

# National Enhanced Elevation Assessment

# Welcome

October 26, 2010

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Senior Advisor  
National Geospatial Program



# Agencies Participating

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

# National Enhanced Elevation Assessment

## About the Project Team

### 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

### Contractor:

- Dewberry

# USGS Path to Digital Elevation Data

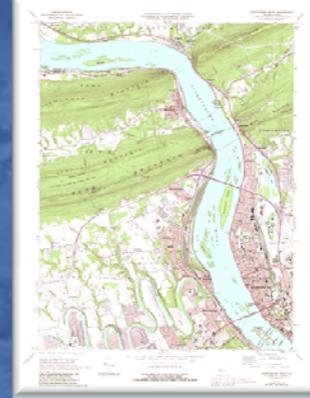
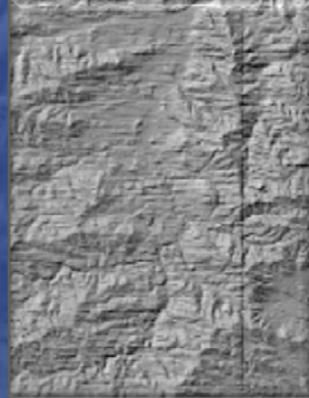
USGS  
Organized

Aerial  
Photographs

First Digital  
Elevation  
Model

Nationwide  
Topographic  
Maps

Seamless  
Nationwide  
Elevation Dataset



1879

1930

1975

1991

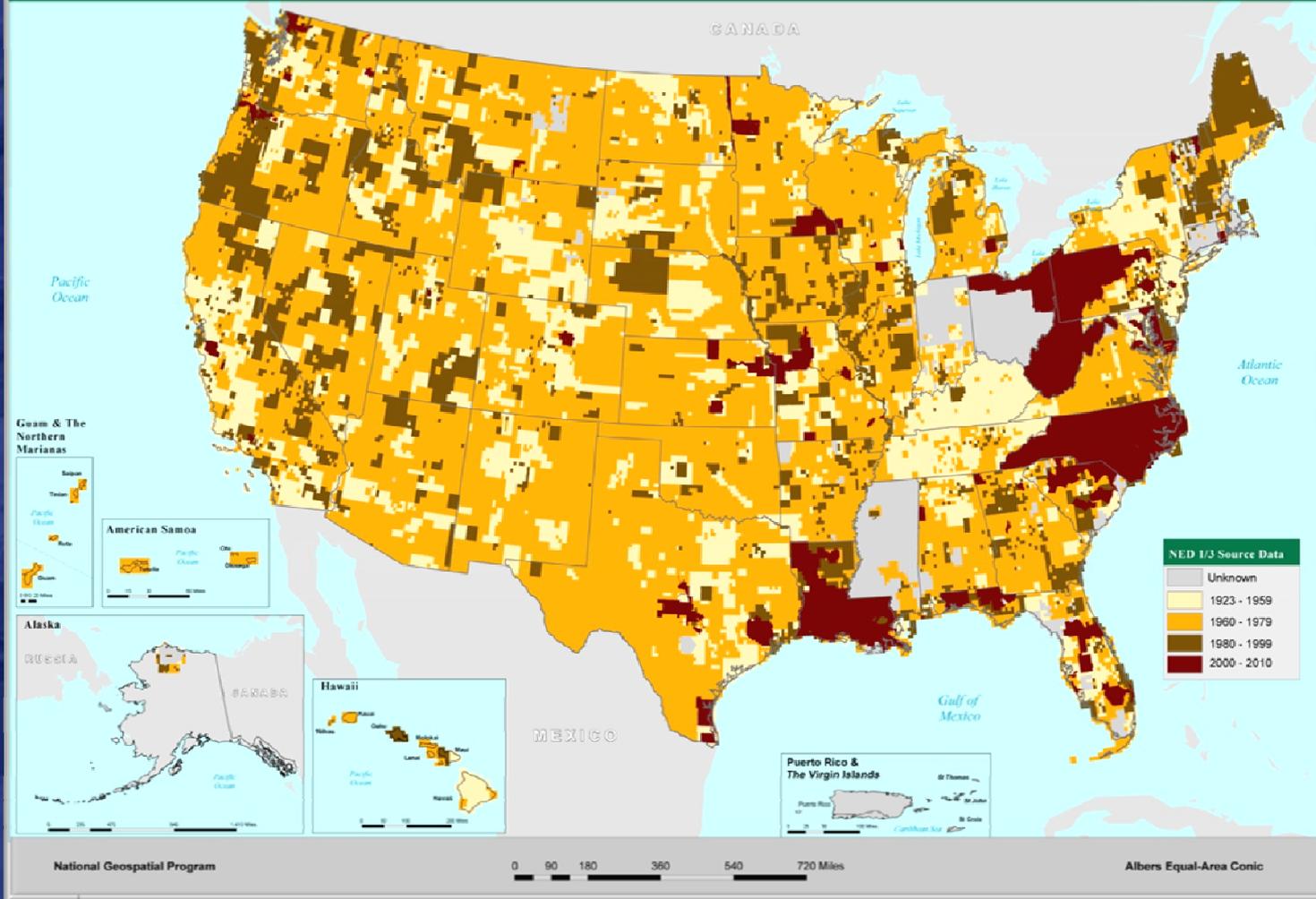
1997

# National Elevation Dataset



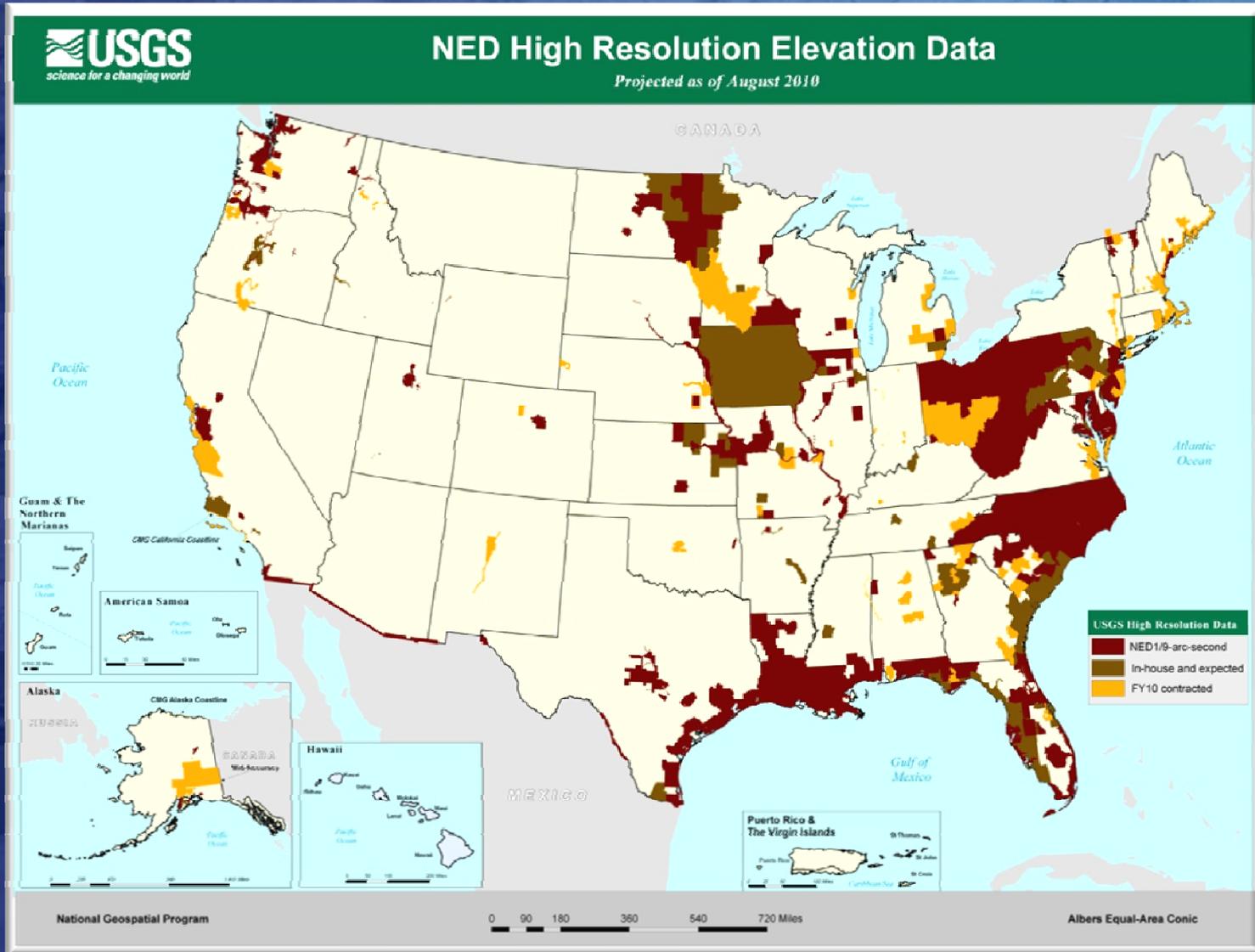
## National Elevation Dataset (NED) by Year Acquired

Projected as of August 2010



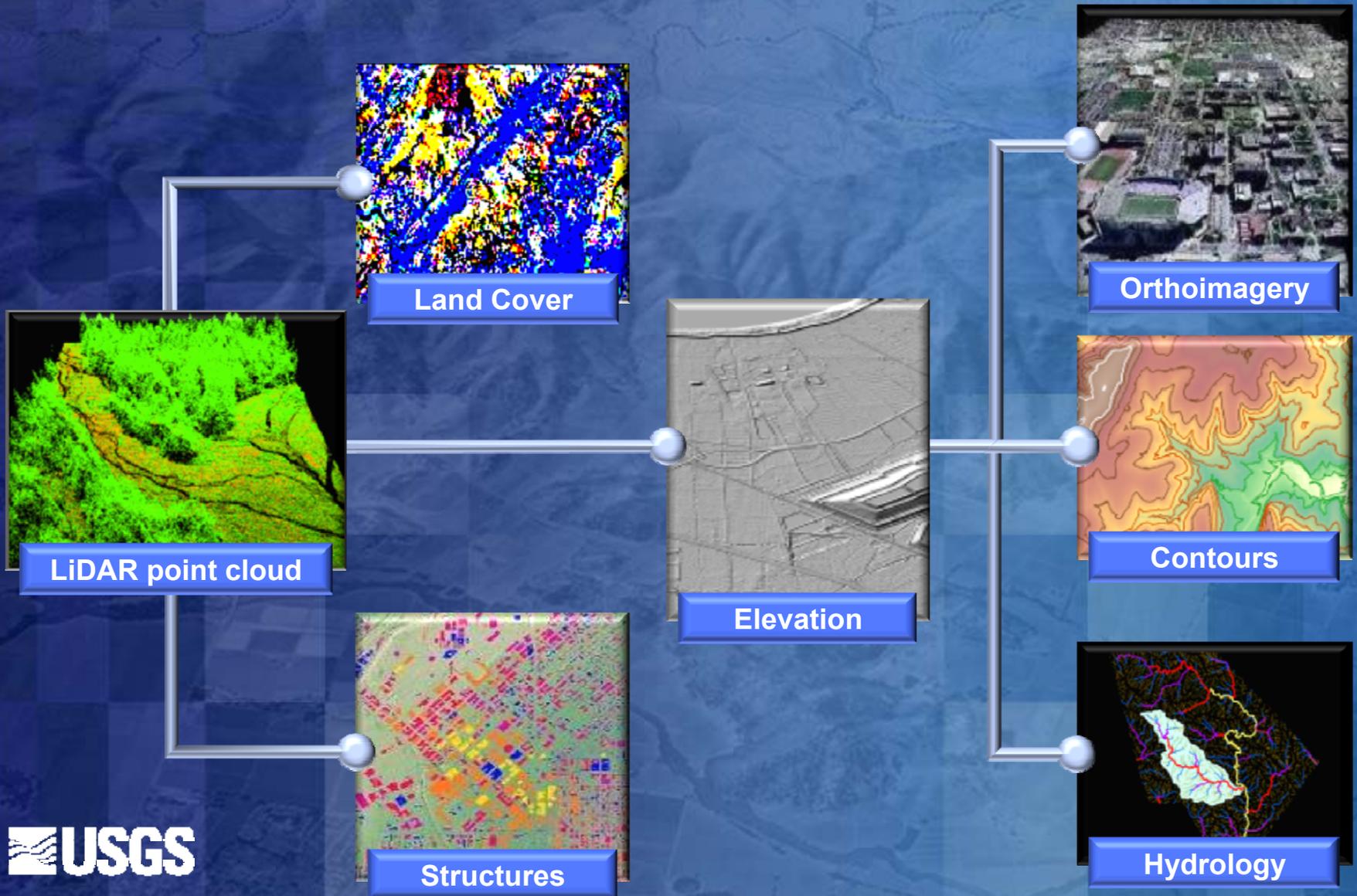
80 Percent of elevation data is more than 30 years old and will not meet accuracy requirements for many applications.

# High Resolution Elevation Data

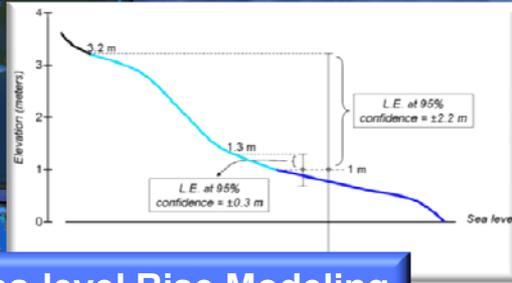
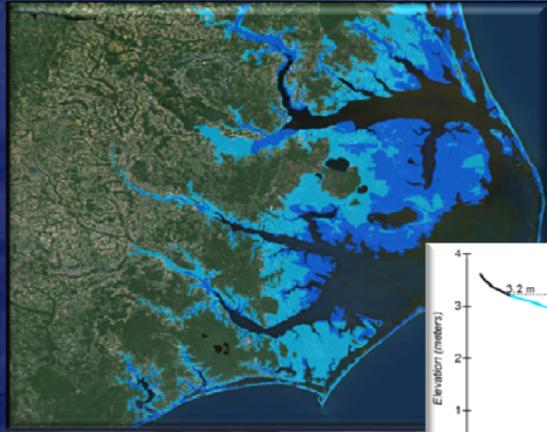


# LiDAR Point Cloud and Derived Elevation Products

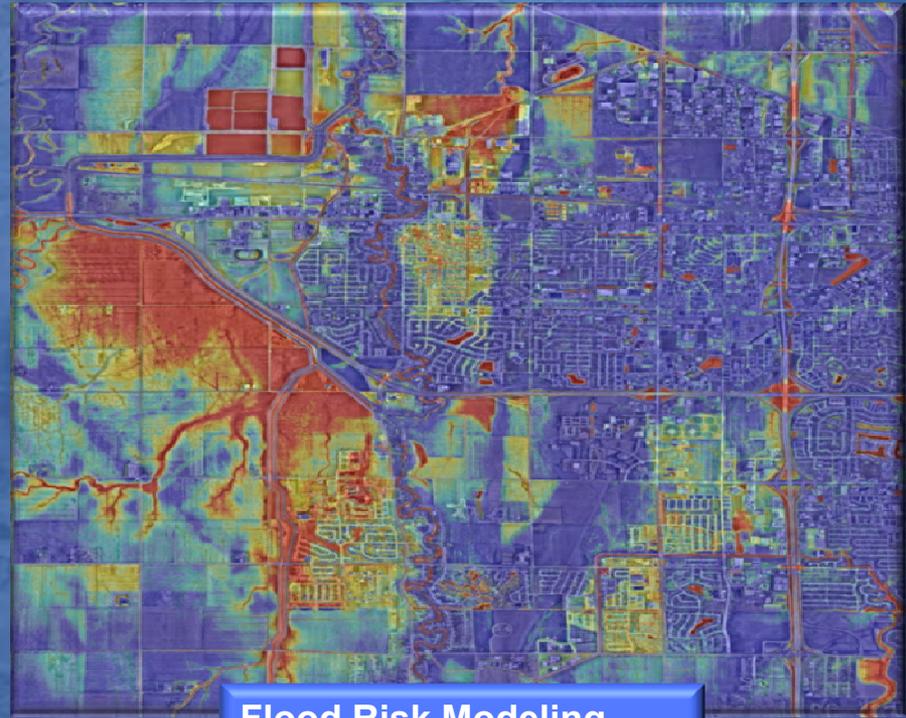
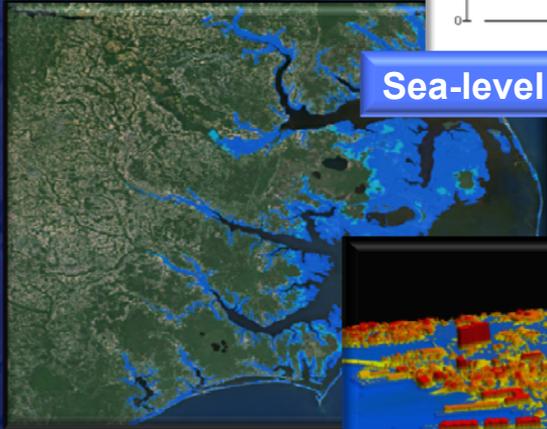
## Supports Data Development and Geospatial Data Integration



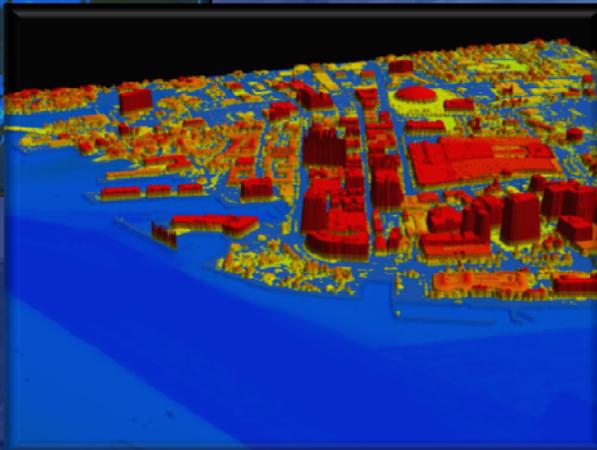
# Geospatial Applications: for Flood and Sea-level Rise Modeling



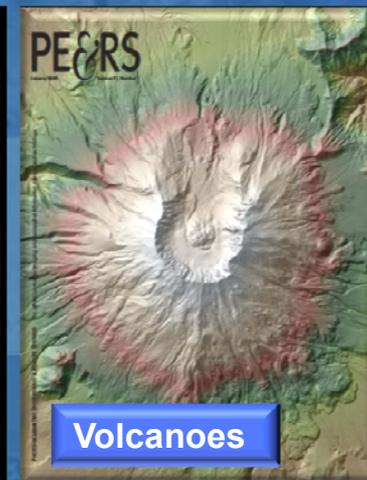
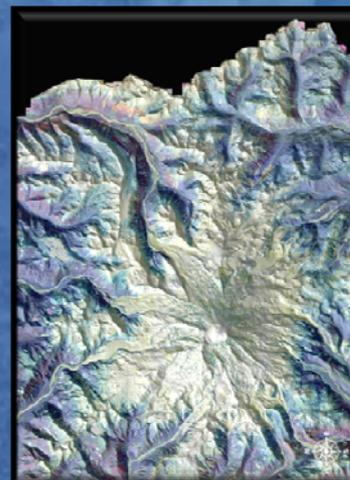
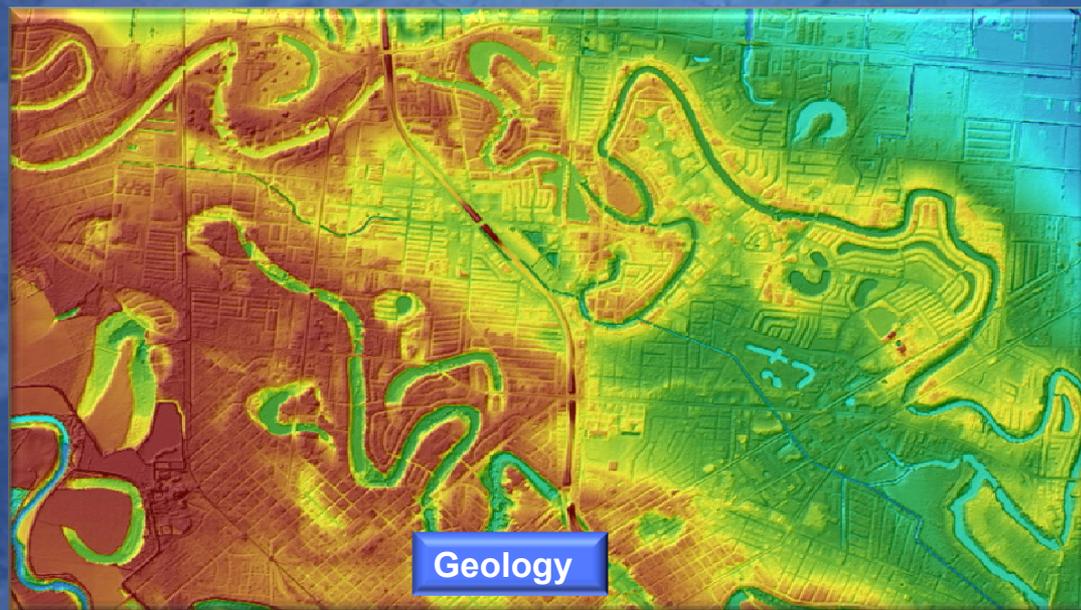
Sea-level Rise Modeling



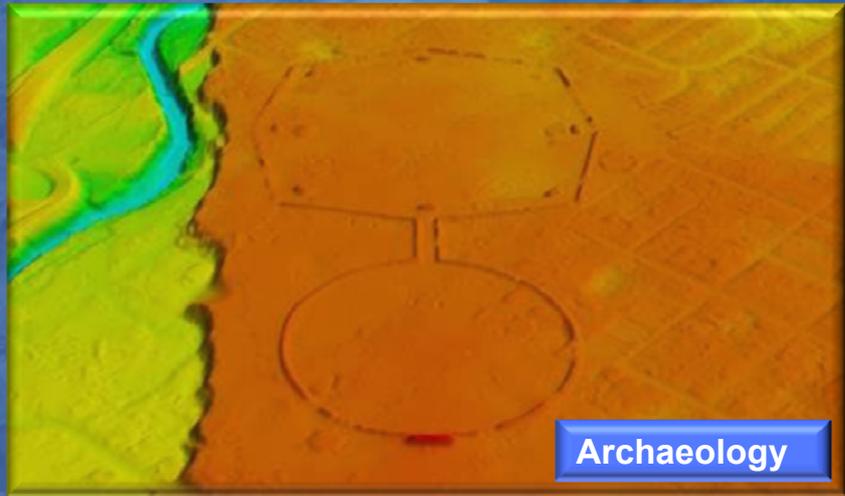
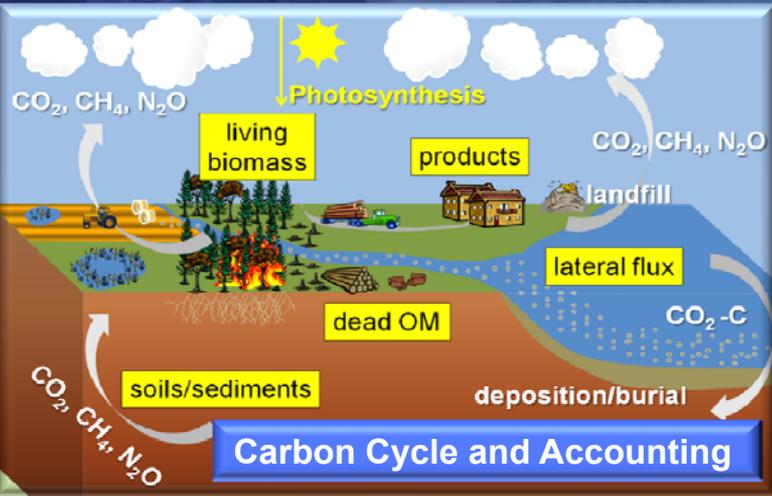
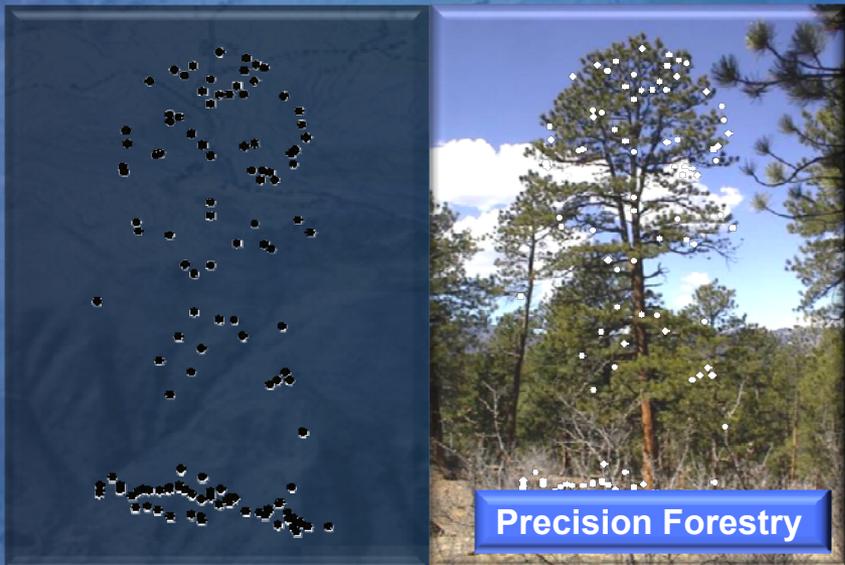
Flood Risk Modeling



# Geospatial Applications: for Bare Earth Science

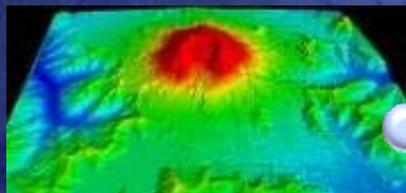


# Advanced Geospatial Applications for LiDAR and Derived Datasets

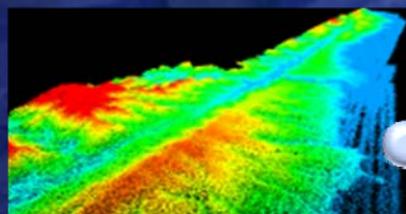


# Concept for a National Enhanced Elevation Program

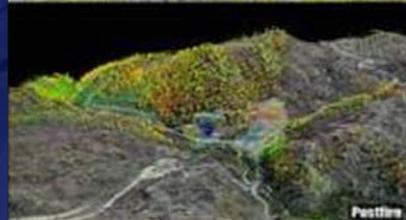
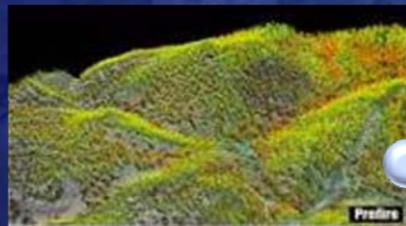
LiDAR to support science needs



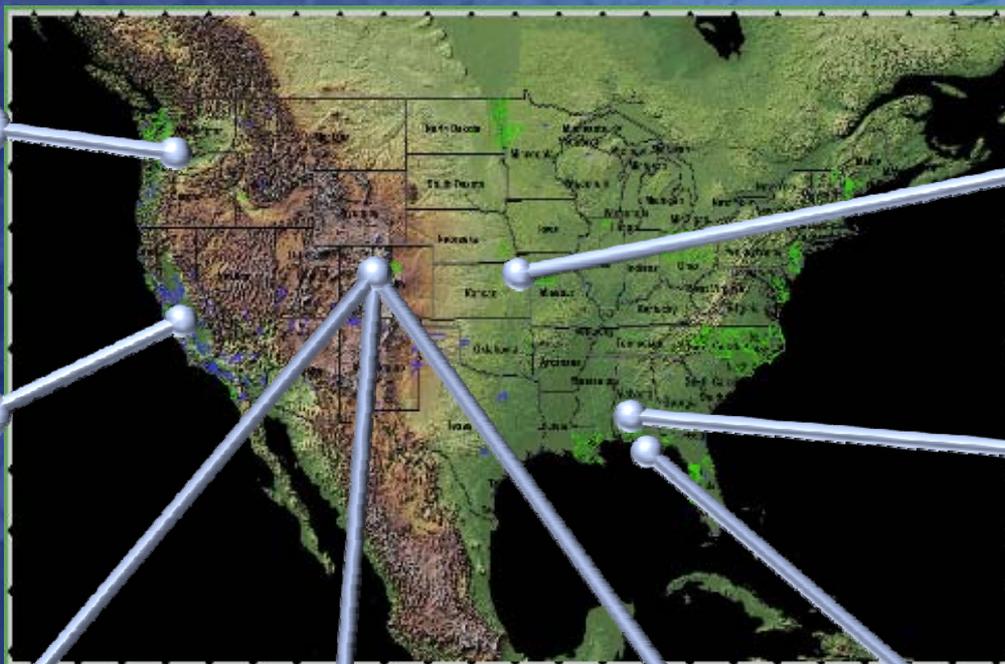
Volcano Monitoring



Earthquake Faults



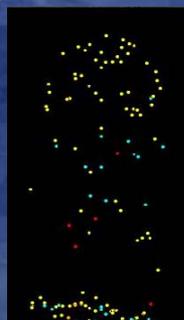
Carbon/Disturbance



Urban Response



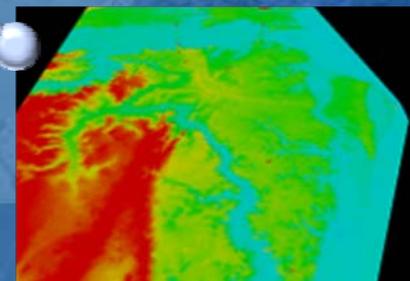
Land Cover



Biomass



Hydrologic Studies



Coastal Studies



# How many functional activities?

- Delineation of canopy surface and forest metrics
- Determination of watershed characteristics
- Delineation of building structures
- Characterization of urban settings
- Monitoring long-term shoreline change
- Mapping land cover and land use
- Measuring earthquake deformation
- Delineation of volcanic structure
- Monitoring volcano hazards
- Urban mapping
- Powerline mapping
- Hydrologic Modeling
- Bare earth products
- Monitoring debris flows
- Wave height surveys
- Sedimentation into rivers
- Monitoring geomorphic processes
- Identification of ponding areas
- Mapping wetland drainage
- Creation of synthetic drainage networks
- Identifying culverts
- Transportation mapping
- 3-D visualization of buildings
- Volume visualization
- Identifying bird habitats
- Mapping confined urban channels vs natural streams
- In the creation of seamless topo/bathy products
- Integration into the National Elevation Dataset
- Derivation of stream channel characteristics
- Mapping and monitoring coastal hazards
- Identify small hydrologic features (ditches, tile drain)
- Mapping fish habitat
- Characterizing wildlife habitat
- Identification of canopy gaps
- Flood inundation modeling
- Derivative hydrologic profiling
- Disaster response
- Fire science
- High-resolution floodplain mapping
- Characterization of canopy structure
- Defining drainage basins
- Jokulhaup monitoring
- Fault-rupture mapping
- Monitoring sea level rise
- Natural Hazards
- Identifying landslide-prone areas
- Creating topographic maps
- Glacier changes
- Carbon sequestration assessments
- Homeland security scenarios

# Enhanced Elevation Data

## Many Stakeholders

- **USGS, FEMA, USDA, NOAA, USACE, NASA, NGA and others**
- **States, local and Tribal governments**
- **Private sector – Forest Products, Development, Energy and others**
- **Organizations:**
  - **Association of American State Geologists**
  - **National States Geographic Information Council**
  - **National Association of Counties**
  - **AmericaView**
  - **Coastal States Organization**
  - **ASPRS, AAG, URISA, etc.**
  - **MAPPS**
  - **Science consortiums**
  - **Others...**

# Elevation data ranking compared to other geospatial data

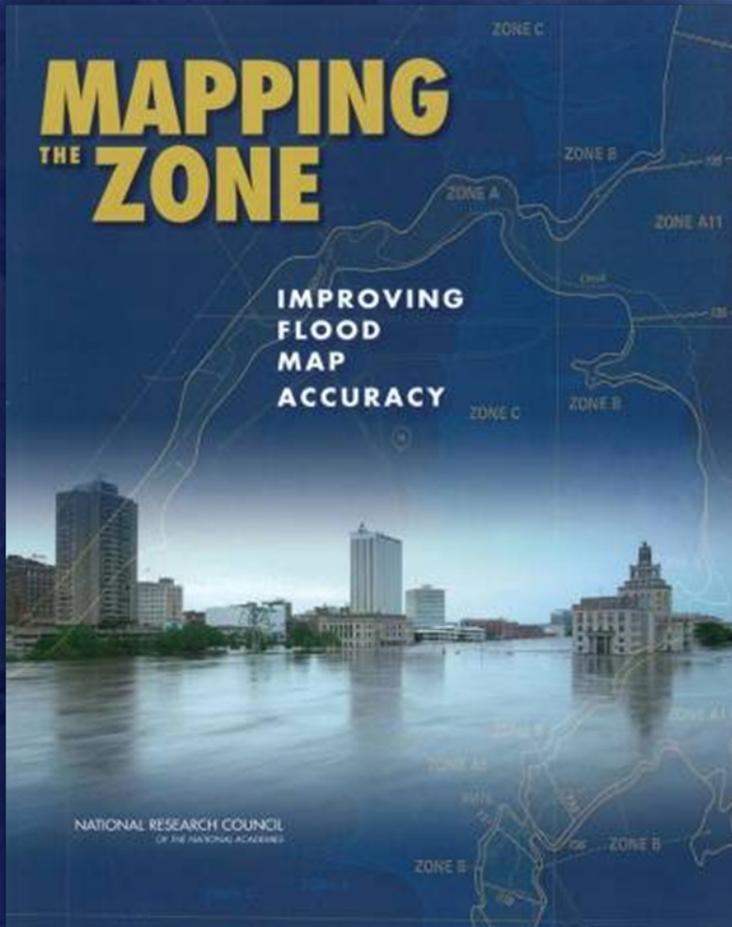
## ...according to our customers

	Structured Interviews				ASPRS Survey		
	No.	Low	Med	High	Low	Medium	High
Orthoimagery	158	3%	10%	<b>87%</b>	9.1% (25)	10.5% (29)	<b>80.4% (222)</b>
Transportation - Public streets/roads	158	7%	17%	<b>76%</b>	6.6% (18)	21.4% (58)	<b>72.0% (195)</b>
Elevation	158	7%	20%	<b>73%</b>	4.0% (11)	14.5% (40)	<b>81.5% (224)</b>
Hydrography – Surface water	158	8%	23%	<b>70%</b>	11.2% (30)	29.5% (79)	<b>59.3% (159)</b>
Boundaries – Civil boundaries e.g. city, county, state	158	14%	31%	<b>55%</b>	16.2% (43)	36.5% (97)	<b>47.4% (126)</b>
Parcels	158	24%	28%	<b>48%</b>	34.7% (93)	29.9% (80)	35.4% (95)
Land cover (i.e. vegetation, built, wetlands, grasslands)	156	23%	41%	36%	16.1% (43)	33.7% (90)	<b>50.2% (134)</b>
Geographic names	158	21%	46%	33%	24.3% (65)	42.9% (115)	32.8% (88)
Boundaries - Public Land Survey System	158	29%	33%	39%	27.6% (74)	32.5% (87)	<b>39.9% (107)</b>
Vertical and horizontal control	158	23%	45%	32%	18.7% (50)	25.0% (67)	<b>56.3% (151)</b>
Boundaries – Federal and Native American lands	157	23%	47%	30%	36.8% (96)	36.0% (94)	27.2% (71)
Pipelines and powerlines	158	22%	53%	25%	36.9% (99)	35.8% (96)	27.2% (73)
Structures – selected public buildings such as schools	158	39%	34%	27%	26.4% (70)	44.5% (118)	29.1% (77)
Transportation – Other routes e.g. forest roads	155	37%	45%	19%	<b>40.8% (108)</b>	40.8% (108)	18.5% (49)
Transportation – Railroads	158	39%	46%	16%	30.6% (81)	44.2% (117)	25.3% (67)
Transportation – Airports	157	<b>42%</b>	42%	16%	38.0% (100)	37.6% (99)	24.3% (64)
Physiographic feature names (mountain, valley, canyon)	158	<b>41%</b>	44%	15%	<b>43.1% (116)</b>	33.1% (89)	23.8% (64)
Transportation – Trails	157	<b>41%</b>	46%	13%	<b>50.0% (132)</b>	35.6% (94)	14.4% (38)
Springs and wells	157	<b>46%</b>	38%	16%	<b>52.6% (141)</b>	31.7% (85)	15.7% (42)
Structures – Buildings	158	<b>48%</b>	37%	15%	39.1% (102)	41.8% (109)	19.2% (50)

# State LiDAR Programs

State	Agency Leading Effort	Funding Source	Primary Applications Cited
Louisiana	LA Oil Spill Coordination Office	FEMA & State match (50/50)	Floodplain insurance mapping
Iowa	Department of Natural Resources	State Agriculture & Natural Resources Fund	Conservation farming, road surveys
Minnesota	Council on GIS	State Conservation Legacy – Clean Water	Support clean water projects
North Carolina	Office of Budget, Div. of Emergency Mgmt.	FEMA	Floodplain insurance mapping
South Carolina	Department of Natural Resources	Federal, state, local consortium	Map bare earth, structures, vegetation
Ohio	Office of Information Technology	Federal, state, local consortium	Orthorectify imagery
Pennsylvania	Department of Conservation	State appropriation	Accurate bare earth elevation model
Oregon	Dept. of Geology & Mineral Industries	Federal, state, local consortium	Map landslides, faults, road construction

# Multiple Studies Completed or in Progress



- NRCS Elevation Initiative (Under contract)
- FEMA National Digital Elevation Acquisition and Utilization Plan for Floodplain Map Updates (to Congress in 2010)
- Alaska Statewide Digital Mapping Initiative (Produced for Alaska Department of Natural Resources, 2009)
- Mapping the Zone (NRC 2009)
- The North Carolina Floodplain Mapping Program (Cost benefit 2008)
- Elevation Data for Floodplain Mapping (NRC, 2007)
- FEMA cost benefit studies (1997, updated 2000)

# National Enhanced Elevation Assessment

## Business Uses and Benefits

Quantify answers to 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?

# National Enhanced Elevation Program

## Strategic Goals

- Directed, national approach to meet critical business uses for precision elevation data
- Standardized quality products collected once and meeting multiple Federal and State mission needs
- Consistent measurements across projects for reliable science
- Readily accessible data in useful formats
- Use of leading edge technology
- Balancing requirements, benefits and costs

# Project Management Plan



[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:

Dewberry

8401 Arlington Blvd.

Fairfax, VA 22031-4666



- Overview, goals & objectives
- Requirements, costs & benefits information collection methodology by Federal, States and non-governmental users:
  - Questionnaire process
  - Interview process
  - Validation process
- Data analyses by Dewberry
- Technology alternatives
- IT implementation scenarios
- Cost-benefit analyses
- Conclusions & recommendations

# National Enhanced Elevation Assessment

1. Documentation of Business Uses and Inventory of Existing Elevation Data
  - Elevation data inventory (in progress) – NOAA, FEMA, USGS
  - Federal business use requirements and expected benefits
  - State and other organization assessment begins in March
2. Aggregation and Analysis of Business Uses
3. Assess Emerging Elevation Data Collection Technology and Related Issues
4. Technology Infrastructure Alternatives
5. Develop Program Implementation Scenarios

# National Enhanced Elevation Assessment

## Federal Requirements

- **Federal Kickoff meeting – October 13, 2010**
- **Online questionnaires**
  - Identify managers and technical leaders to take survey
  - Monitor survey responses and encourage non responders
- **Workshop or Interviews**
  - Decide on workshop or interview approach for your agency
  - Identify workshop or interview participants
  - Set a date for your workshop or interviews
  - Coordinate invitations and host your agency workshop or interviews
- **Validate agency requirements and expected benefits**
- **Be supportive and positive – we only get one shot at this**
- **Finished (last interviews completed) – March 25, 2011**

# Elevation Data Quality Levels

Quality Levels	Elevation Source	Horizontal Resolution Terms			Vertical Accuracy Terms	
		Point Density	Nominal Pulse Spacing	DEM Post Spacing	RMSEz in Open Terrain *	Equivalent Contour Accuracy
QL 1	LiDAR	8 pts/m <sup>2</sup>	0.35 m	1/27 arc-sec (~1 m)	9.25 cm	1-ft
QL 2	LiDAR	2 pts/m <sup>2</sup>	0.7 m	1/27 arc-sec (~1 m)	9.25 cm	1-ft
QL 3	LiDAR	1 – 0.25 pts/m <sup>2</sup>	1 – 2 m	1/9 arc-sec (~3 m)	≤18.5 cm	2-ft
QL 4	Imagery	1 – 0.04 pts/m <sup>2</sup>	1 – 5 m	1/3 arc-sec (~10 m)	46.3 cm – 139 cm	5 – 15 ft
QL 5	IFSAR	0.04 pts/m <sup>2</sup>	5 m	1/3 arc-sec (~10 m)	92.7 cm – 185 cm	10 – 20 ft

\* Vertical accuracy is reduced in vegetated land cover categories

# Milestones for Analysis Phase

- **Planning meeting - March 15, 2011**
- **Complete population of geodatabase - April 14, 2011**
- **Analyze Business Use requirements by elevation data Quality Level and geographic area, costs and benefits; develop candidate national elevation datasets, IT infrastructure alternatives and implementation scenarios; perform cost-benefit analyses; develop conclusions and recommendations; and draft Project Report - July 14, 2011**
- **Present draft Project Report to USGS - July 15, 2011**
- **Project Report to study coordination team- August 15, 2011**
- **Finalize and submit all deliverables - August 26, 2011**

# National Enhanced Elevation Assessment

## Possible Program Implementation Scenarios

- A highly distributed program where each agency independently plans, collects, manages, and distributes their data – a status quo solution. This solution anticipates that agencies would coordinate their activities with others to the extent that they do so today.
- A national program where enhanced elevation data acquisition, processing, and distribution responsibilities are shared and well coordinated by Federal, State, and other partners.
- A national program where the Federal Government administers the enhanced elevation data acquisition, processing and distribution on behalf of all users through a lead Federal Agency.

# National Enhanced Elevation Program

## Idealized Goals and Schedule

- **FY10**
  - Establish project team and management oversight
  - Initiate National Enhanced Elevation Assessment
  - Build on ARRA success and partnerships with FEMA, NGA, states and others
- **FY11**
  - National Enhanced Elevation Assessment complete
  - Develop National Enhanced Elevation Plan
- **FY12**
  - Develop supporting documents – alternatives analysis, design, implementation plan, etc.
  - Develop organizational approaches
- **FY13**
  - Implementation begins

