USGS 3DEP

The National Map

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What is the 3D Elevation Program?

A call for action to…

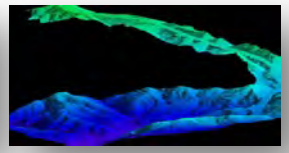
- Accelerate the acquisition of high quality light detection and ranging (lidar) data in the conterminous U.S. (CONUS), Hawaii, and the U.S. Territories; and interferometric synthetic aperture radar (ifsar) data in Alaska
- Completely refresh the National Elevation Dataset (NED) with new lidar and ifsar elevation data products and services
- Leverage collaboration among federal, states, local and tribal partners to systematically complete national 3D elevation data coverage in eight years
- Raise governance to the executive level and build on the structure already in place at the operational level under the National Digital Elevation Program (NDEP)
- Increase the overall investment in 3D elevation to $146 million annually to return more than $690 million annually in new benefits


Natural Resource Conservation


Infrastructure Management


Flood Risk Mitigation


Precision Farming


Land Navigation and Safety


Geologic Resources and Hazards Mitigation

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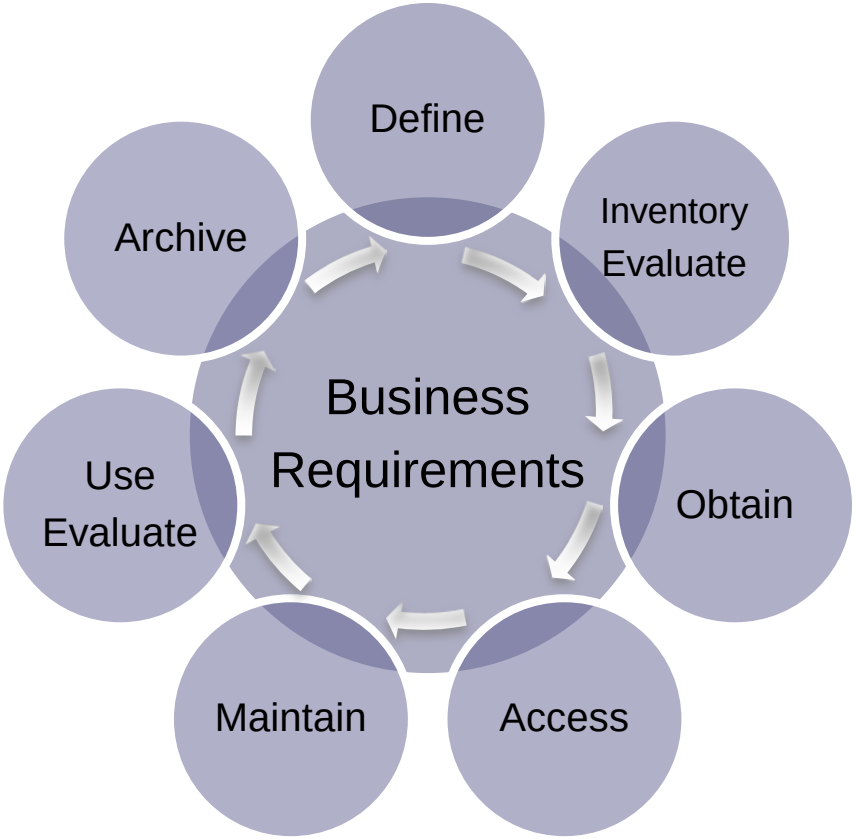
USGS Lead Agency for Terrestrial Elevation

Office of Management and Budget Circular A-16

- For more than 15 years, the USGS has managed the National Elevation Dataset (NED) and coordinated acquisition through the National Digital Elevation Program (NDEP) on a project-by-project basis
- We are at a point in the data lifecycle of defining the next generation national elevation program



Geospatial Data Lifecycle

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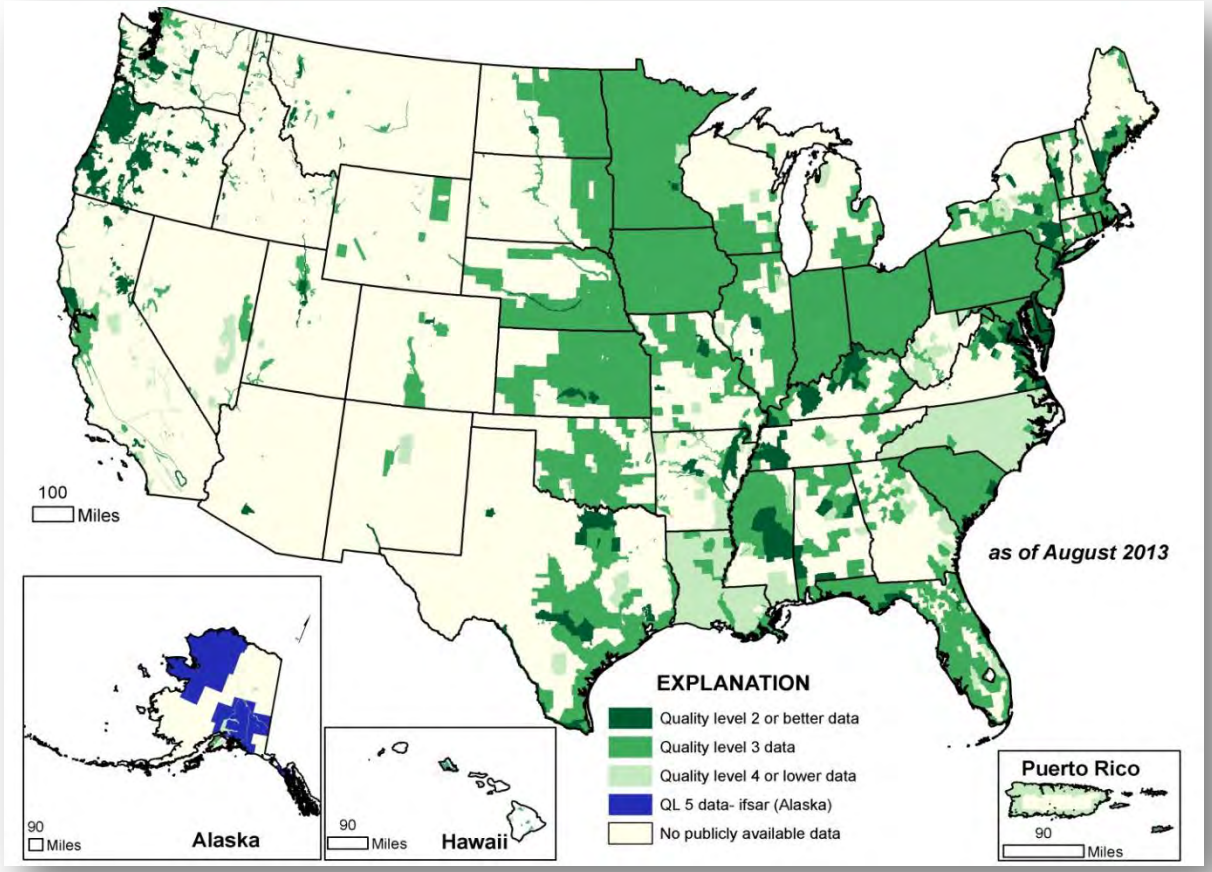
U.S. Interagency Elevation Inventory

2013 Status Map of Publically Available Lidar and Ifsar



Lidar: 38% of the lower 49 states has coverage

- ***Only 4 percent meets the 3DEP goal of QL2 or better***

Ifsar: 43.5% of Alaska has coverage

- ***More than half the State needs ifsar data to complete the 3DEP goal for coverage***

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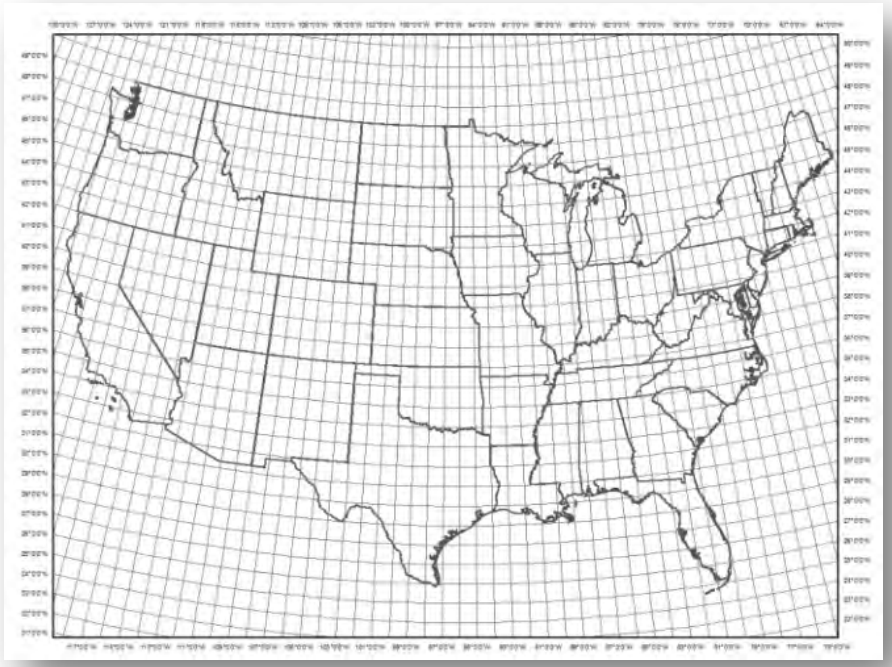
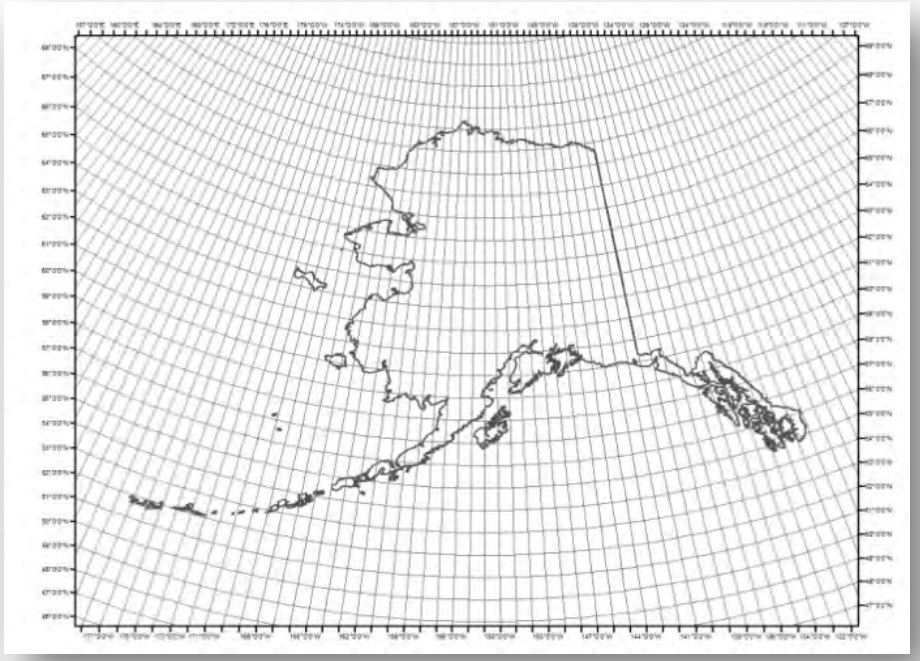
To view the inventory go to: www.csc.noaa.gov/inventory

Analyzed requirements, benefits and costs by 1-degree cells

Using all Quality Levels and Update Frequencies per Functional Activity.





- 947 1-degree cells of the 48 conterminous states
- 401 1-degree cells of Alaska
- Hawaii and U.S. territories evaluated by individual islands

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Currently in Progress: revision and alignments of specifications (USGS and ASPRS)

3DEP/NEEA Quality Level	Pulse Spacing (Density) [m (ppsm)]				ASPRS Class	$RMSE_Z$ Error [cm]			
	3DEP (v1.1)	NEEA	v1.0	ASPRS[1]		ASPRS	v1.0	NEEA	3DEP (v1.1)
QL0	0.35 (8)	---	---	0.35 (8)	Class III	5	---	---	5
QL1	0.35 (8)	0.35 (8)	---	0.35 (8)	*Class IV(+)*[2]	10	---	9.25	10
QL2	0.71 (2)	0.71 (2)	---	0.71 (2)	Class IV	10	---	9.25	10
v1.0	---	---	2.00 (0.7)	1.00 (1)	Class V	12.5	12.5	---	---
QL3	1.41 (0.5)	2.00 (0.7)	---	1.41 (0.5)	Class VI	20	---	18.5	20

Due out June, 2014

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CA 3DEP activities, thus far….

California Public Utilities Commission

- Initial NEEA Survey and interviews
- Yearly inventory updates
- Workshop to reach consensus for highest quality need for each 1-degree cell to meet all agency needs
- Opportunistic partnerships for Q1 and Q2 lidar

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CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE

Caltrans

CALIFORNIA GEOLOGICAL SURVEY

DEPARTMENT OF WATER RESOURCES STATE OF CALIFORNIA

+ Data Quality Level Choices

Quality Levels	Data Source	Horizontal Resolution	Vertical Accuracy	
		Point Density	RMSEz in Open Terrain	Equivalent Contour Accuracy
QL 1	LiDAR	8 points/m²	9.25 cm	1 foot
QL 2	LiDAR	2 points/m²	9.25 cm	1 foot
QL 3	LiDAR	1 – 0.25 points/m²	≤18.5 cm	2 feet
QL 4	Imagery/ LiDAR	1 – 0.04 points/m²	46.3 – 139 cm	5 – 15 feet
QL 5	Imagery/ IFSAR	0.04 points/m²	92.7 – 185 cm	10 – 20 feet

Bathymetric LiDAR requirements assessed for three Quality Levels to include Low, Standard and High. Standard Quality Level (3-5 meter post spacing; RMSEz ~ 20 cm)

Note – USGS LiDAR base acquisition specification version 13 is for QL3 data

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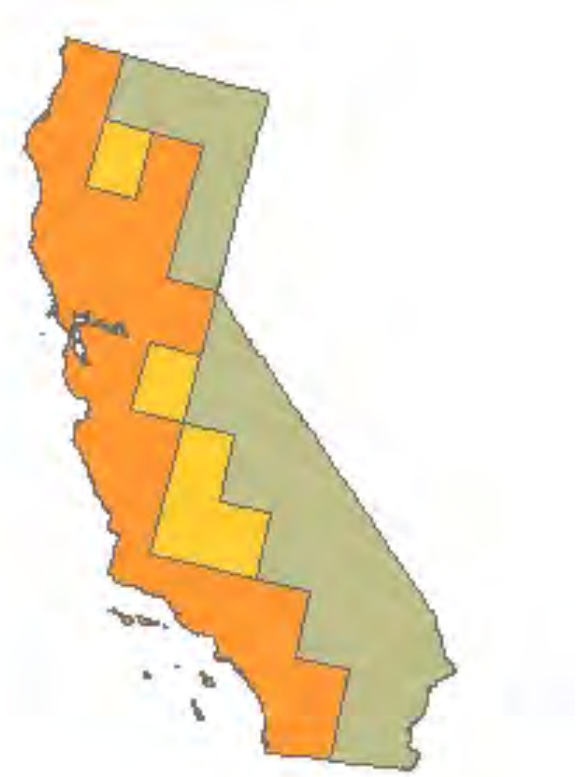
Flood Risk Management



- Sea level rise
- Regional hydrological processes
- Levee integrity
- Flood risk mapping

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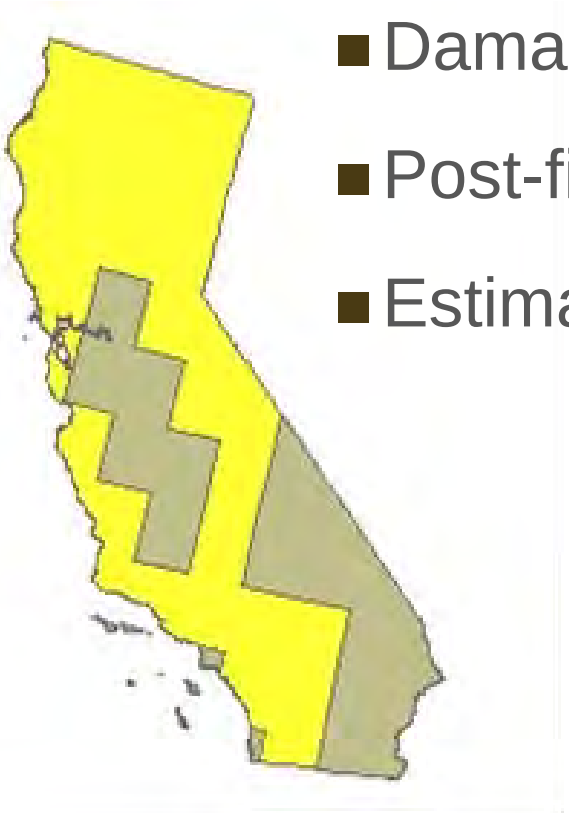
Wildfire Management, Planning, and Response

- Fire behavior modeling
- Damage assessment
- Post-fire litigation
- Estimated benefits: 16M



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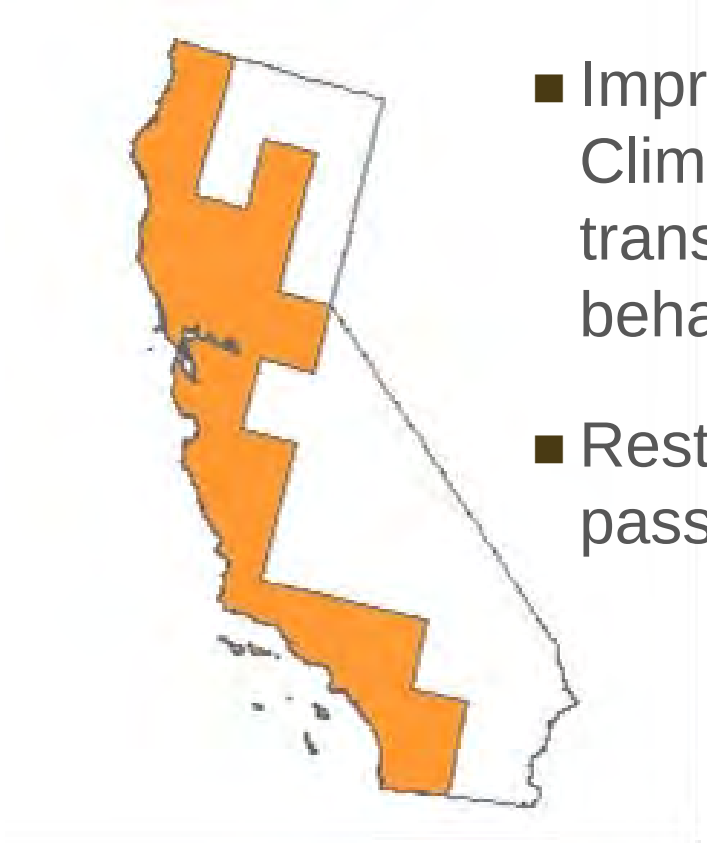
Coastal Zone management

- Improved monitoring
- Improved modeling--Climate, sediment transport, tsunami behavior
- Restoration and fish passages



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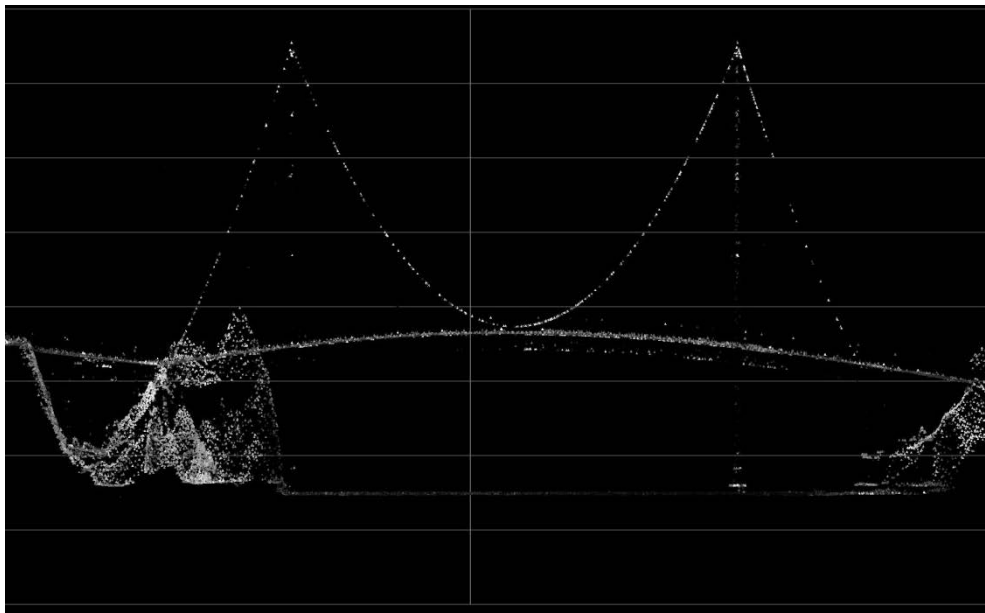
Infrastructure and Construction Management

- Road, culvert, bridge design
- Transportation planning: high speed rail
- Hydraulic modeling



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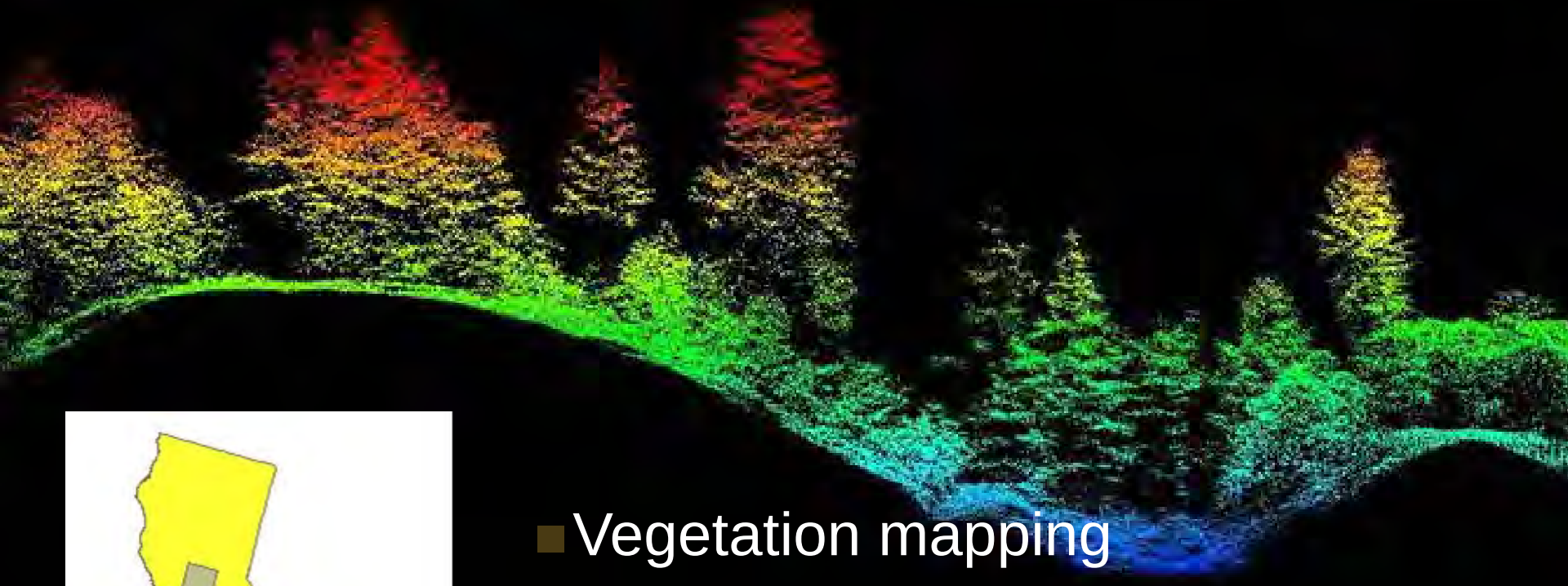
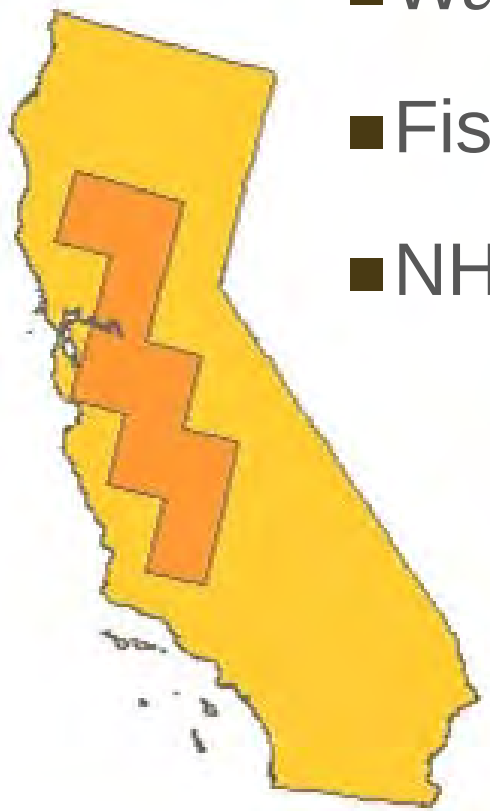
Forest Resource Management

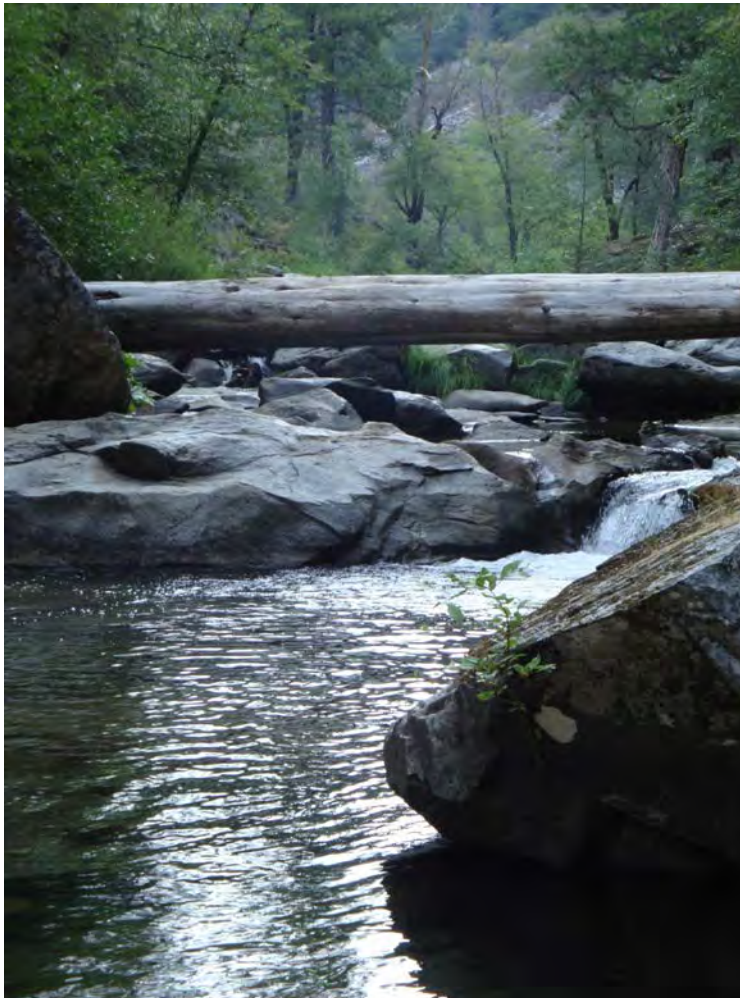


- Vegetation mapping
- Habitat analysis
- Change detection

River and Stream Resource Management

- Water conveyance
- Fish passage
- NHD stewardship





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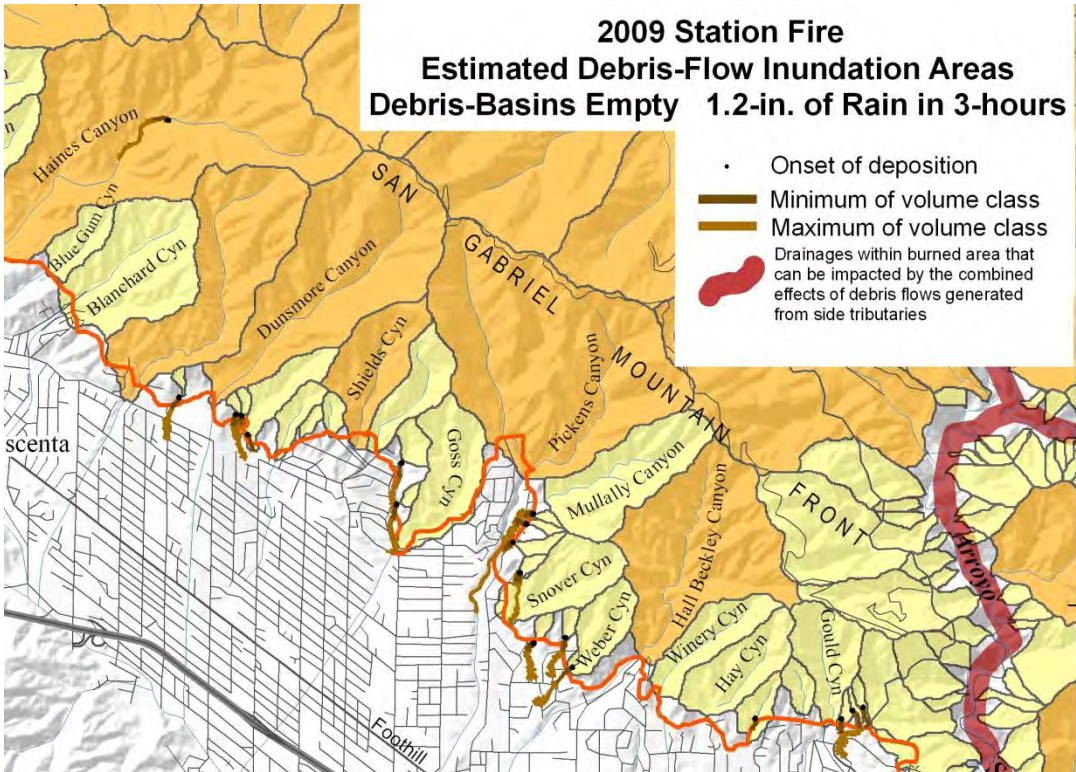
Geologic Resource Assessment and Hazard Mitigation

- Geologic mapping
- Seismic, tsunami, landslide hazard mapping and zonation



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Example: USGS Geologic Resource Assessment and Hazards Mitigation

Mission critical use: Identify areas, level of activity and risk associated with earth hazards to reduce losses and increase public safety

Data requirement: Predominantly quality level 1

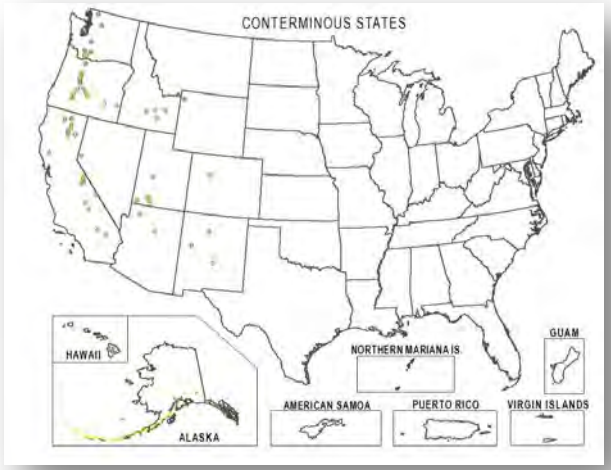
Update frequencies: 4-10 years

Expected combined benefits: $31.25M/year

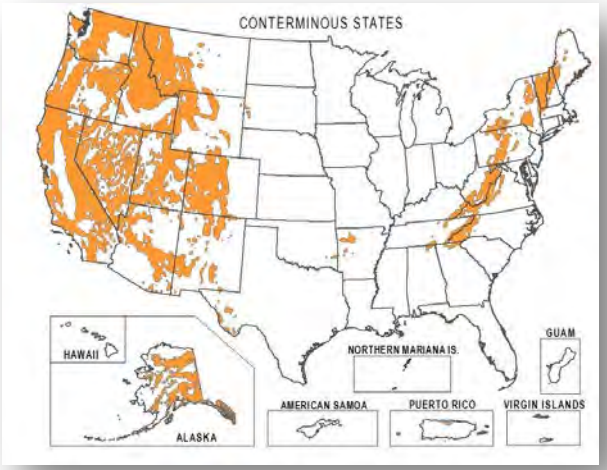
Example applications:

- Identify faults/landslides under thick vegetation
- Enhance infrastructure engineering design
- Estimate size, speed and effects of landslides
- Create loss mitigation strategies
- Provide maps and models to emergency planners

Seismic



Volcanos



Landslides

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Urban and Regional Planning

- Land use planning
- Coastal protection
- Economic development; energy
- Local slope analysis

United States Interagency Elevation Inventory

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FEMA

Select State/Territory

Select County/Island

Instructions | FAQ

Download Inventory | Metadata

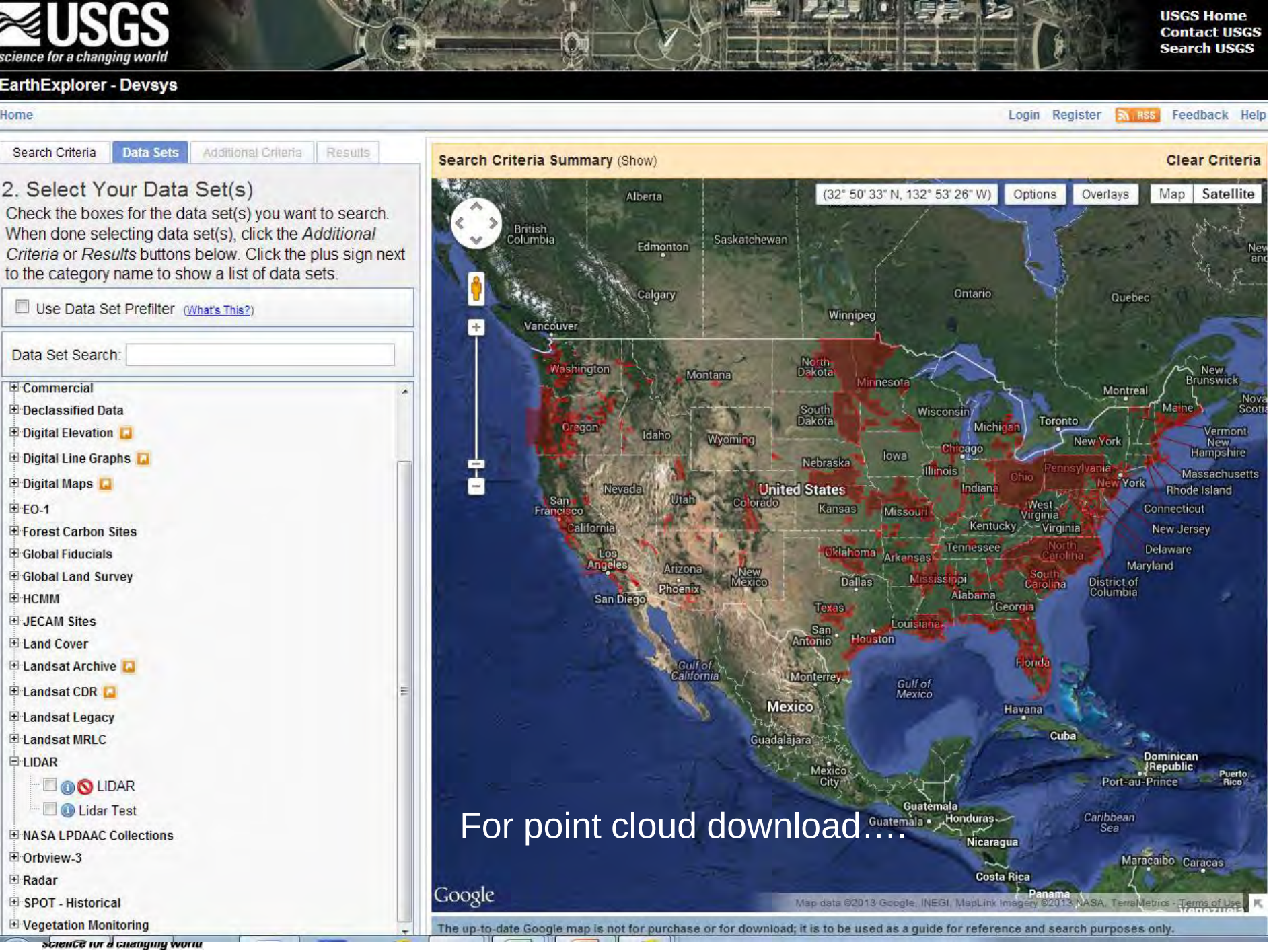
Map Service | More Information

Contact Us

Data Type

- Topographic Lidar
- Topobathy Shoreline Lidar
- IfSAR Data
- Bathymetric Lidar
- NOAA Hydrographic Surveys
- Other Bathymetric Surveys
- USACE Dredge Surveys
- Trackline Bathymetry
- Multibeam Bathymetry

*Data inventory current as of August 2013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Check the boxes for the data set(s) you want to search. When done selecting data set(s), click the Additional Criteria or Results buttons below. Click the plus sign next to the category name to show a list of data sets.
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Data Set Search:
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Declassified Data
Digital Elevation
Digital Line Graphs
Digital Maps
EO-1
Forest Carbon Sites
Global Fiducials
Global Land Survey
HCMM
JECAM Sites
Land Cover
Landsat Archive
Landsat CDR
Landsat Legacy
Landsat MRLC
LIDAR
LIDAR
Lidar Test
NASA LPDAAC Collections
Orbview-3
Radar
SPOT - Historical
Vegetation Monitoring
Search Criteria Summary (Show)
Clear Criteria
(32° 50' 33" N, 132° 53' 26" W)
Options
Overlays
Map
Satellite
Alberta
British Columbia
Edmonton
Saskatchewan
Calgary
Ontario
Quebec
Winnipeg
Vancouver
Washington
Montana
North Dakota
Minnesota
Oregon
Idaho
Wyoming
South Dakota
Wisconsin
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California LiDAR Estimated Costs, 163,695 mi^2

Quality Level	$/mi^2	Total Costs
QL1 LiDAR	$547.30	$89,590,274
QL2 LiDAR	$334.48	$52,870,000
QL3 LiDAR	$252.67	$41,360,816

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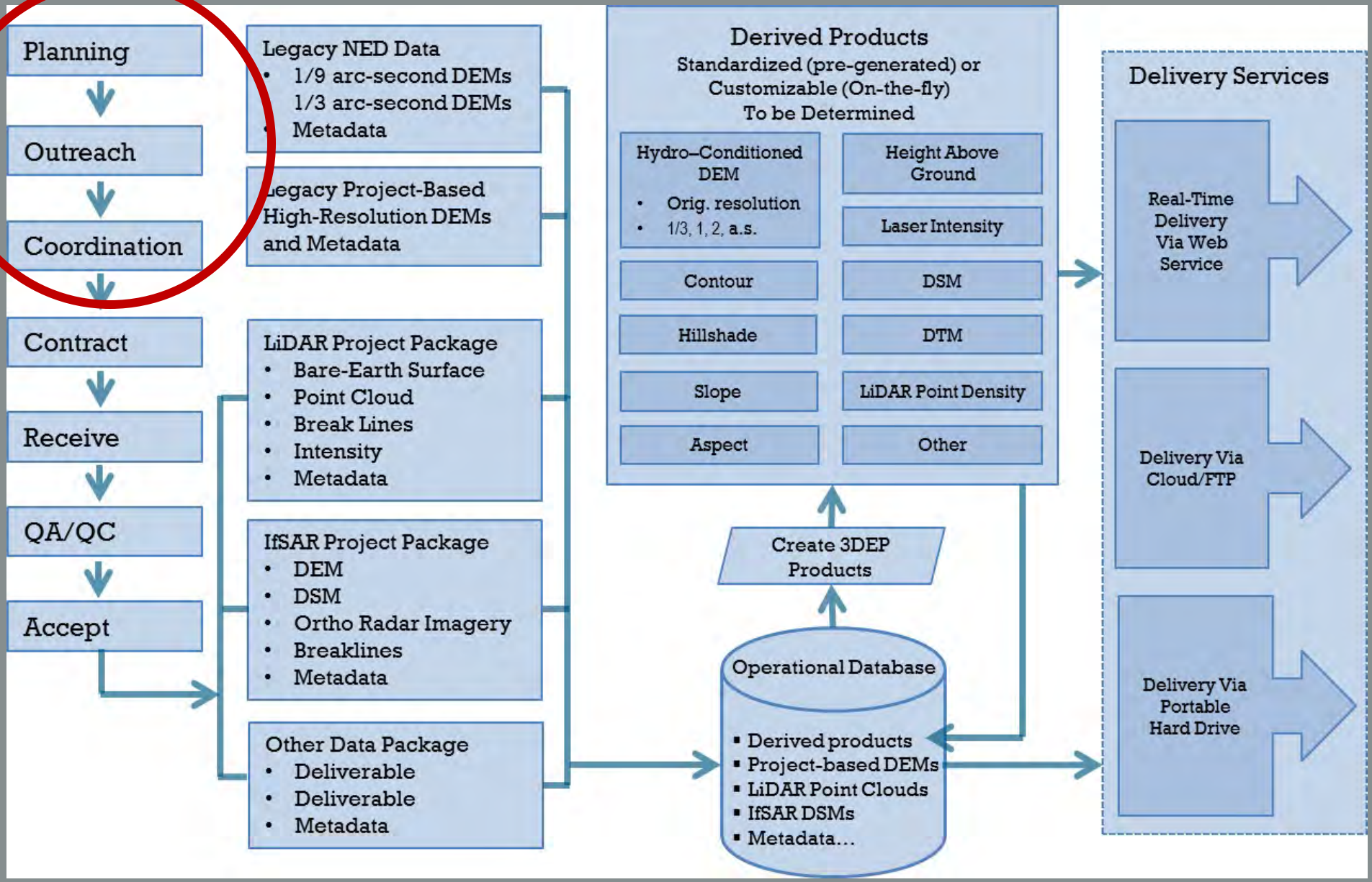
Dewberry

Steps in progress at the Federal Level

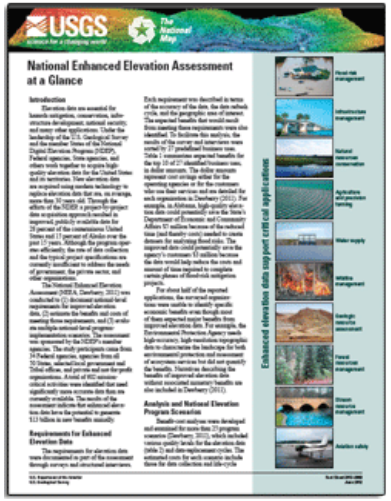
- Formalize program recommendation(s) and 3DEP strategic plan
- Sync USGS deliverables to better meet needs (for example, build out 1-m elevation model for the country)
- One-stop shop: National Map
- Intensify outreach
  - Develop outreach materials
  - Engage key professions, industries, states, etc.
  - Coordination with partner agencies (NOAA, FEMA, states)
- Develop 3DEP funding strategy and implementation timeline
- Summer 2014: first funding announcement

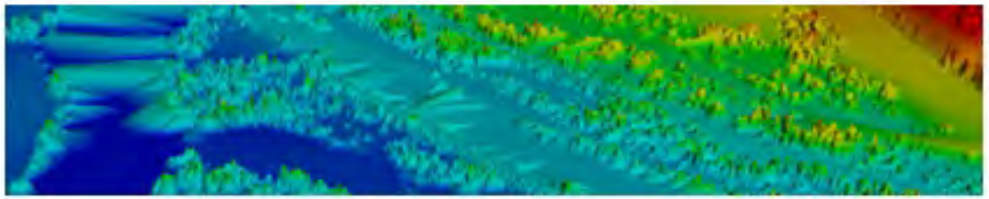
Products– 3DEP



3DEP Resources

- NEEA Report
- USGS Fact Sheets
  - NEEA at a glance
  - 3D Elevation Program
- Resources in work
  - State information sheets
  - Journal articles
  - 3DEP webpage





Final Report of the National Enhanced Elevation Assessment

Revised March 29, 2012

http://nationalmap.gov/3DEP

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The 3D Elevation Program—Summary for California

Introduction

Elevation data are essential to a broad range of applications, including forest resources management, wildlife and habitat management, national security, recreation, and many others. For the State of California, elevation data are critical for infrastructure and construction management; natural resources conservation; flood risk management; wildfire management, planning, and response; agriculture and precision farming; geologic resource assessment and hazard mitigation; and other business uses. Today, high-quality light detection and ranging (lidar) data are the sources for creating elevation models and other elevation datasets. Federal, State, and local agencies work in partnership to (1) replace data, on a national basis, that are (on average) 30 years old and of lower quality and (2) provide coverage where publicly accessible data do not exist. A joint goal of State and Federal partners is to acquire consistent, statewide coverage to support existing and emerging applications enabled by lidar data. The new 3D Elevation Program (3DEP) initia-

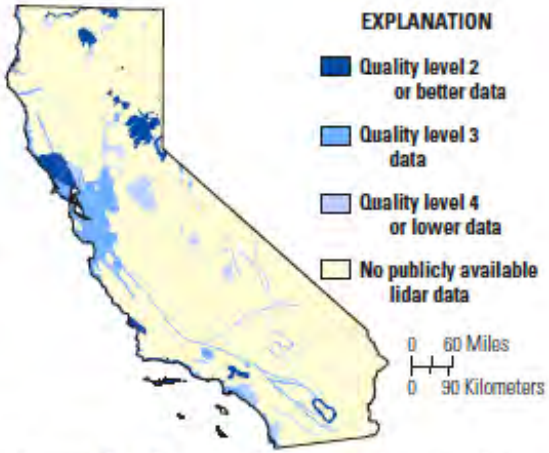

Figure 1. Map of California showing the areal extent and quality levels of planned and existing publicly available light detection and ranging (lidar) data in August 2013. Quality level 2 or better lidar data meet 3DEP requirements. See table 2 for quality level information.

would result in at least $28 million in new benefits annually to the State. The cost for such a program in California is approximately $53 million, resulting in a payback period of 1.9 years and a benefit-to-cost ratio of 4.3 to 1 over an 8-year period. Because monetary estimates were

3D Elevation Program

3DEP is a national program managed by the USGS to acquire high-resolution elevation data. The initiative is backed by a comprehensive assessment of requirements (Dewberry, 2011) and is in the early stages of implementation. 3DEP will improve data accuracy and provide more current data than is available in the National Elevation Dataset (NED). The goal of this high-priority cooperative program is to be operational by January 2015 and to have complete coverage of the United States by 2022, depending on funding and partnerships. The new program has the potential to generate $13 billion/year in new benefits through improved government services, reductions in crop and homeowner losses resulting from floods, more efficient routing of vehicles, and a host of other government, corporate, and citizen activities (Dewberry, 2011).

Benefits of a Funded National Program

Next Steps for California

- Identify lead state agency and working group
- Continue to build inventory and understanding about existing data
- Refine state requirements, add program costs and determine real $$ benefits
- Consider added business needs from county/regional requirements
- Respond to Federal implementation and partnership strategies
- Identify state sources of funding
- Bring it all together: strategic planning

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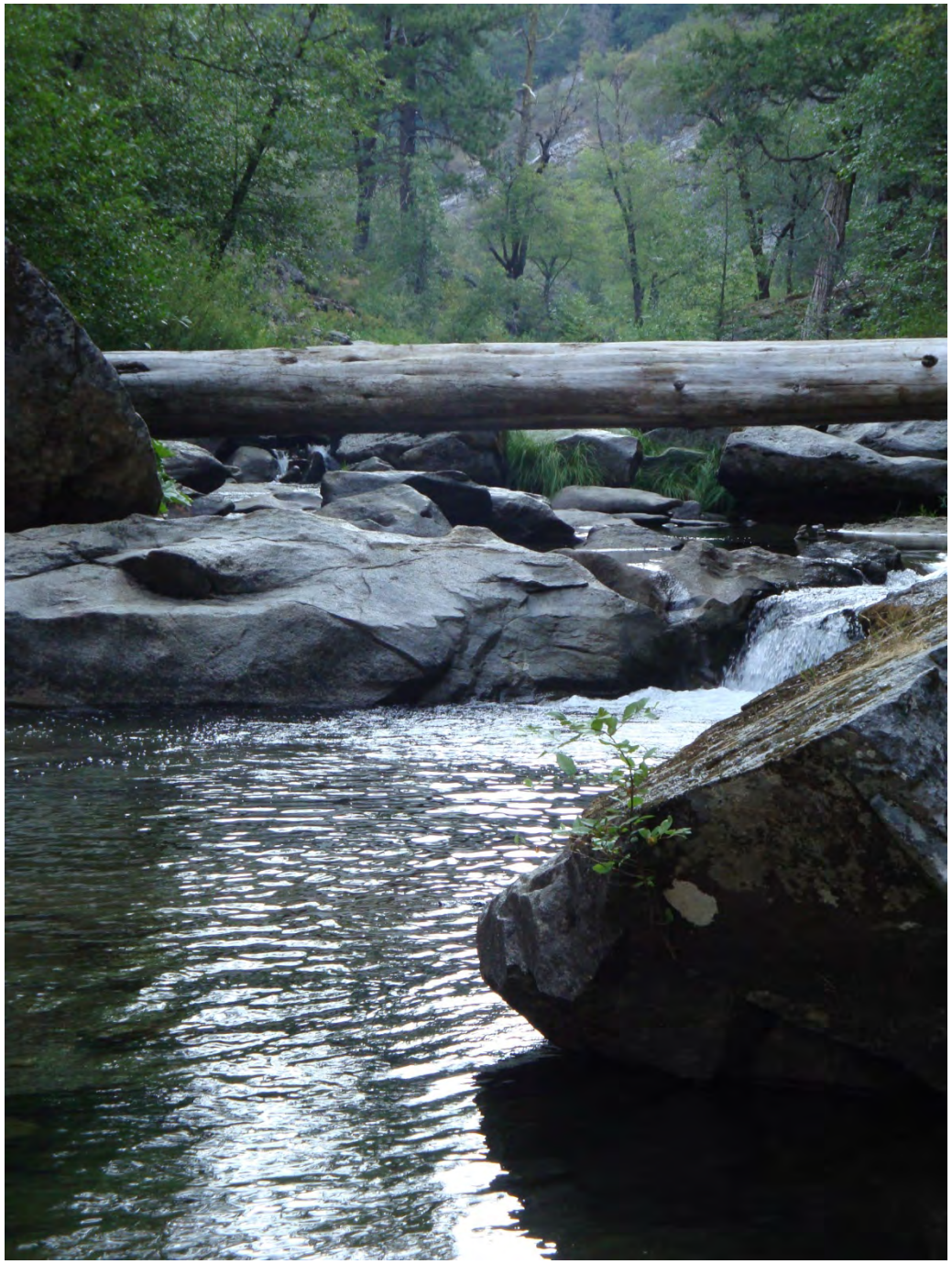

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Questions?