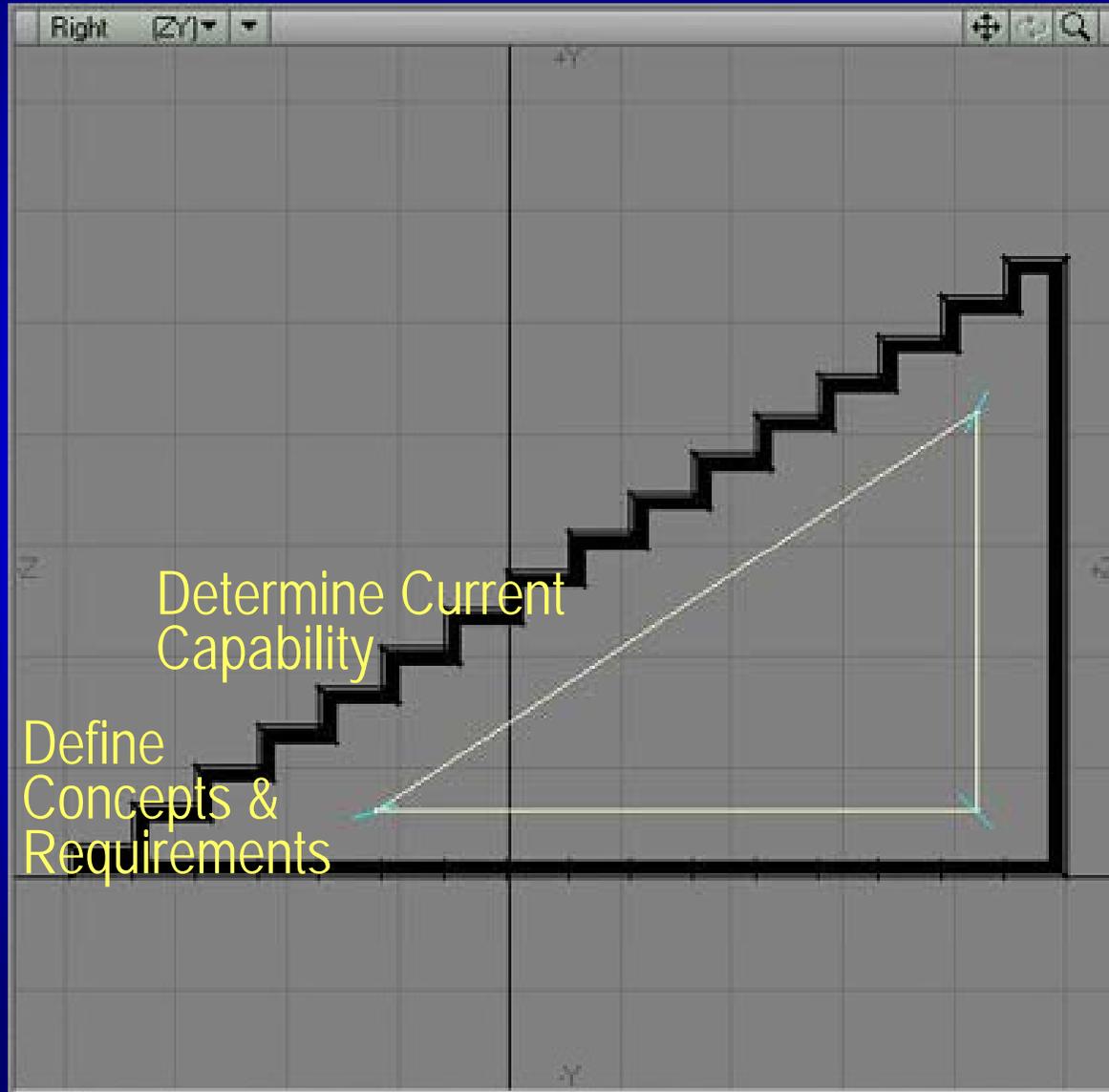
- threats and exposures (e.g., disease in animal with zoonotic potential, environmental exposures and natural disasters, and terrorism events),
- adverse events,
- diseases and outbreaks (e.g., nationally notifiable diseases).



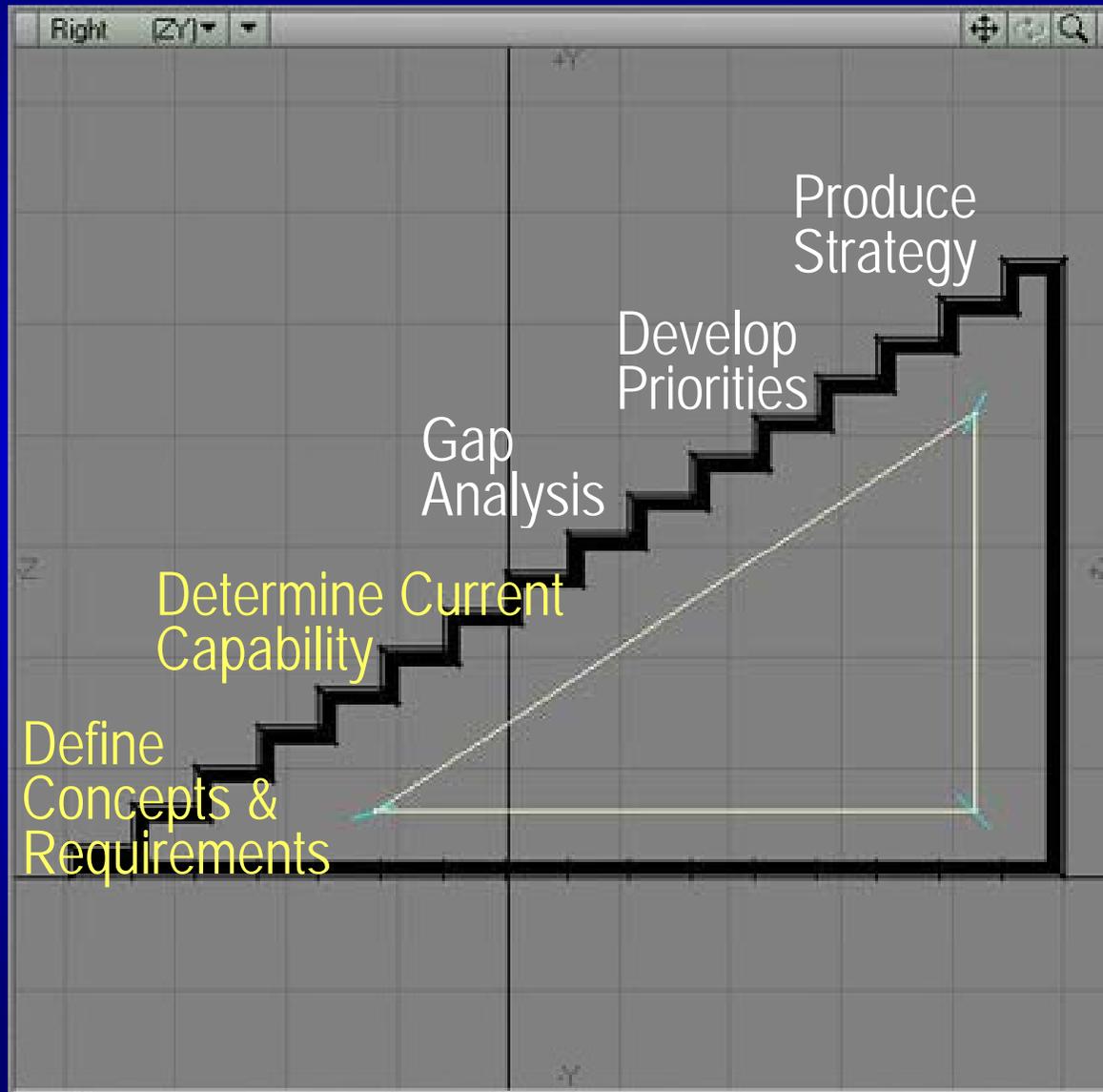
Stakeholder Participation



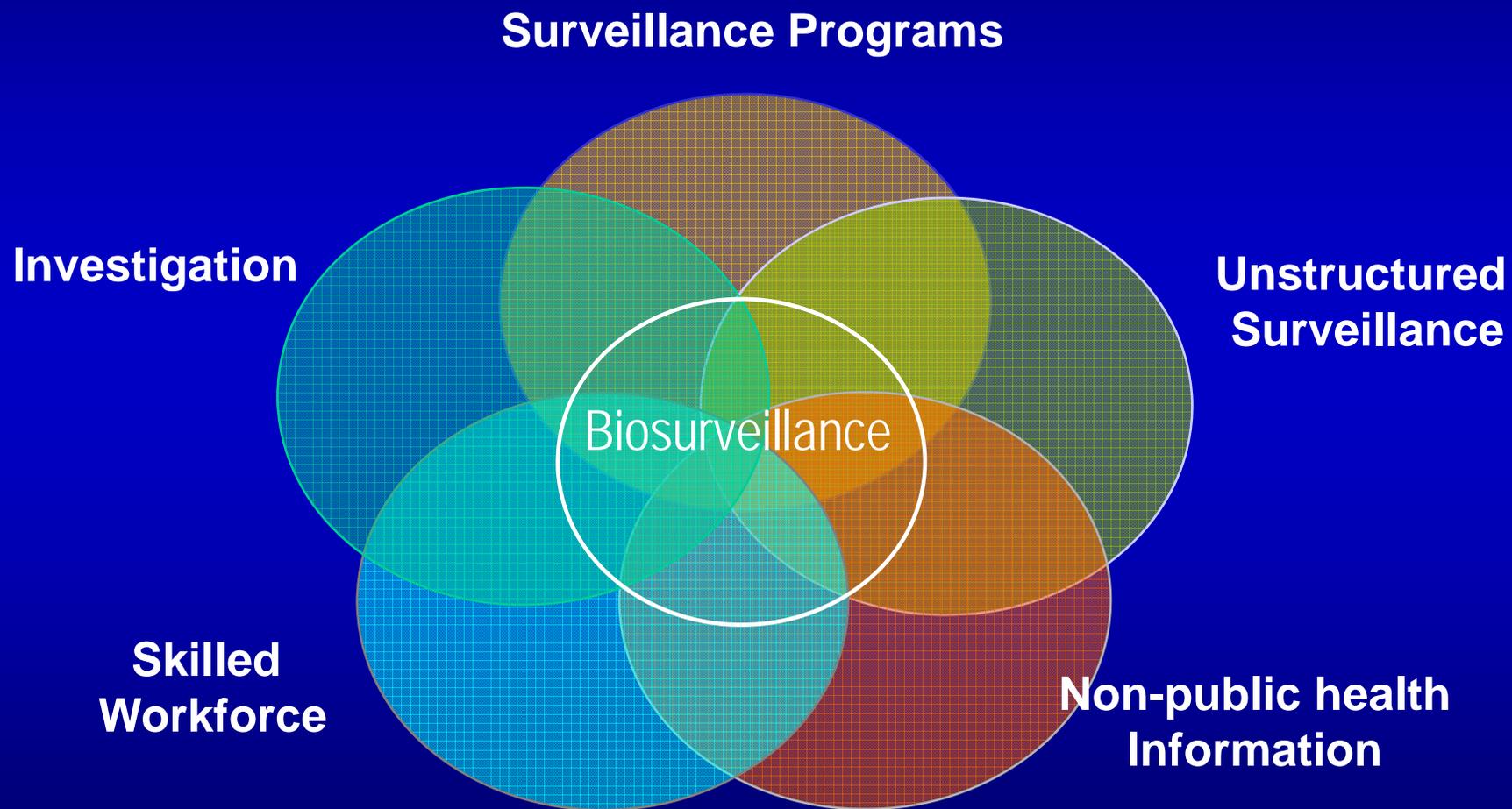
Steps in the Strategy Development



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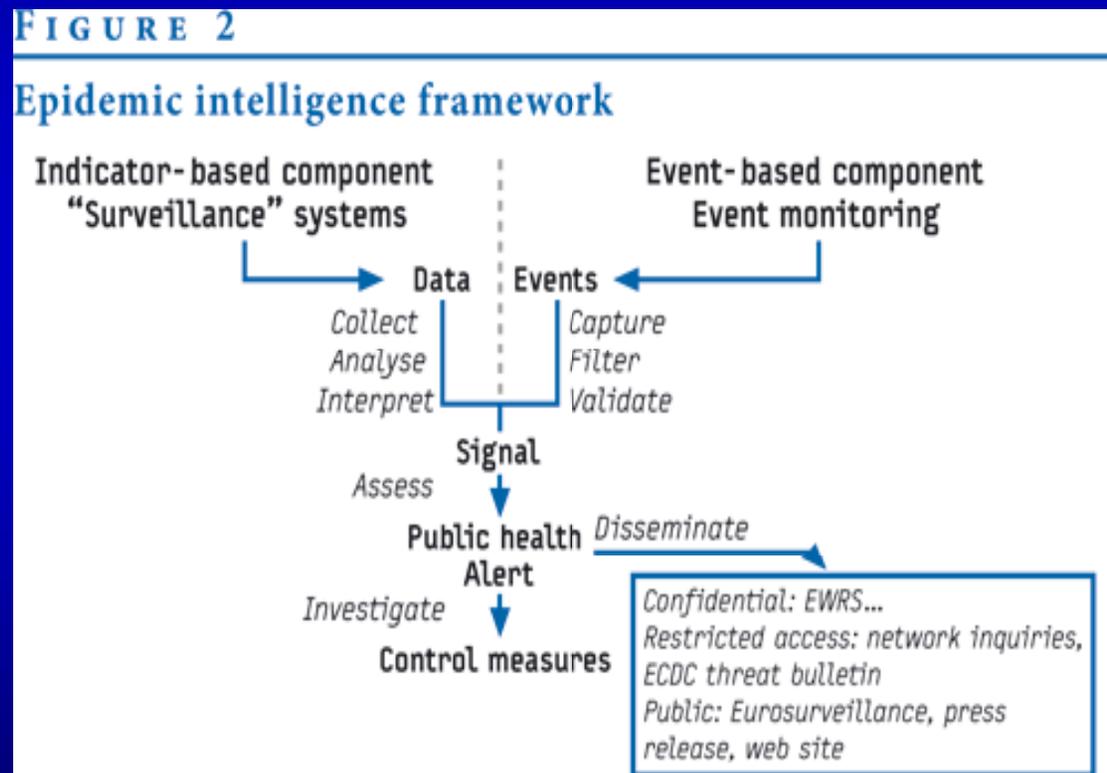


A Biosurveillance Capability



Epidemic Intelligence, European CDC

All activities related to the early identification of potential health hazards that represent a risk to health, and their verification, assessment and investigation so that appropriate public health control measures can be recommended.



European CDC, 2006

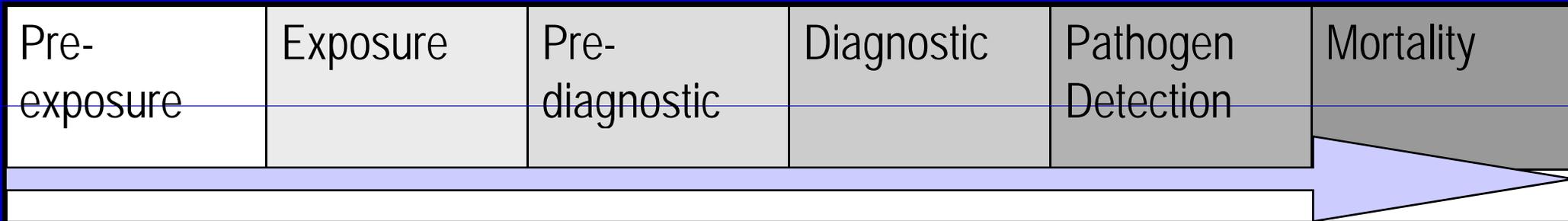


Methods for estimating current nationwide biosurveillance capability

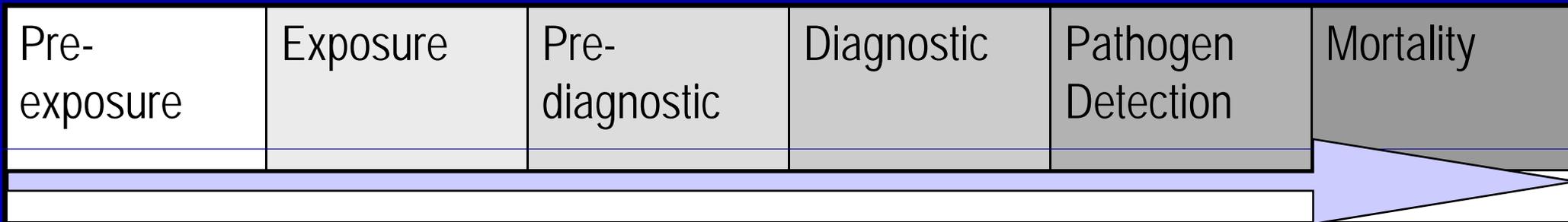
- Categorize broadly sources of information and inventory current systems and capacities
- Characterize categories of information: timeliness, representativeness, information quality and sustainability
- Describe current workforce
- Describe current limitations



Current Biosurveillance Capability Categories of Information



Current Biosurveillance Capability Categories of Information



Identifying biosurveillance systems and programs within these categories



Current National Biosurveillance Capability: Sampling

Pre-exposure	Exposure	Pre-diagnostic	Diagnostic	Pathogen Detection	Mortality
<ul style="list-style-type: none"> •Intelligence & Law enforcement •Reports from outside a jurisdiction •Food and product recalls 	<ul style="list-style-type: none"> •BioWatch •Hazardous Substances Emergency Events Surveillance •FSIS Consumer Complaint Monitoring Center •USDA National Animal Health Monitoring System 	<ul style="list-style-type: none"> •BioSense •Local syndromic surveillance systems (e.g., EARS, RODS, ESSENSE) •DoD ESSENSE 	<ul style="list-style-type: none"> •Reportable disease surveillance •National Notifiable Disease Surveillance System •Electronic Foodborne Outbreak Reporting System 	<ul style="list-style-type: none"> •PulseNet •Laboratory Reporting Network •CaliciNet •WHO Influenza Collaborating Centers •Food Emergency Response Network •Emerging Infections Program •DoD GEISS 	<ul style="list-style-type: none"> •Pneumonia & Influenza Deaths Surveillance •Electronic Death Registries •Medical Examiner and Coroner Surveillance

OPEN SOURCE DATA: Google.org/Flutrends, ProMed, Epi-X, GPHIN, Project Argus, Health Map, CIDRAP reports

WORKFORCE: epidemiology, informatics, environmental health, laboratory

Exposure	Pre-diagnostic	Diagnostic	Pathogen discovery	Mortality
BioWatch, BioHazard Detection System	Reportable Disease Surveillance Systems e.g., NEDSS base systems)		Electronic death registration systems	
Potable water supply monitoring	Sentinel Influenza Provider Network		Pediatric influenza death surveillance	
Hazardous Substances Emergency Events Surveillance	Syndromic surveillance systems (e.g., EARS, RODS, ESSENSE, Bio-Defend, First Watch, BioSense) using: emergency departments, 911 calls, OTCs, Prescription drugs sales, school reports		National Molecular Foodborne Subtyping Network (PulseNet)	Medical examiner and coroner surveillance
	Pediatric RSV surveillance			Pneumonia and influenza mortality surveillance
	Tuberculosis clinics, surveillance and treatment monitoring			
Poison control center call surveillance		Emerging Infections Program (e.g. Active Bacterial Core, FoodNet, Unexplained Deaths project)		
Environmental toxins surveillance programs (e.g., lead, mercury, arsenic, cadmium, pesticides)		Electronic laboratory reporting (ELR)		
24-7 Physician and Epidemiologist On-call service				
Laboratory Response Network				
Vector surveillance (e.g., mosquitoes)	National West Nile Surveillance System (ArboNet)			
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Health Alert Network (HAN)				

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	<h2 style="text-align: center; color: yellow;">Biosurveillance Capability at a State Health Department</h2>			influenza mortality			
Poison control center call su							et, Unexplained
Environmental toxins survei mercury, arsenic, cadmium,							
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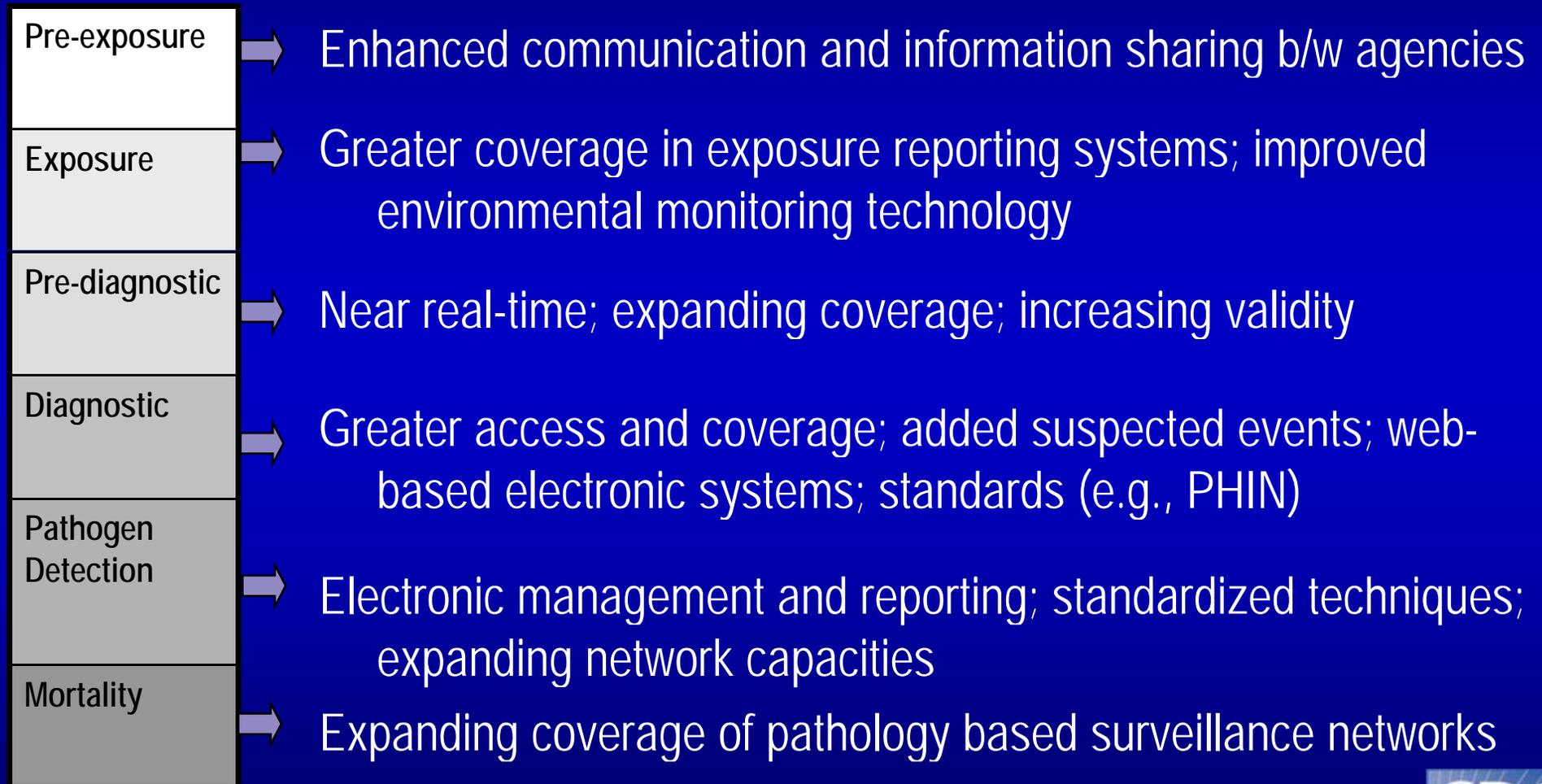
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Current Biosurveillance Capability: Promising Practices



Current Biosurveillance Capability: Limitations

- Syndromic surveillance – low predictive value, integration with traditional surveillance
- Electronic diseases surveillance systems (NEDSS) – inefficient implementation; diversity of systems
- Electronic Laboratory Reporting (ELR) – stalled implementation, inability for lab networks to exchange data
- Outbreak management systems (OMS) – lack of support
- Workforce shortages (e.g., ~ 34% more epidemiologists needed to carry out essential functions; public health informatics)



Priorities in the National Biosurveillance Strategy building on existing capability

1. Electronic health information exchange
2. Electronic laboratory information exchange
3. Integrated biosurveillance Information
4. Global disease detection and collaboration
5. Unstructured data
6. Biosurveillance workforce of the future



Conclusions

- ❑ Respondents & existing surveys emphasize broad scope
- ❑ Concentrated locally & supported nationally
- ❑ A well-defined capability allows for development of national strategies, provides opportunities for investment, and supports IHR
- ❑ Newer methods are timely – need improved quality; traditional methods are high quality – need improved timeliness
- ❑ Need to finish what has been started: ELR, Electronic Disease Surveillance Systems, Outbreak Management Systems
- ❑ Determine appropriate methods for integration and information sharing



Biosurveillance Capability in North Carolina



NC Public Health Information Network (NC PHIN)

Early Detection:
Suspected Cases

Health
Alert
Network

Alerting & Paging

Confirmed Cases

NC EDSS

EMS



Wildlife

Vet Lab

Poison Center

Immunization
Registry

Lab Results

Hospital Emergency
Departments (EDs)

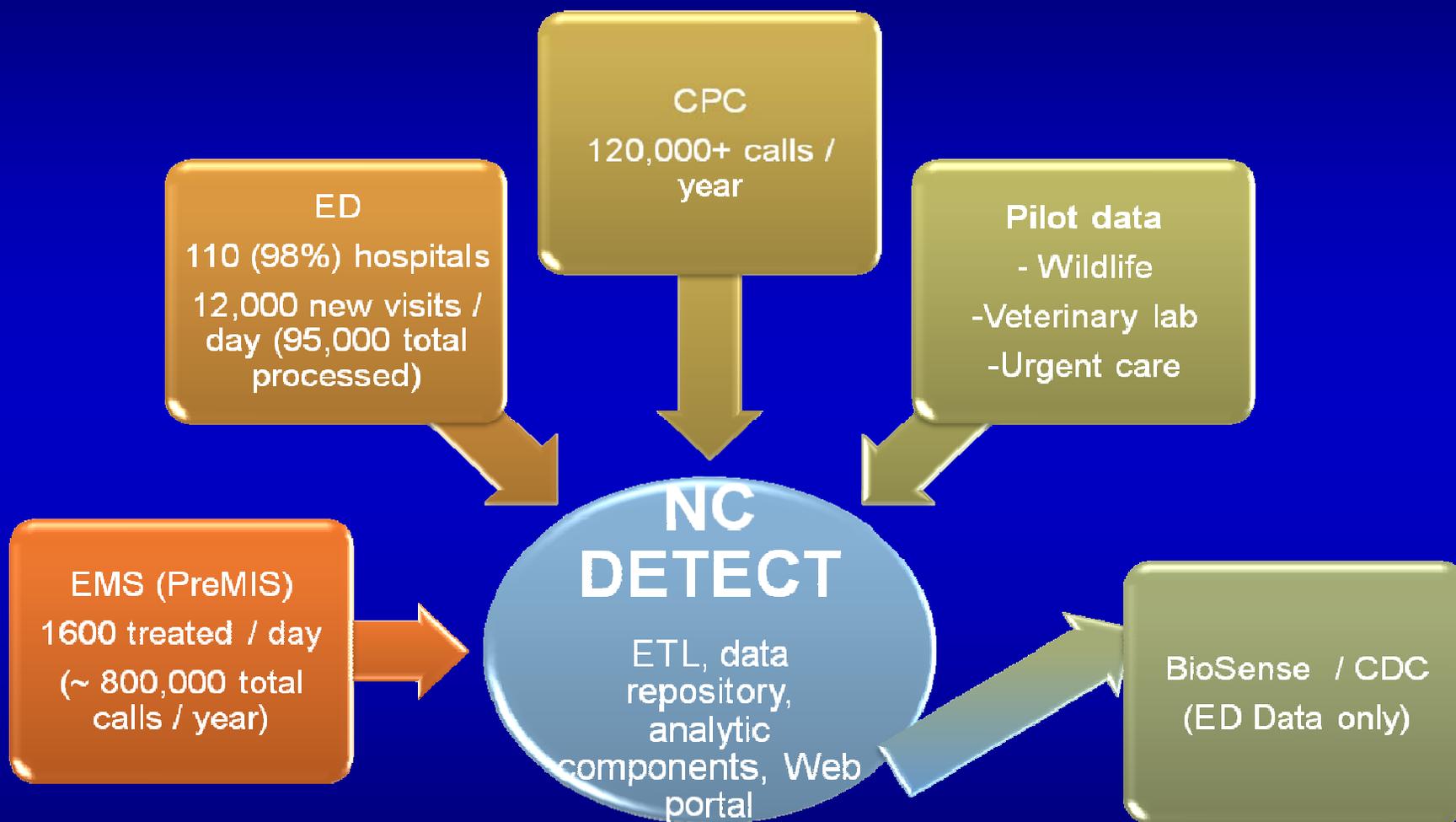
Physician Reported Cases

“Enhanced surveillance”

“Traditional surveillance”

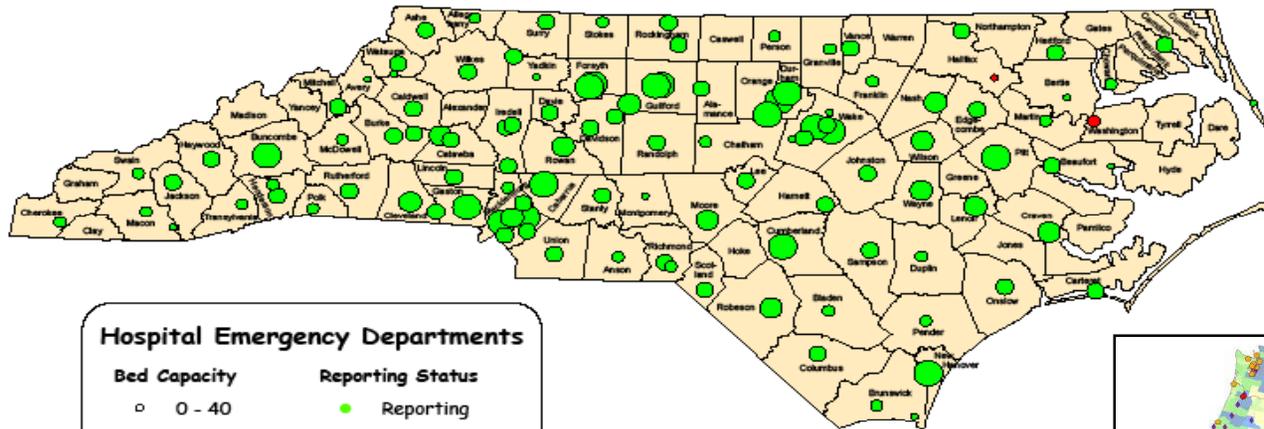


NC DETECT data capability



NC DETECT statewide ED coverage

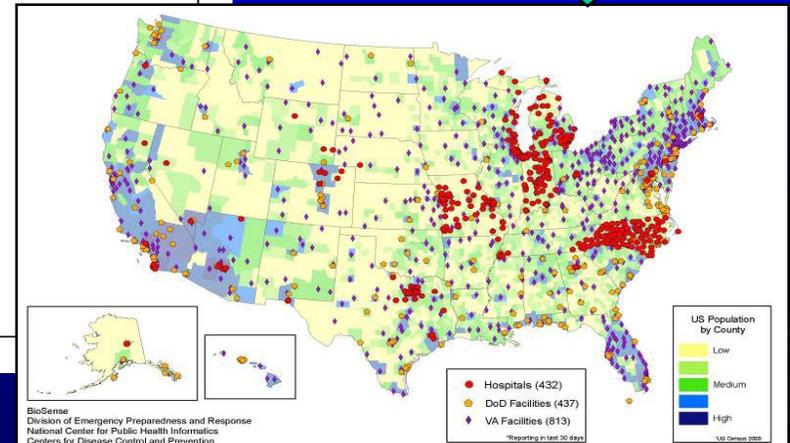
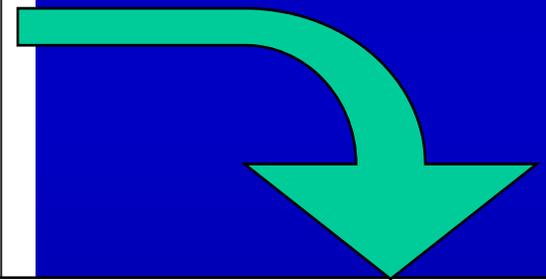
Hospital Emergency Departments Reporting to NC DETECT
by General Bed Capacity
As of April 30, 2008 (110 hospitals reporting)



Hospital Emergency Departments

Bed Capacity	Reporting Status
○ 0 - 40	● Reporting
○ 41 - 70	● Not Reporting
○ 71 - 110	○ County
○ 111 - 300	
○ more than 300	

Daily feed to BioSense



BioSense
Division of Emergency Preparedness and Response
National Center for Public Health Informatics
Centers for Disease Control and Prevention

*Reporting as of 30 days

US Population by County
Low
Medium
High

Environmental health surveillance and monitoring

- Hazardous substances and emergency events surveillance system (HSEES)
- Food safety and protection programs
- Lead surveillance in adults and children
- Dairy safety and protection programs
- Vector surveillance programs
- Shellfish sanitation program
- Water protection program
- Radiation protection program



Agriculture (animal, food and plant) biosurveillance

- Veterinary reportable disease surveillance
 - Including surveillance at markets and auctions and investigations
- Veterinary Diagnostic Laboratory System
 - Central laboratory in Raleigh and 4 satellite labs
 - Diagnostics of diseases in livestock, poultry, and companion animals
- Wildlife surveillance (e.g., chronic wasting disease)
- Multi-Hazard Threat Database
 - Web-based decision support tool for planning and response to agriculture emergencies
- 24/7 on-call capability for agriculture related emergencies
 - Surge capability with NC Veterinary Response Corps

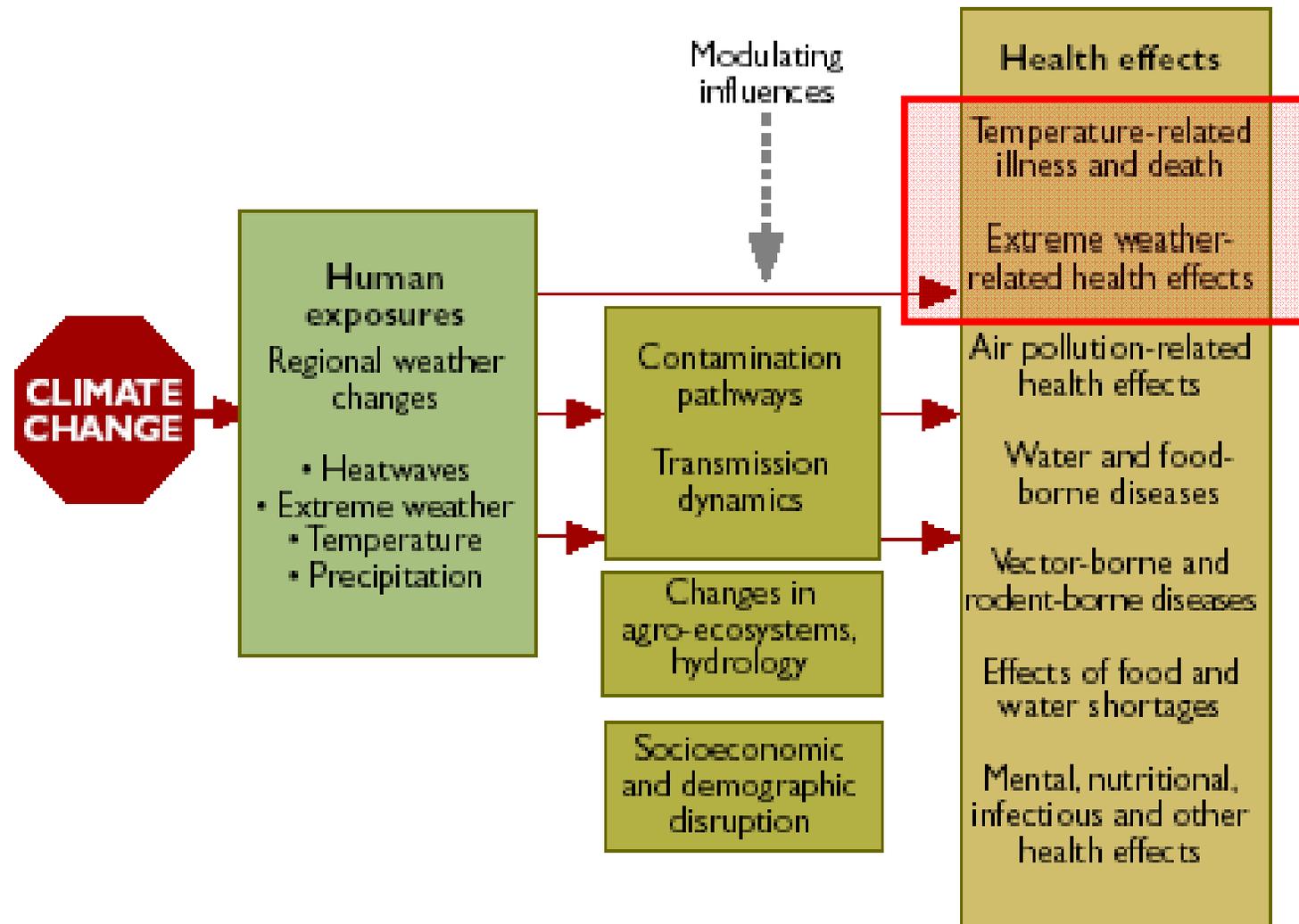


Applications of Biosurveillance to Climate Change



UN Intergovernmental Panel on Climate Change

Figure 3.1. Pathways by which climate change affects human health (modified from reference 2)



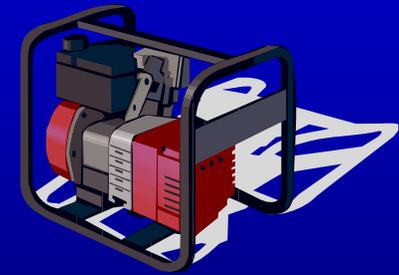
Recent work on biosurveillance and disasters

- Biosurveillance and mortality resulting from a severe weather event – *Baer et al*
- Use of syndromic surveillance for enhanced situational awareness during wildfires, Florida, 2008 – *Powell et al*
- Monitoring hospital emergency department visits for chief complaints of insect bites after a major flood – *Thomas et al*



Disaster surveillance

- 2006 Seattle, WA severe weather event
- Power outages to 4 million residents
- 249 confirmed cases of CO poisoning
- 75% of cases identified using ED-based syndromic surveillance
- Temporal-spatial clusters identified



Disaster surveillance

- 2008 Florida, Wildfires: 102 fires affecting > 40,000 acres
- Dense smoke advisory for southern Florida
- Significant spike in asthma visits identified in Broward Co.
- Provided situational awareness to EM



Disaster surveillance

- 2007 Ohio: Floods
- ED-based surveillance
- 4.7 times increased risk of bug bite (vector borne diseases) visits in flood region compared with non-flood region
- Peak observed 14 days after flood (consistent with mosquito life cycle)

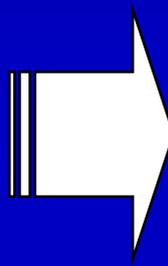
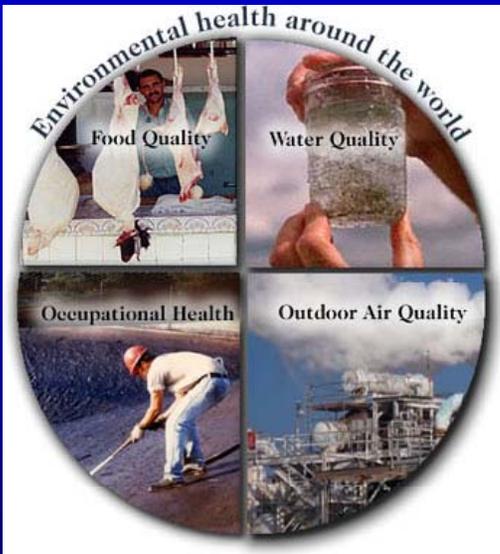


Disaster Epidemiology

- Identify priority health problems and determine extent of morbidity/mortality
- Investigate etiologies and risk factors
- Determine priority health interventions
- Determine the extent of damage, capacity of the local healthcare infrastructure, and community needs
- Ensure safe water, food and implement infection control
- Evaluate the impact of health programs



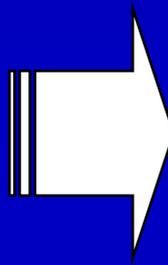
Integrated Disaster Epidemiology Capability in North Carolina



- Broaden the scope of epidemiology in the disaster setting
- Include public health, environment, agriculture and emergency management
- Determine critical information needs
- Mechanisms for displaying and sharing information



Integrated Disaster Epidemiology



JackBe - Mozilla Firefox

General Schedules

General

Aircraft: EASTCOM

Aircraft Registry	Aircraft Status	Base Location
K50338562	Non-operational	Lisbon, Portugal (PRT)
K14695531	Operational	Kuwait, Kuwait (KWT)
K76717608	Degraded	Barcelona, Spain (ESP)
K27050145	Degraded	Lucknow, India (IND)
N74431136	Operational	Madrid, Spain (ESP)
N56802016	Degraded	Paris, France (FRA)
N39607283	Non-operational	Cannes, France (FRA)
N68297102	Degraded	Berlin, Germany (DEU)
K82866524	Degraded	Berlin, Germany (DEU)
K14055599	Degraded	London, United Kingdom (GBR)
K66091604	Non-operational	Johannesburg, South Africa (ZAF)
N78201970	Non-operational	Palermo, Italy (ITA)

Aircraft: EASTCOM 1/6

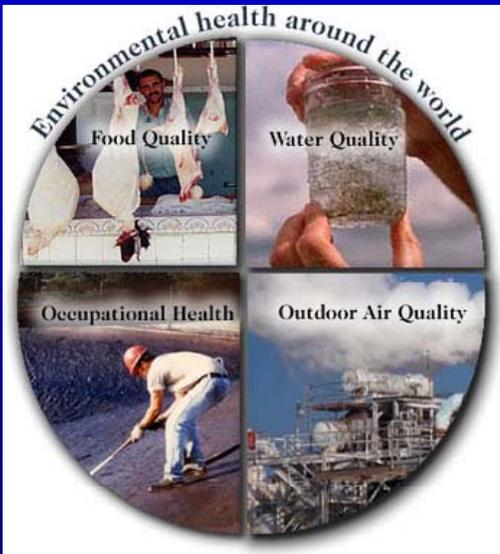
RSS: RSS - CA State parks

RSS: Yahoo

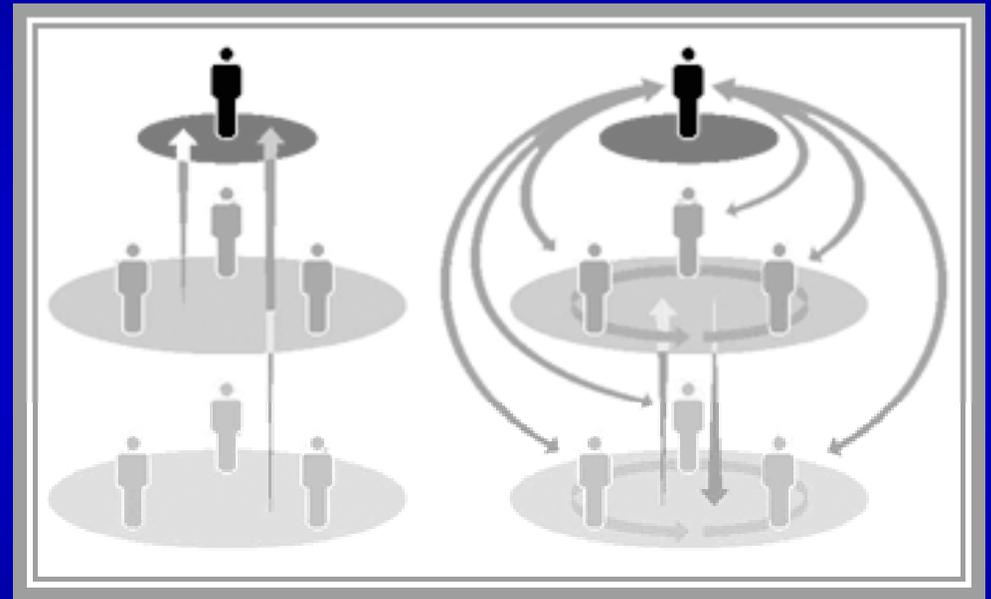
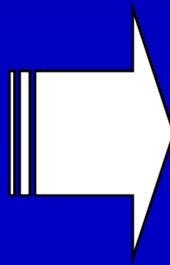
Jefferson pleads not guilty to bribery (AP)
 AP - Rep. William Jefferson pleaded not guilty Friday to charges of soliciting more than \$500,000 in bribes while using his office to broker business deals in Africa.

Stocks inch up after global sell-off (AP)
 AP - Wall Street, trying to reverse three days of sharp losses, rose moderately Friday as Treasury yields retreated from overnight highs.

3 Errors



Integrated Disaster Epidemiology



Biosurveillance and Climate Change

- Outcomes possibly related to climate change are detected, investigated and intervened
- Through a nationwide biosurveillance capability
- At all levels of government, practice and the private sector
- Enhancements in information sharing, integration and workforce

