

# National Enhanced Elevation Data Requirements Assessment

The term “enhanced elevation” is used to describe precise 3-D measurements of land or submerged topography, built features, vegetation structure, and other landscape detail.

NGAC Meeting, June 8, 2011

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U.S. Department of the Interior  
U.S. Geological Survey



# National Enhanced Elevation Assessment

## About the Project

### Sponsor:

- National Digital Elevation Program (NDEP) committee member agencies

### Funding Partners:

- U.S. Geological Survey (Managing Partner)
- National Geospatial-Intelligence Agency
- Federal Emergency Management Agency
- Natural Resources Conservation Service

### In-kind Partners:

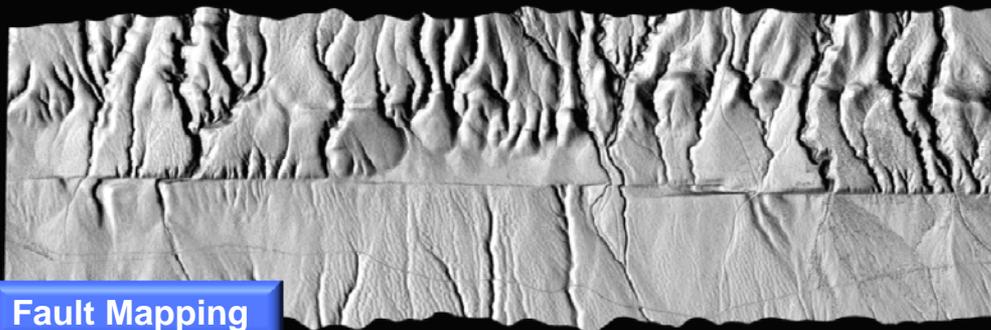
- National Oceanic and Atmospheric Administration
- Many Federal agencies, state agencies and other study participants

# Enhanced Elevation Data

## Many Stakeholders

- Fifty States, local and Tribal governments
- Thirty plus Federal agencies
- Private sector – Forest Products, Development, Energy and others
- Regional organizations – beginning to compile list
  - Puget Sound Partnership
  - Chesapeake Bay Program
- Professional Organizations representing many interests
  - American Society for Photogrammetry and Remote Sensing (ASPRS)
  - AmericaView
  - Association of American Geographers (AAG)
  - Association of American State Geologists (AASG)
  - Coastal States Organization (CSO)
  - Floodplain Management Association (FMA)
  - Management Association for Private Photogrammetric Surveyors (MAPPS)
  - National Association of Counties (NACo)
  - National Governors Association (NGA)
  - National States Geographic Information Council (NSGIC)
  - The Association of State Floodplain Managers (ASFPM)
  - Urban and Regional Information Systems Association (URISA)

# National Enhanced Elevation Assessment

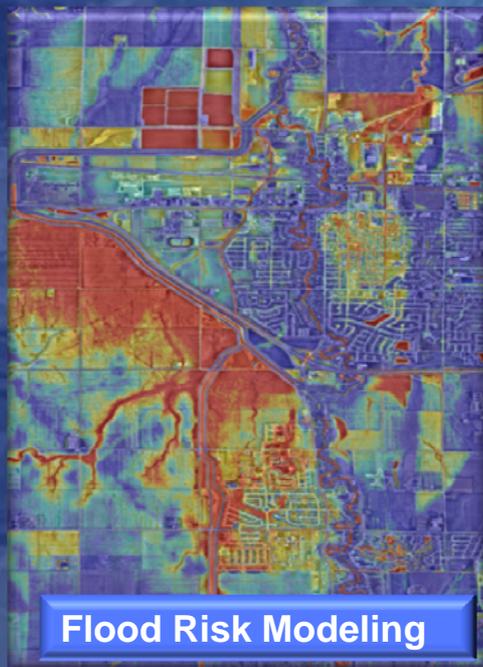


Fault Mapping

- Identify business requirements and benefits for a national enhanced elevation data program.
- Develop program implementation alternatives.
- Answer key questions:
  - Is it more cost effective for the government to manage these activities within the context of a national program?
  - Are there additional national or agency benefits derived from such a strategy?
  - What does the optimized program look like?
- Assessment to be completed in November, 2011



Landslide Inventory



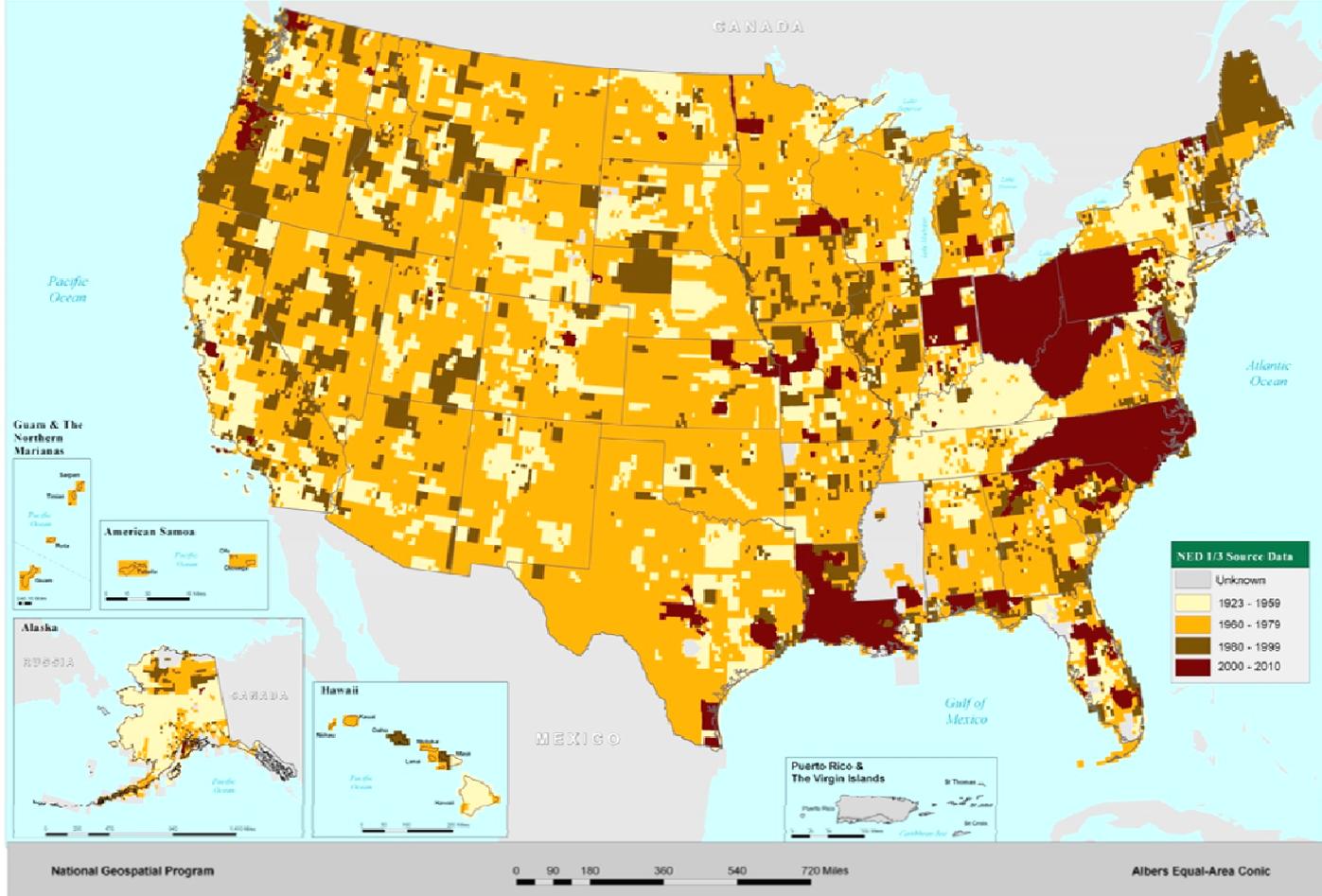
Flood Risk Modeling

# National Elevation Dataset



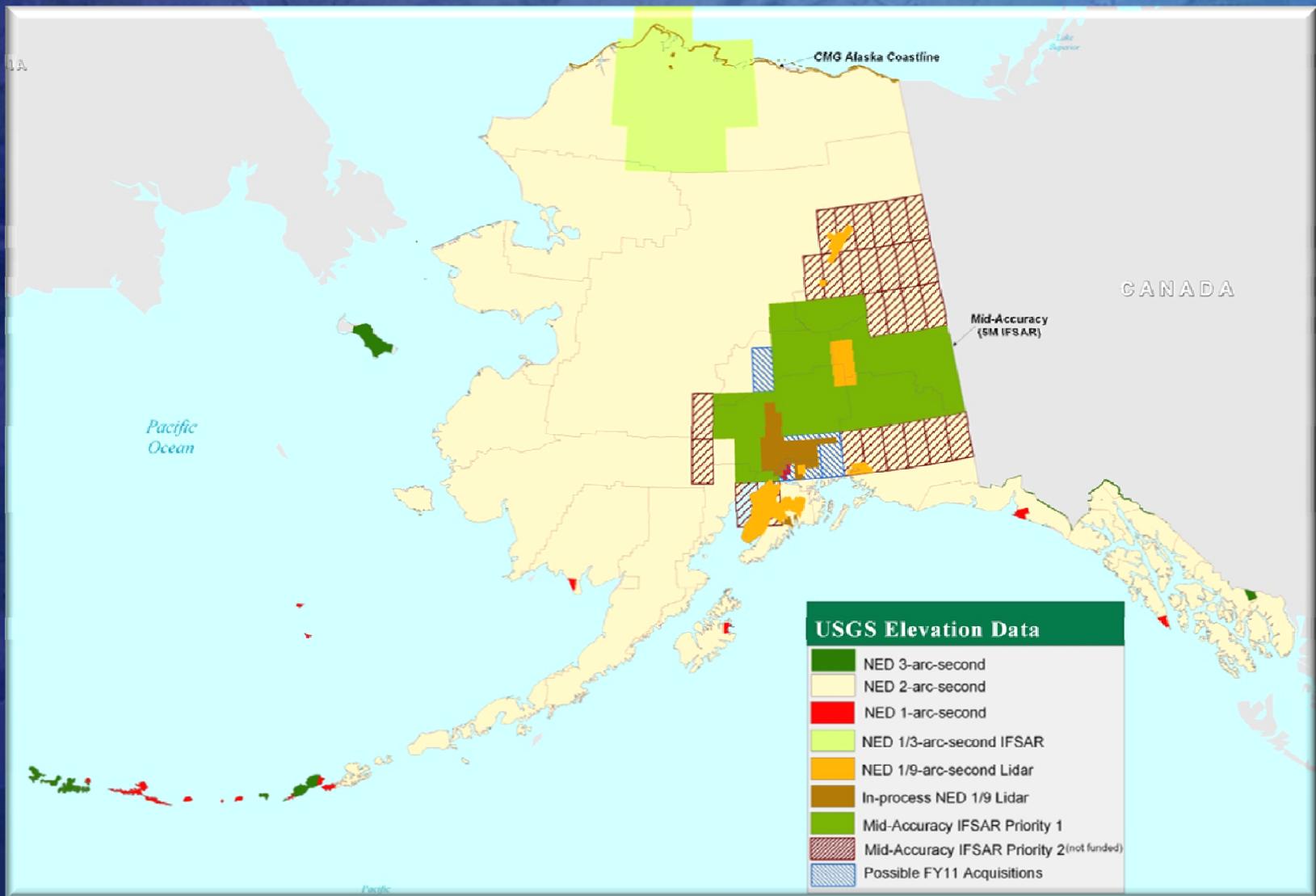
## National Elevation Dataset (NED) by Year Acquired

Projected as of April, 2011



80 Percent of elevation data is more than 30 years old (up to 88 years) and will not meet user requirements for many applications.

# National Elevation Dataset



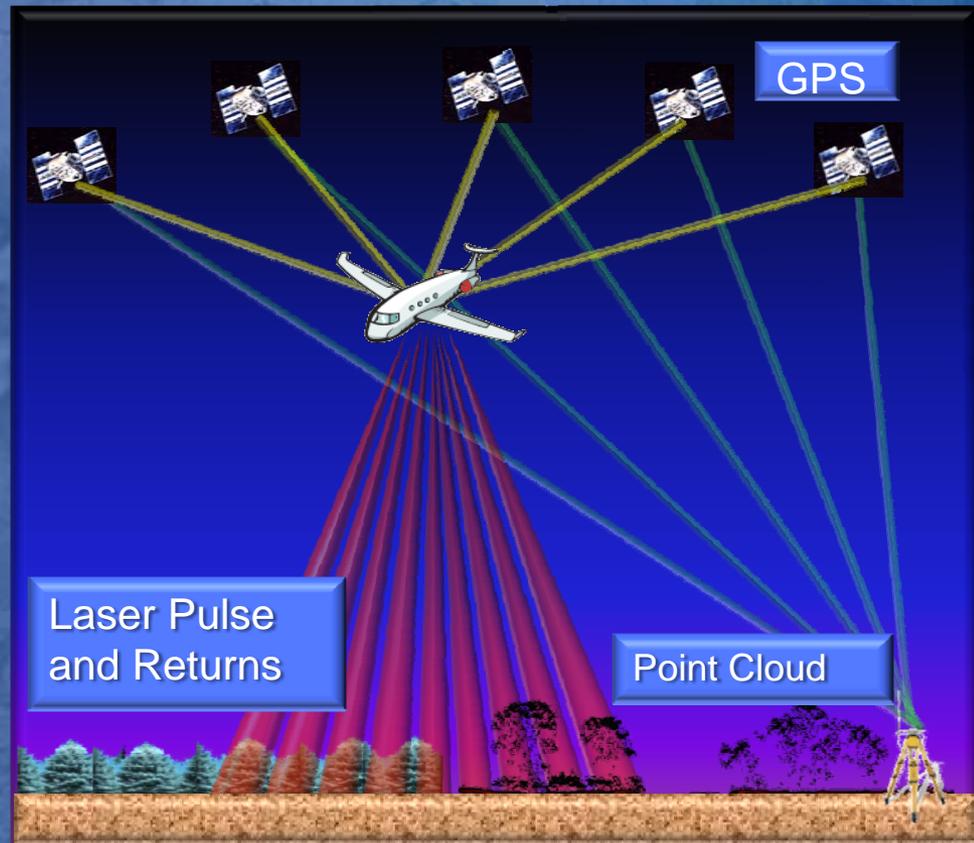
# Two Technologies of Choice

## Light detection and ranging (LiDAR)

- System with a laser and detector (range), scanning mirror (laser direction), GPS (location), and IMU (orientation)
- Output 300,000+ laser pulses per second
- Record laser reflection information
- Billions of recorded points create 3-dimensional representation of bare earth, vegetation and structures at centimeter-level accuracy

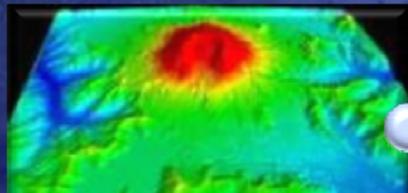
## Interferometric synthetic aperture radar (IfSAR)

- Cloud penetration
- Lower acquisition cost than lidar

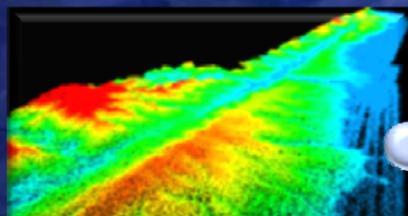


# Concept for a National Enhanced Elevation Program

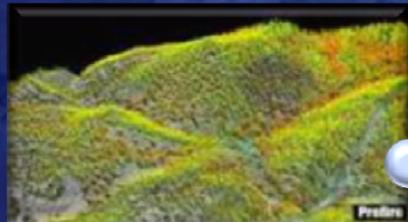
Support science needs



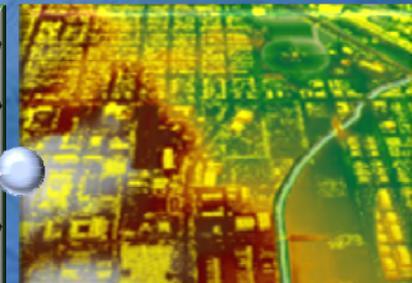
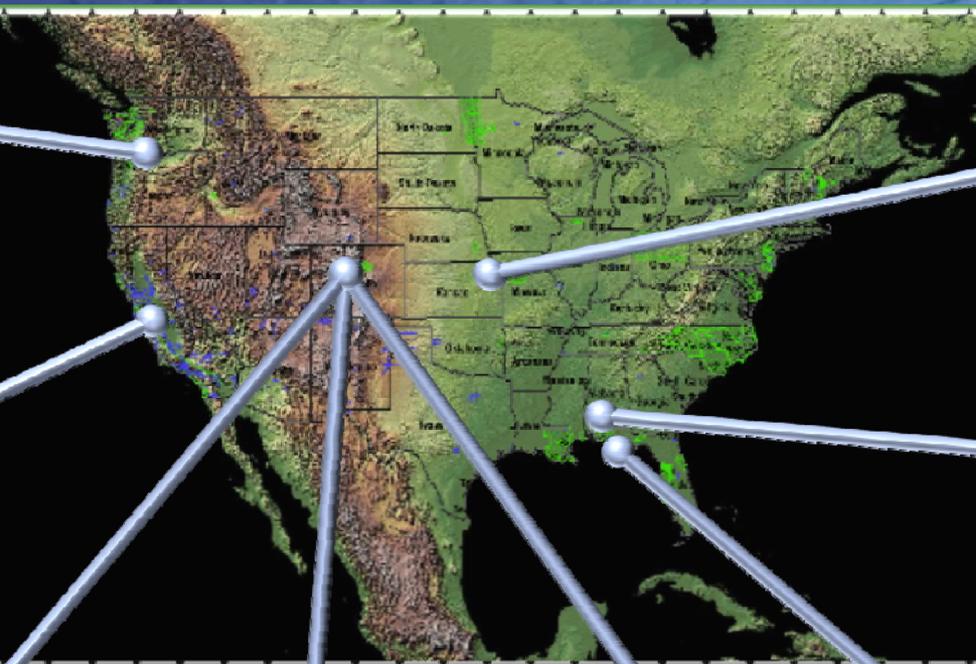
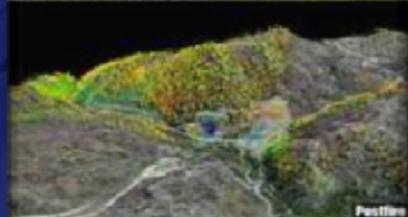
Volcano Monitoring



Earthquake Faults



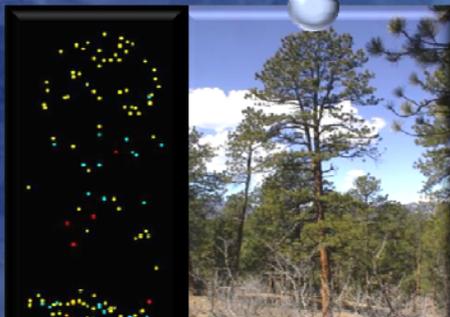
Carbon/Disturbance



Urban Response



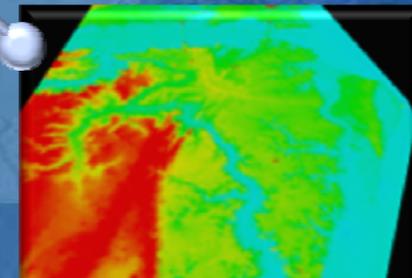
Land Cover



Biomass



Hydrologic Studies



Coastal Studies



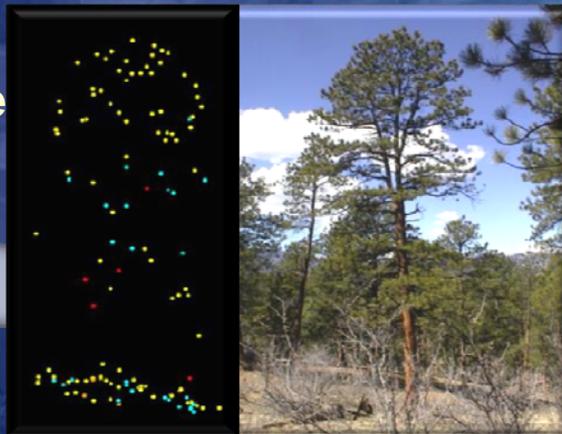
# Must Scale to Address Large Area Requirements



State

Landscape

Plot



- Biomass and Carbon estimates
- Fire fuels models
- Geologic fault mapping
- Floodplain modeling
- Homeland security line of site analysis
- Hydrologic network improvements
- Landslide prone areas mapped
- Land cover assessment and mapping
- Precision agriculture
- Property valuation
- Species and habitat assessments
- Structures mapped in 3-D
- Three dimensional GIS enabled
- Urban area planning
- Wetland inventory improvements
- Wind and solar energy assessments

# National Enhanced Elevation Assessment



[2<sup>nd</sup> DRAFT] Project Management Plan

Assessment of the Business Requirements and Benefits of

Enhanced National Elevation Data

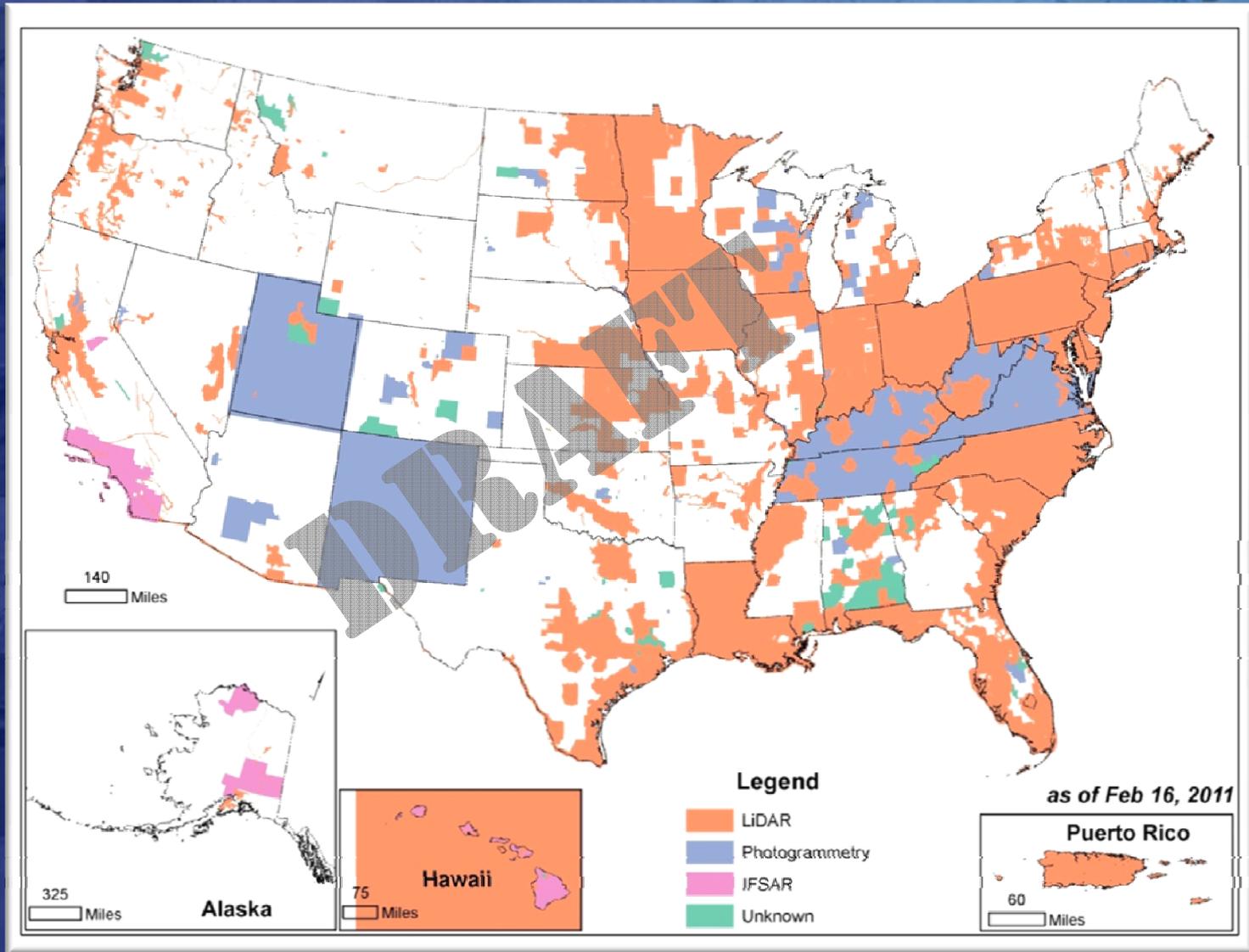
September 15, 2010

Prepared by:  
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1. Documentation of Business Uses and Inventory of Existing Elevation Data
  - Elevation data inventory – NOAA, FEMA, USGS
  - Federal business use requirements and expected benefit – complete May
  - State and other organization assessment initiated on April 1
2. Business Use Aggregation and Analysis
3. Assess Emerging Elevation Data Collection Technology and Related Issues
4. Technology Infrastructure Alternatives
5. Develop Program Scenarios

# Enhanced Elevation Data Inventory



# Federal Agencies Participating Business Requirements Assessment

Federal Emergency Management Agency

U.S. Army Corps of Engineers

Federal Energy Regulatory Commission

U. S. Nuclear Regulation Commission

Federal Communications Commissions

Federal Aviation Administration

National Geospatial-Intelligence Agency

Tennessee Valley Authority

National Aeronautics and Space Administration

U.S. Fish and Wildlife Service

Bureau of Ocean Energy and Management

National Telecommunications & Information Administration

National Oceanic and Atmospheric Administration

Natural Resources Conservation Services

Center for Disease Control and Prevention

Environmental Protection Agency

U.S. Forest Service

Department of Transportation

Bureau of Land Management

Department of State

Department of Homeland Security

Bureau of Reclamation

U.S. Bureau of Census

U.S. Geological Survey

Farm Service Agency

Bureau of Indian Affairs

National Park Service

Department of Energy

Office of Surface Mining

Department of Justice

Housing and Urban Development

# Environmental Protection Agency

## Functional Activity: Environmental Protection, Land Cover Characterization and Runoff Modeling

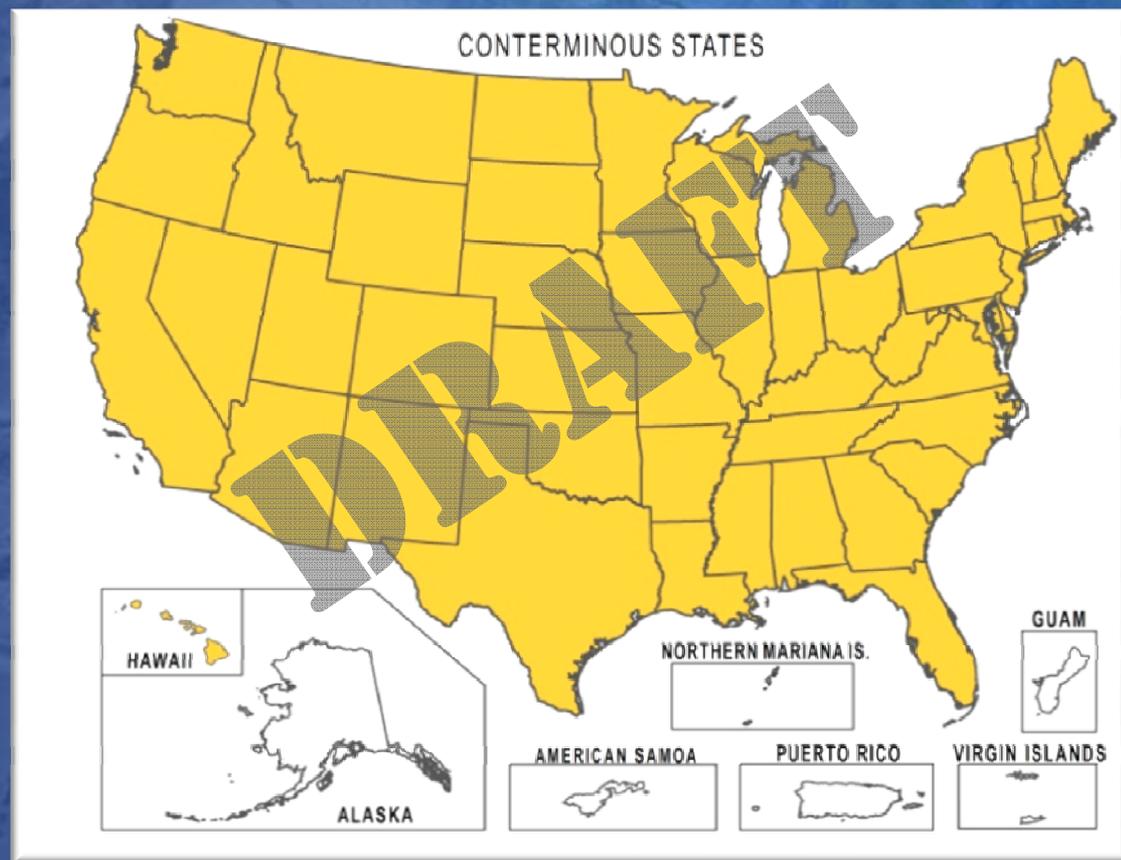
Mission-Critical Requirements: High accuracy LiDAR data are mission-critical to understand urban area modeling, to understand characteristics and hydrodynamics of streams and estuaries, and to make decisions on how to protect and/or restore the air we breathe, the water we drink, and/or the environment that sustains us.

Update frequency: 3-5 years

Estimated program budget supported by elevation data: \$544M/yr

Quantifiable Benefits of Enhanced Elevation Data:

Estimated combined financial benefits to EPA, states and local communities: \$54.4M/year



# Bureau of Indian Affairs

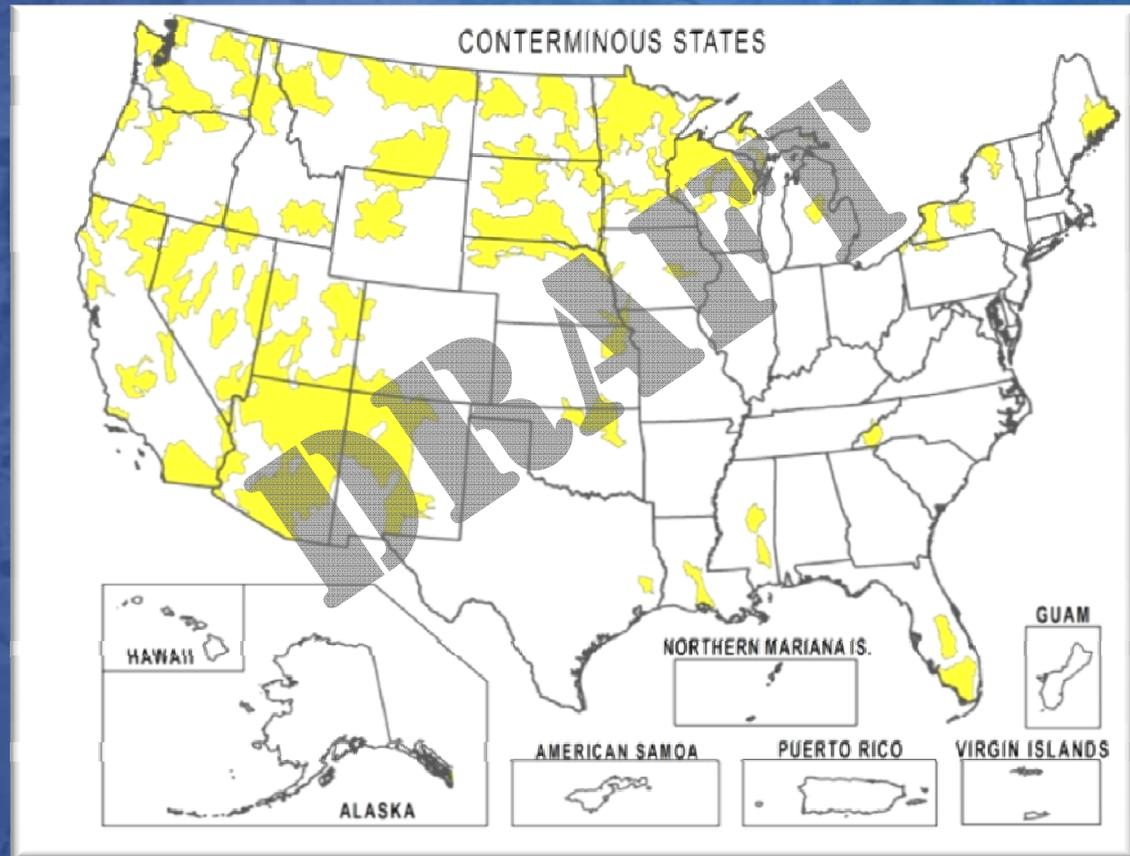
## Protection & Enhancement of American Indian Trust (AIT) Assets

Mission-Critical Requirements: For management of forest and water resources on AIT lands and watersheds flowing into and out from AIT lands

Update frequency: 6-10 years

Estimated program budgets supported by elevation data: \$XXX  
Quantifiable Benefits of Enhanced Elevation Data

\$ XXX for BIA not having to contract for forest inventories, and \$ XXX for Tribes receiving an estimated 10% increase in timber harvests by improved forest management.



# Bureau of Reclamation

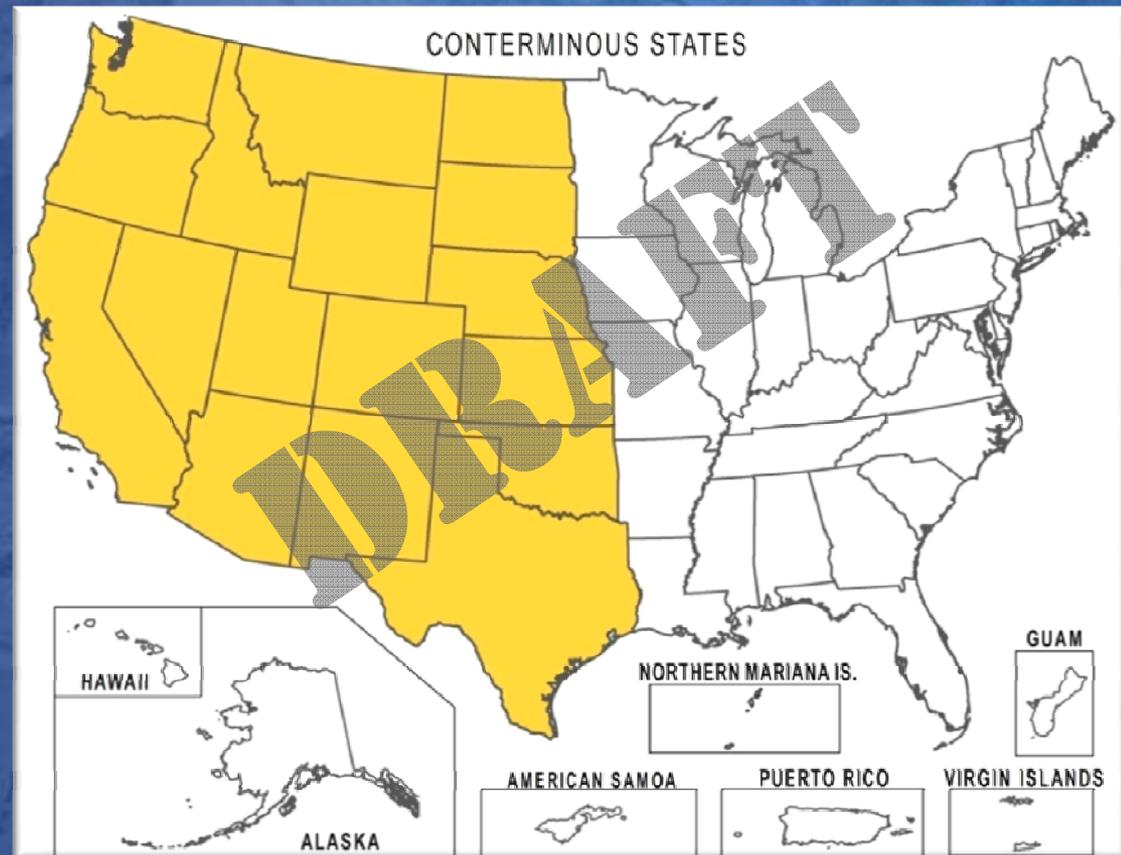
## Management of Resources Related to Delivery of Water and Power

Mission-Critical Requirements: For monitoring river flows and fish habitats, reservoir volume calculations, water forecasting, habitat mapping, identification of restoration opportunities, and modeling and analysis.

Update frequency: 2-3 years

Estimated program budget: \$ XXX

Potential benefits of \$ XXX/ year.  
Benefits would be realized from reduced acquisition costs, reduced labor on design and construction of new projects, error reduction resulting from use of disparate datasets, and savings from having stakeholders perform some of their own analyses



# Fish and Wildlife Service

## Functional Activity - Endangered Species and Fisheries and Habitat Conservation

Mission-Critical Requirements: For management of ES and FHC: QL3 LiDAR for the lower 48 states and Hawaii; QL5 IFSAR for Alaska, Guam, American Samoa, Northern Mariana Islands, and Puerto Rico.

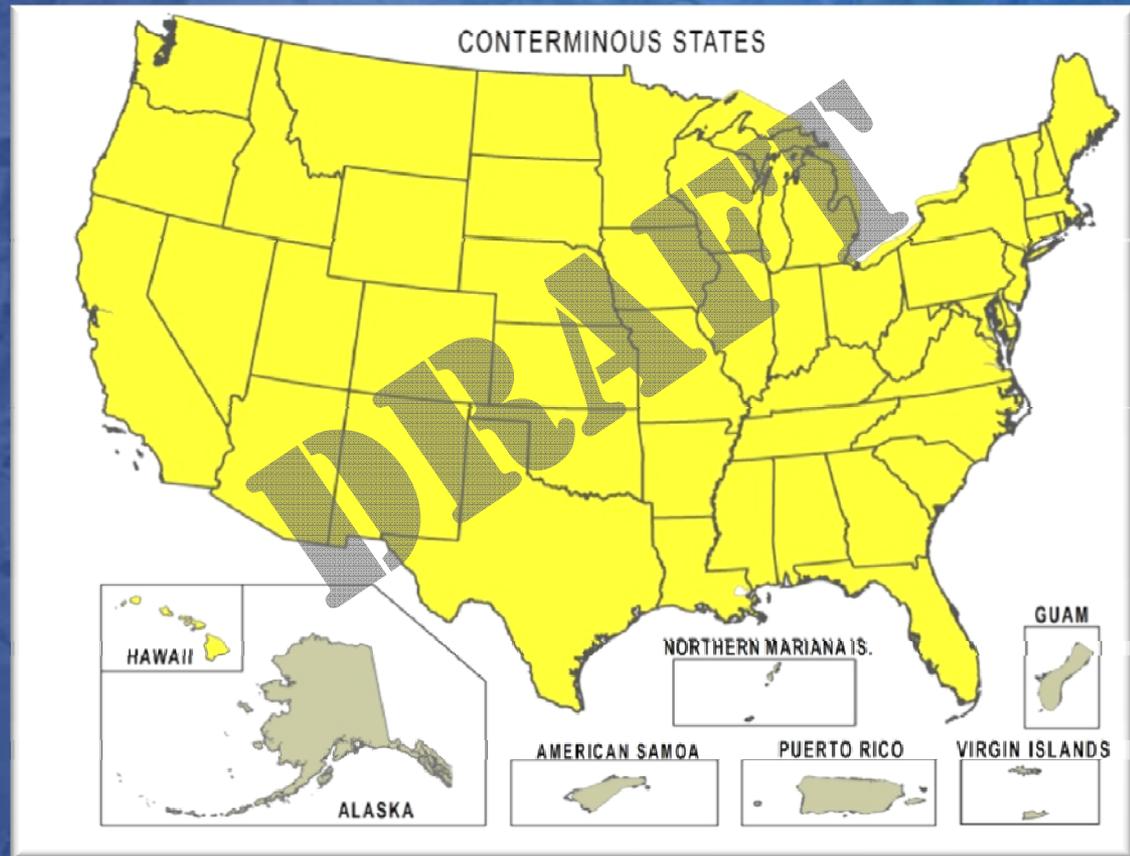
For this Functional Activity, FWS prefers LiDAR acquisition during leaf-on conditions.

Update frequency: 6-10 years

Estimated program budget supported by elevation data:

\$437.1M/year

Quantifiable benefits of enhanced elevation data: Cannot estimate cost savings



# National Geospatial Intelligence Agency

## Functional Activity: Homeland Security and Disaster Preparedness

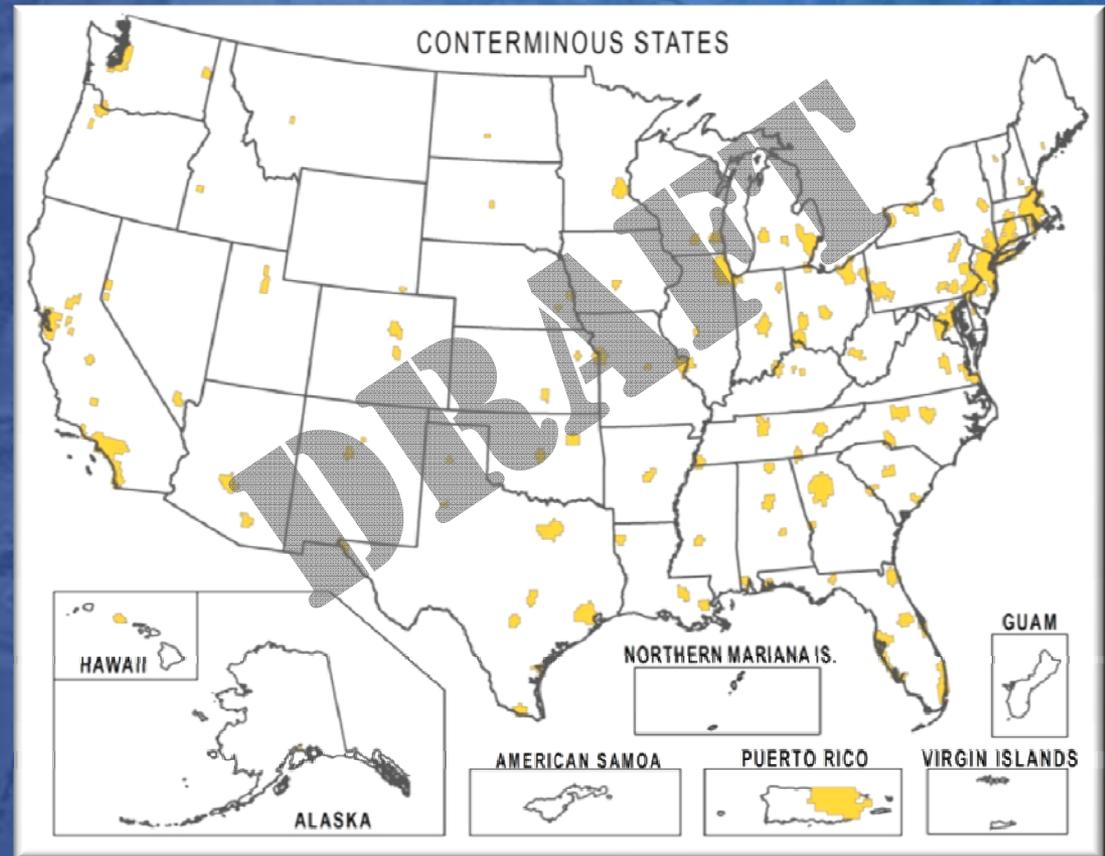
Mission-Critical Requirements: For disaster response, law enforcement, homeland security, research, and 3D modeling, simulation, and analyses.

Update frequency: 4-5 years

Estimated program budget:

\$\_\_\_/year

Quantifiable Benefits of Enhanced Elevation Data: No credible cost savings can be placed on the dollar value of infrastructure or lives protected from acts of terrorism or natural disasters.



# National Ocean and Atmospheric Administration

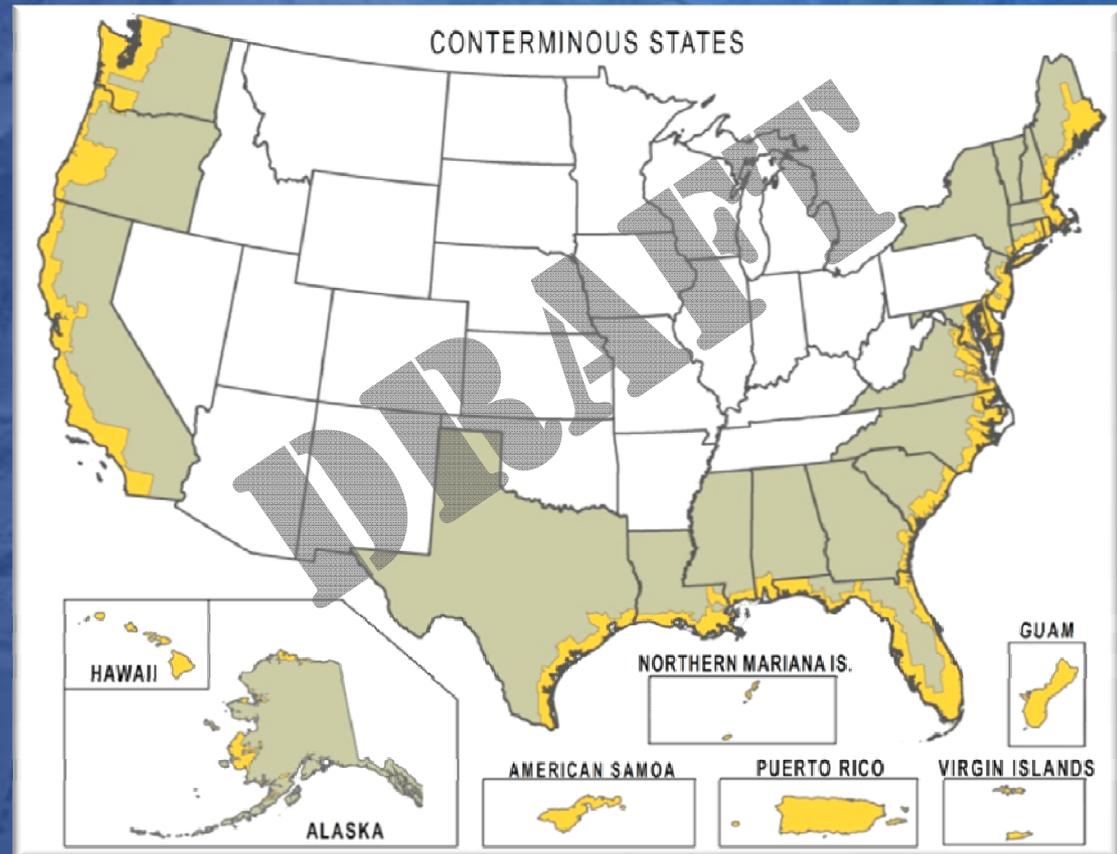
## Functional Activity: Coastal Mapping and Modeling

Mission-Critical Requirements: For modeling, mapping and forecasting coastal hazards; tsunami modeling and warnings; and support of NOAA's initiatives including the Integrated Ocean and Coastal Mapping initiative.

Update frequency: 4-5 years

Estimated program budget: \$\_\_\_\_/year

Quantifiable Benefits:  
Coastal hazard modeling and mapping saves lives and property, as do improved tsunami warnings. Additionally, NOAA would reduce its operational costs by \$300K/year.



# Federal Emergency Management Agency

## Functional Activity: Flood Risk Analysis

Mission-Critical Requirements - For input into the floodplain modeling and mapping process that results in FIRMs, which are used an estimated 15 million times annually for floodplain management and insurance rating.

Update frequency: 6-10 years

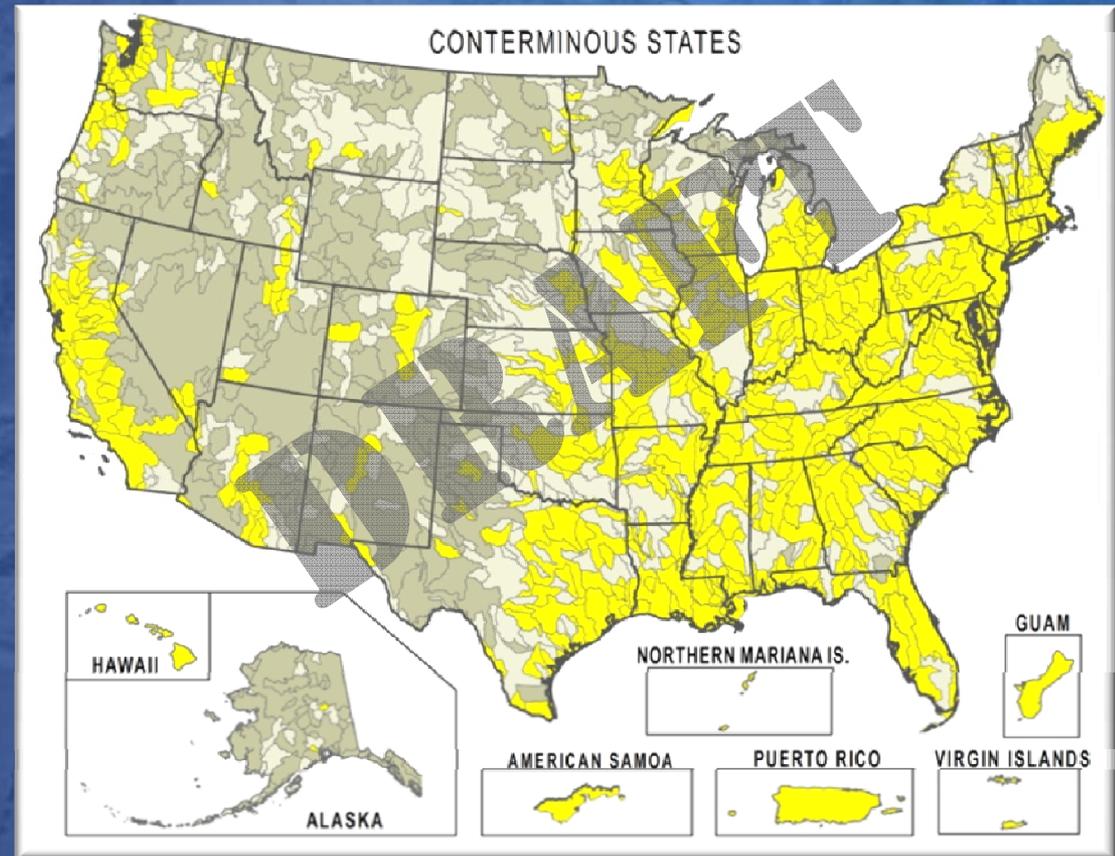
Estimated program budget

supported by elevation data:

\$900M/year

Quantifiable Benefits of Enhanced Elevation Data:

FEMA would save \$10M/year in internal costs; FEMA's customers will save over \$1B/year in flood damage reductions from the NFIP, largely dependent on accurate and credible elevation data trusted by the public.



# Federal Emergency Management Agency

## Functional Activity: Flood Insurance Rating

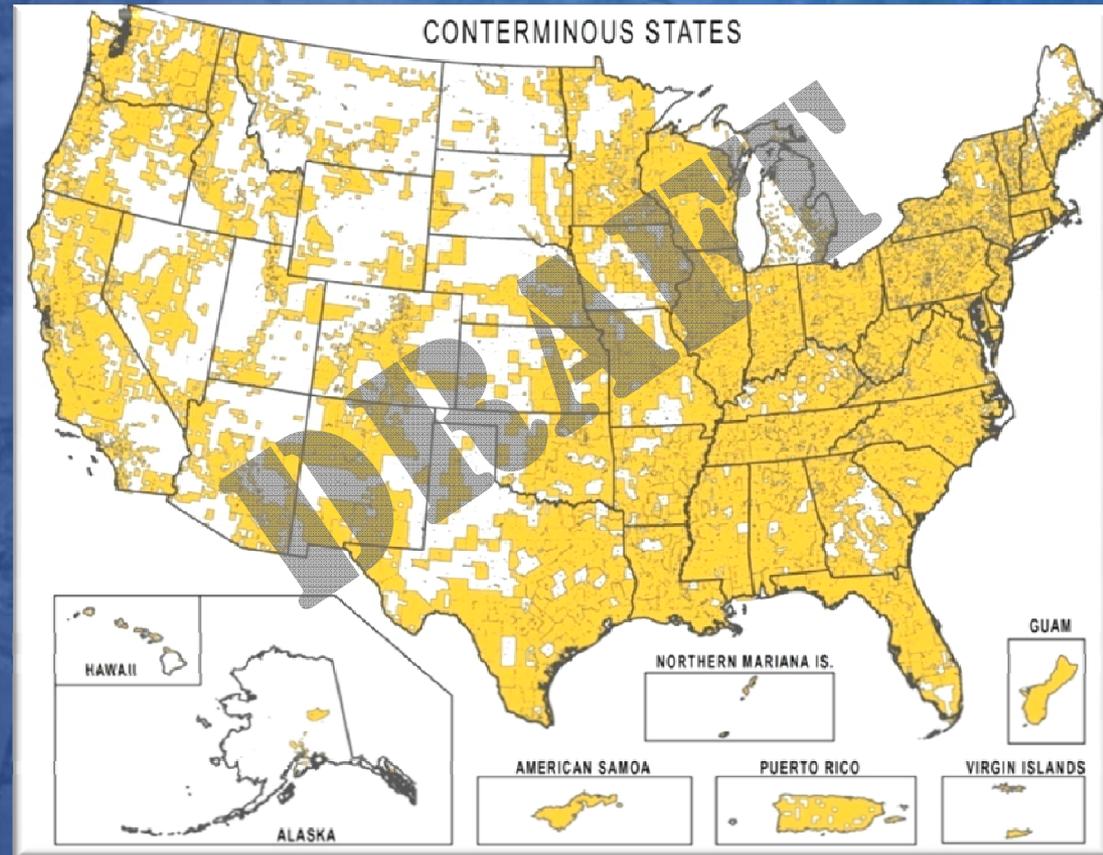
Mission-Critical Requirements: For establishing flood insurance premiums for structures in SFHAs by comparing elevations of the structure, the surrounding ground, and the water surface elevation of the 1% annual chance flood at that location.

Update frequency: >10 years

Estimated program budget: \$3B/year

Quantifiable Benefits of Enhanced Elevation Data:

Eliminating the need for Elevation Certificates could save home owners and businesses an estimated \$\_\_\_/year



# National Enhanced Elevation Assessment



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