



# Report on the Open Water Data Initiative (OWDI)

FGDC Steering Committee  
June 16, 2016

Vicki Lukas, USGS National Geospatial Program

Subcommittee on Spatial Water Data

# For more information

Subcommittee on Spatial Water Data  
(SSWD) Co-chairs:

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Subcommittee on Spatial Water Data



# The Challenge

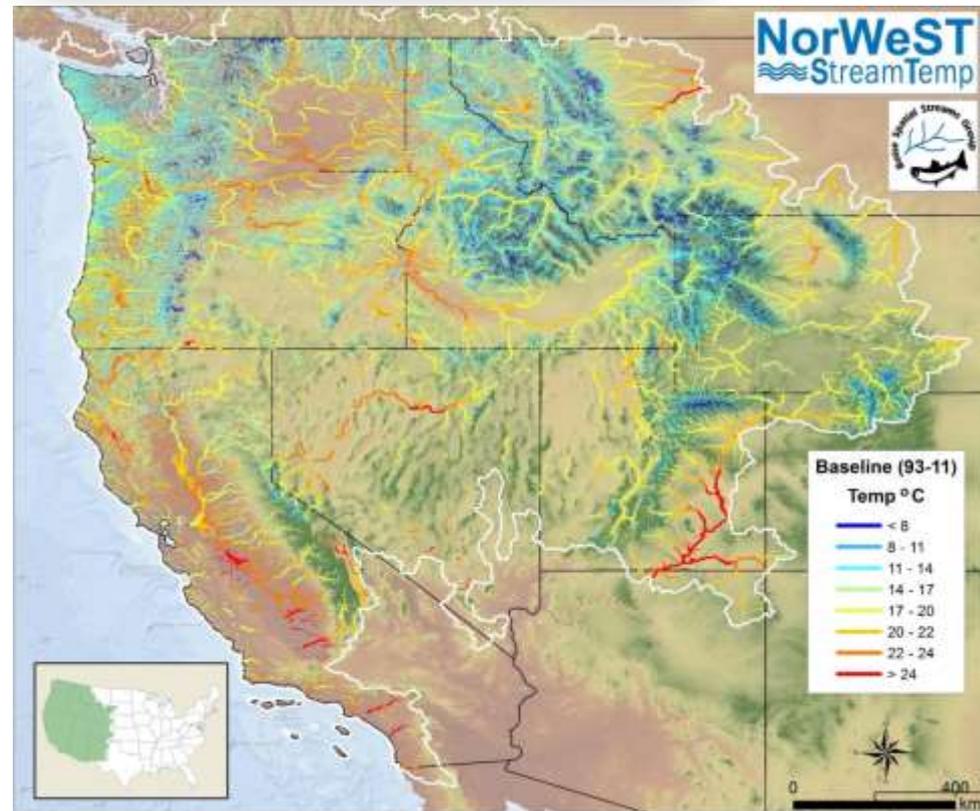
- ◆ The Nation faces increasing pressures on the nation's water supply – yet access to water data is difficult
  - Collected by hundreds of organizations
  - No common infrastructure
  - WaterML2 is an opportunity - a new data exchange standard for exchanging many kinds of hydro-meteorological observations and measurements
- ◆ Need to understand the connections - requires a geospatial framework
  - Landscape to stream
  - Stream to stream



# An Example

- ◆ Temperature database was compiled from 100s of biologists and hydrologists working for >100 resource agencies and contains >150,000,000 hourly temperature recordings at >20,000 unique stream sites
- ◆ Took >12 person-years for 1993-2011 to compile, with more data collected since
- ◆ To collect from scratch would cost ~\$10M
- ◆ Huge investment in data that are valuable to a host of applications – need to make them easily accessible

**NorWeST**  
Stream Temp



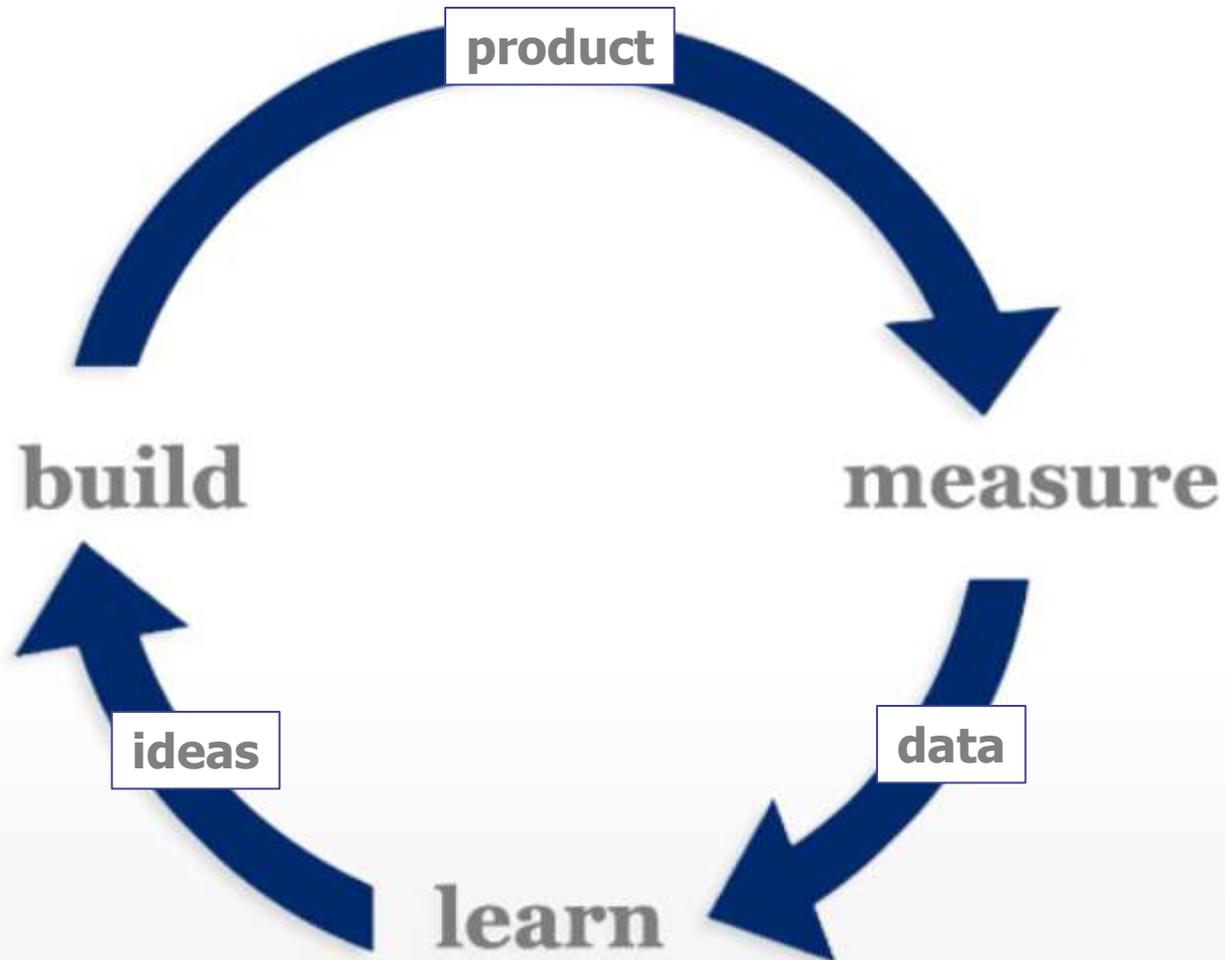
# Addressing the Challenge

- ◆ Information is foundational to understanding existing water resources issues and developing sustainable future solutions
- ◆ The FGDC and the Advisory Committee on Water Information (ACWI) launched the Open Water Data Initiative (OWDI) in 2014
- ◆ Managed by the Subcommittee on Spatial Water Data (SSWD)
- ◆ GOALS
  - Integrate fragmented water information into a connected, national water data framework
  - Leverage existing data, systems, infrastructure and tools to underpin innovation, modeling, data sharing, and solution development
  - The adoption of community data standards, protocols, and common vocabularies is critical to this effort





# Lean Startup Methodology



# OWDI Roadmap

## Open Water Web

Water Data Catalog	Water Data as a Service	Enriching Water Data	Community for Water Data, Tools
Find Source Data	Consensus Standards	Network Routing	Marketplace for Knowledge
Create Themes	Visualization and Delivery	Coupling Models	Usage Tracking
Recruit / Engage Partners	Catalog and Serve	Geospatial Framework	Best Practices



# OWDI Use Cases



## **Use Case 1:**

National Flood Interoperability Experiment



## **Use Case 2:**

Drought Decision Support System

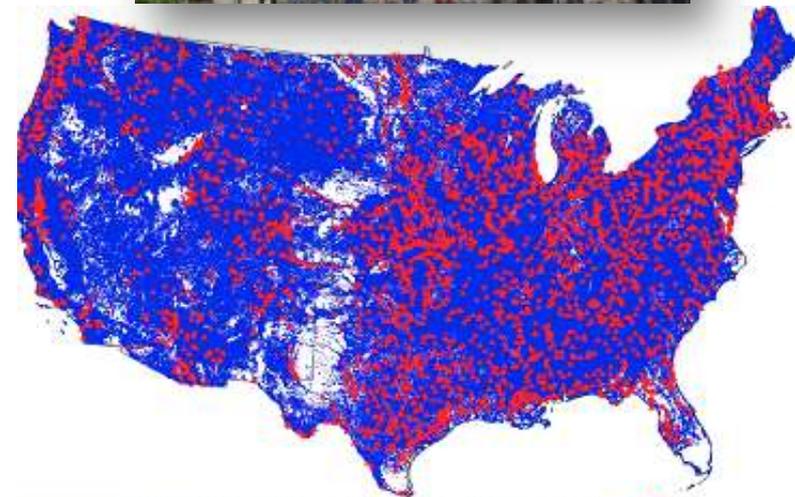


## **Use Case 3:**

Spill Response Tool

# National Flood Interoperability Experiment (NFIE)

- ◆ Partnership between NWS and the academic community
- ◆ Included a 2015 Summer Institute at the National Water Center for 44 graduate students from 19 Universities
- ◆ Goal - Help build a new high resolution, near real-time hydrologic simulation and forecasting model for the nation
- ◆ Results
  - Moving from modeling ~3,600 river forecast points at gages to forecasts for all 2.7 M NHDPlus flowlines – 750x the spatial resolution and better, more complete coverage
  - NWS accelerated their plans to make the National Water Model operational this summer



Current NWS AHPS points (red)  
NWM output points (blue)



**CUAHSI**  
UNIVERSITIES ALLIED FOR WATER RESEARCH

# National Flood Interoperability Experiment (NFIE)

## Movement towards WaterML2 Open Format

### USGS Gage 08159000

### NWS Forecast Point ATIT2

#### USGS Observed Flows, July 19

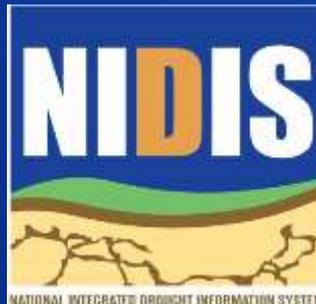
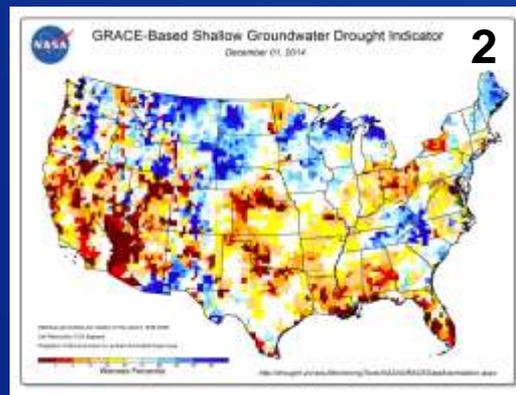
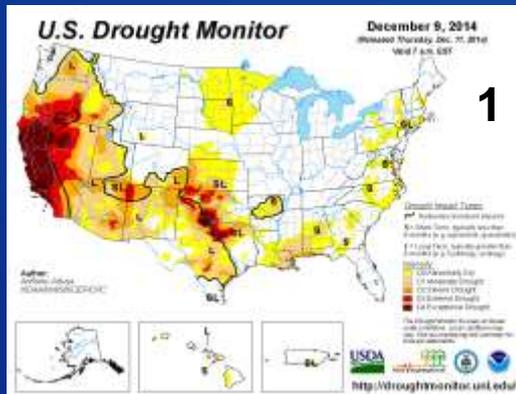
#### NWS Forecast Flows, July 19-20

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# Drought and Water Data

Has your community been  
**IMPACTED BY DROUGHT?**  
 Tell us by submitting a "CoCoRaHS Drought Impact Report"



## Drought Information Sources

1. USDA Drought Monitor
2. NASA GRACE Drought Indicators
3. Western Water Assessment
4. National Drought Resilience Partnership
5. Western Governors' Drought Forum
6. National Drought Mitigation Center
7. National Integrated Drought Information Center – Drought Portal
8. Community Collaborative Rain, Hail and Snow Network (crowdsource)

## Not pictured:

- Western States Water Council WaDE
- NOAA-NWS Climate Prediction Center & NWS River Forecast Centers,
- NRCS Forecast maps
- Drought webpages of states
- Info from conferences, workshops and studies on drought planning and impacts

**RECLAMATION**

# Drought in the Lower Colorado River Basin



- Developed a comprehensive drought visualization web site
- Compilation of many different data sources



<https://www.doi.gov/water/owdi.cr.drought/en/index.html>

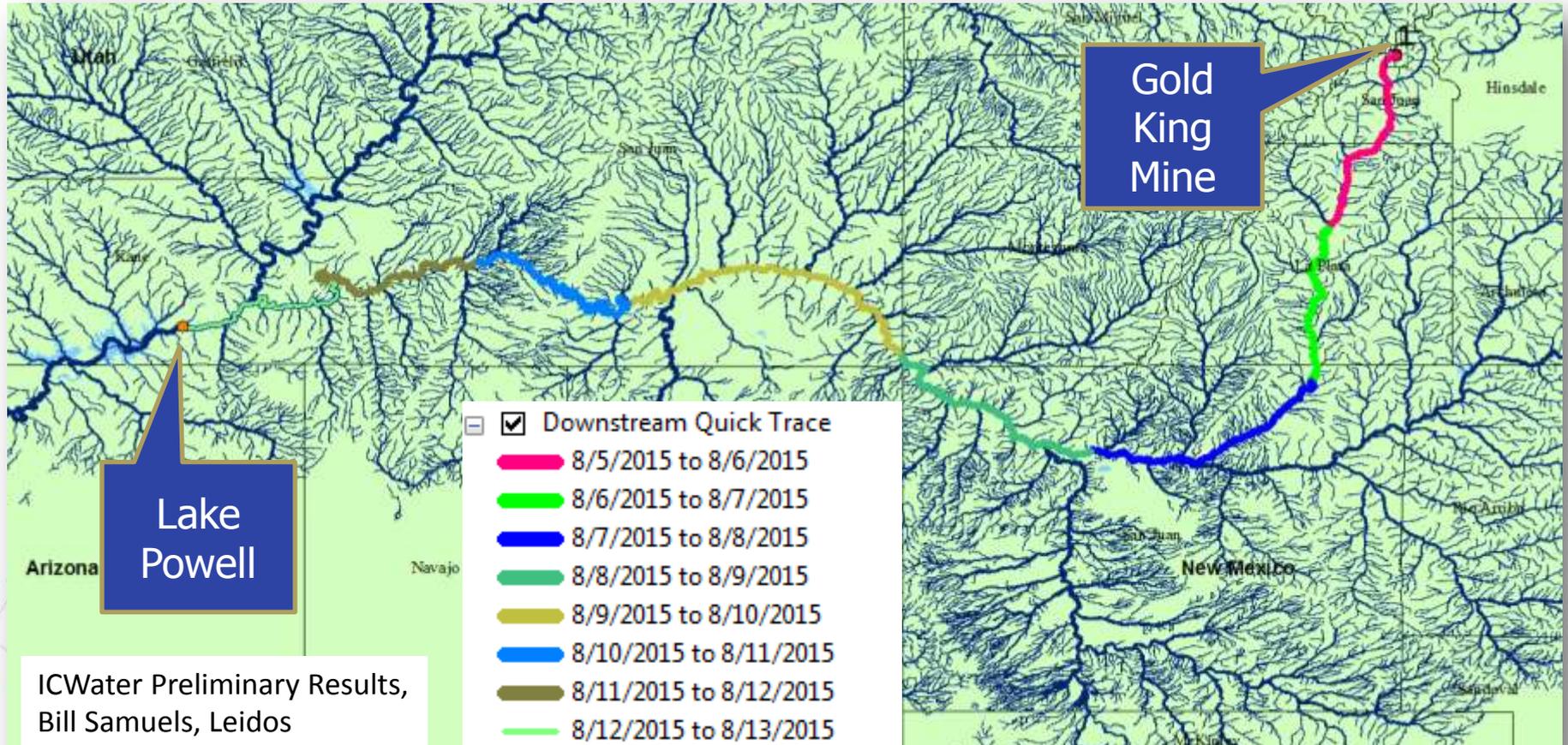
Angela Adams - Bureau of Reclamation  
aadams@usbr.gov – 702-293-8491

RECLAMATION

# Spill Response

## Gold King Mine Spill

- ◆ Identifying datasets for use case, ex. improving time of travel estimates
- ◆ ICWater on desktop – ultimate goal to provide as a web service

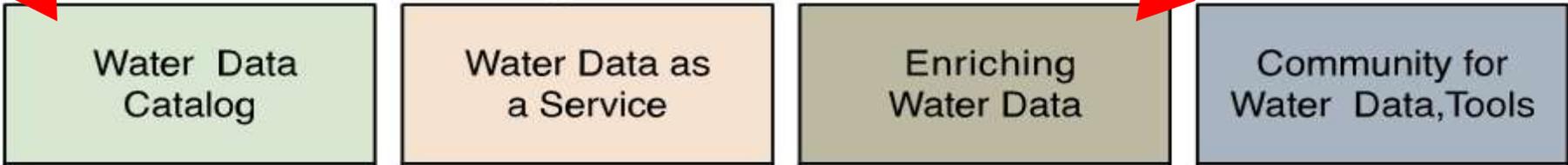


# Network-Linked Data Index

## Water Data Catalog and Enriching Water Data

- ◆ The Water Quality Portal (WQP) is a cooperative service sponsored by the USGS, EPA, and the National Water Quality Monitoring Council to serve data collected by over 400 state, federal, tribal, and local agencies
- ◆ Developed network-based search engine integrated with WQP
  - Enables a federated data model that allows users to share data linked to the spatial framework of NHDPlus
  - Data discovery using upstream/downstream navigation
- ◆ Open source in GitHub repository
- ◆ Working on API documentation

## Open Water Web



Water Data Catalog

The diagram shows four colored boxes representing components of the Open Water Web. From left to right: a light green box for 'Water Data Catalog', a light orange box for 'Water Data as a Service', a light brown box for 'Enriching Water Data', and a light blue box for 'Community for Water Data, Tools'. Two red arrows point to the first and third boxes.

Water Data as a Service

Enriching Water Data

Community for Water Data, Tools

HUC:  ?

NLDI Site Service: ?

Characteristics:  ?

Project ID:  ?

Parameter Code:  ?  
(NWIS ONLY)

Minimum results per site:  ?

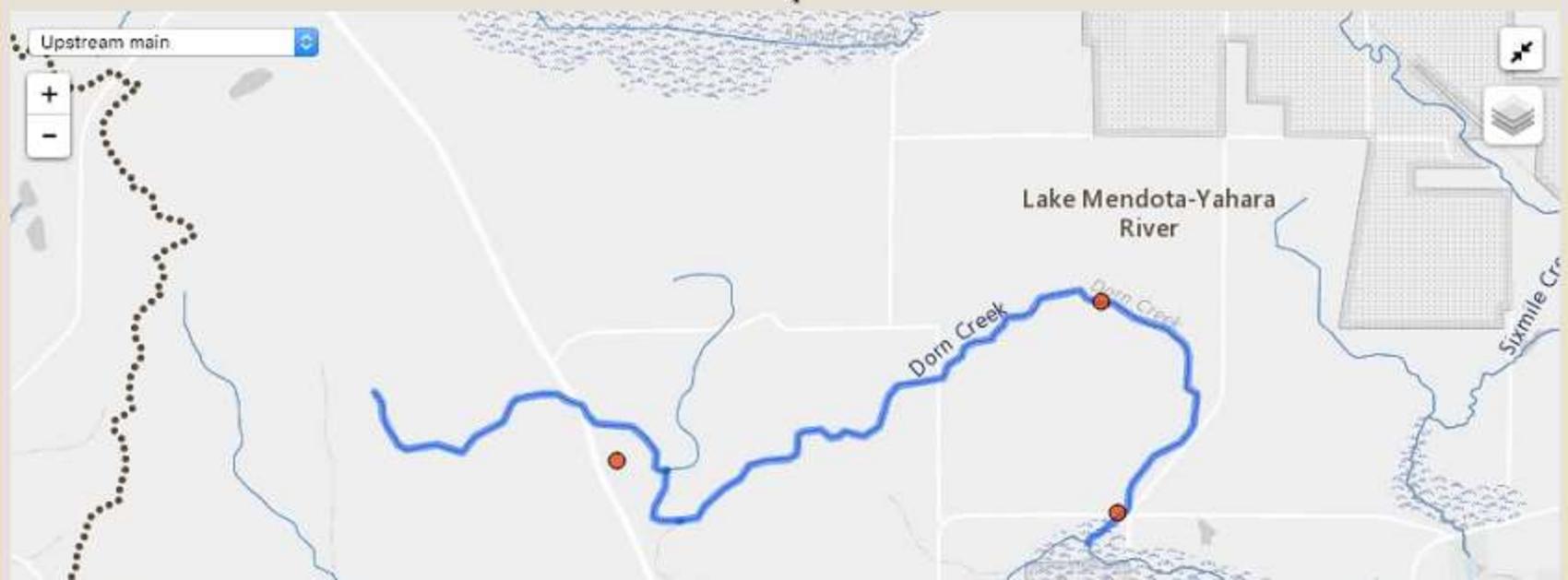
Date range  to:   
- from:

Biological sampling parameters: ?

Assemblage:  ?

Taxonomic Name:  ?

- ◆ Network trace filters data
- ◆ Users apply additional search parameters
- ◆ Millions of sites in the Water Quality Portal accessible



# Data Inventory Dashboard

## Water Data Catalog



### Open Water Web

Water Data Catalog

Water Data as a Service

Enriching Water Data

Community for Water Data, Tools

- ◆ Water Use WG – offshoot of the Drought Group
- ◆ Easily interpreted dashboard of status of data availability
- ◆ Template for other WGs

**USGS The National Map**  
The National Map of Geographic Information

### Open Water Data Initiative (OWDI) Water Use Dataset Workgroup

#### Summary

The Open Water Data Initiative (OWDI) Water Use Dataset Workgroup folder within Sciencebase contains a brief report that documents existing water use datasets and their primary characteristics, identifies important water use data gaps and current efforts to address those gaps, and provides recommendations on how to incorporate water use datasets into the OWDI framework. It will also serve as a repository for a water use dataset inventory and support an interface that details the current status of national, regional, state and local water use datasets, and provides access back to the online data sources.

#### Water Use Dataset Resources

Click on the tabs below for further information.

Openly Published: Yes Pending No [What is "Openly Published"?](#)

- Ground Water Protection Council - Fractious
- Ground Water Protection Council/ U.S. Energy Information Administration - Open EI
- Lawrence Livermore National Laboratory - National and State Water-Energy Sankey Diagrams
- USGS Ancillary Estimates of Water Use - 1985 - 1995
- USGS Consumptive Use Estimates - 1965 - 1995
- USGS National Groundwater Monitoring Network Portal
- USGS Principal Aquifer Withdrawals - 2000
- USGS Water Withdrawals - 1950 - 2010
- Dept. of Energy / Sandia National Laboratory Energy and Water in the Western and Texas Interconnects
- Great Lakes Commission - Great Lakes Regional Water Use Database

Provides comparable water use information on withdrawals, diversions and consumptive uses for the Great Lakes Commission (<http://www.glc.org>).

Publication Format: Annual reports, website (can query the database)  
Published using "Open" formats? Yes, database can be queried through the website, but cannot be accessed in an automated fashion (web services)  
Period of Record: 1994 - 2014  
Timestamp: Annual  
Spatial Extent: By jurisdiction (state and province), by basin, and by sector of use

<http://viewer.nationalmap.gov/apps/owdi/>

# Much More to Do...

## Open Water Web

### Water Data Catalog

- Data quality information for observations
- Machine readable ontologies

### Water Data as a Service

- ◆ Testing of NHDPlus V2.1 in cloud – make permanent and scale up
- ◆ Metrics of service usage needed
- ◆ Many more datasets

### Enriching Water Data

- ◆ Network upstream/down stream trace in beta testing
- ◆ Unified scalable spatial framework - NHD+High Resolution

### Community for Water Data, Tools

- ◆ Web-based forum (wiki or similar) on GeoPlatform
- ◆ Long-term goal: OPEN is standard operating procedure



# OWDI Resources

- ◆ ArcGIS Online web map showcasing some OWDI data services:

<http://arcg.is/1EIL4bP>

- ◆ National seamless NHDPlus V2.1 download:

<ftp://ec2-54-227-241-43.compute-1.amazonaws.com/NHDplus/NHDPlusV21/Data/NationalData/>



# For more information

Co-chairs SSWD:

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Ed Clark - [edward.clark@noaa.gov](mailto:edward.clark@noaa.gov)

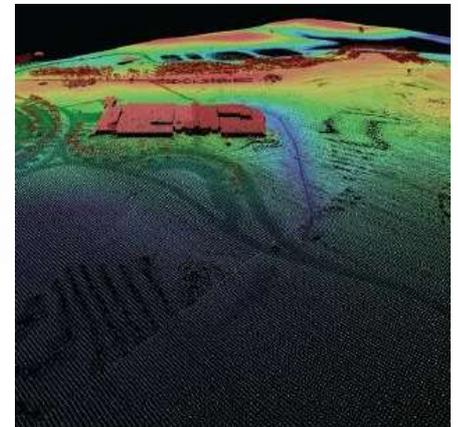
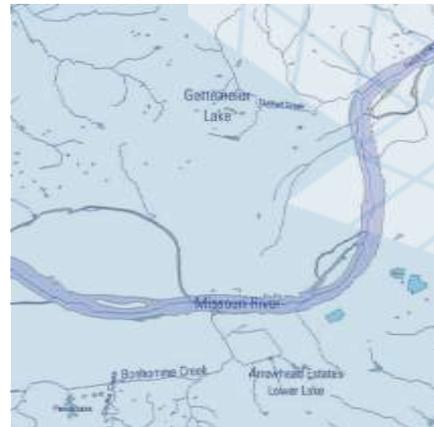
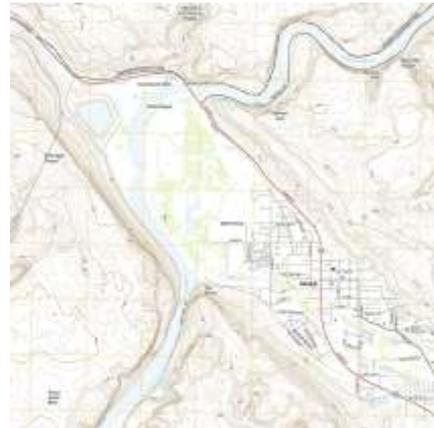


Subcommittee on Spatial Water Data





# 3D Elevation Program (3DEP) Update for NGAC



Vicki Lukas  
June 16, 2016

# + 3D Elevation Program (3DEP)

## Topics

- Status of data acquisition and funding
- Multi-year planning effort – request NGAC's help
- Governance update
- Approach for emerging lidar





# 3DEP is a Partnership Program

- National lidar coverage with IfSAR in Alaska in 8 years
- Address the mission-critical requirements of 34 Federal agencies, 50 states, and other organizations documented in the National Enhanced Elevation Assessment
- Return on investment 5:1, with the potential to generate \$13 billion/year in new benefits through applications that span the economy
- Leverage the capability and capacity of private industry mapping firms
- Achieve a 25% cost efficiency gain by collecting data in larger projects
- Completely refresh national elevation data holdings with new lidar and IfSAR elevation data products and services



Natural Resource  
Conservation



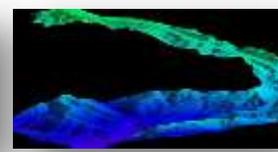
Infrastructure  
Management



Flood Risk Mitigation



Precision Farming



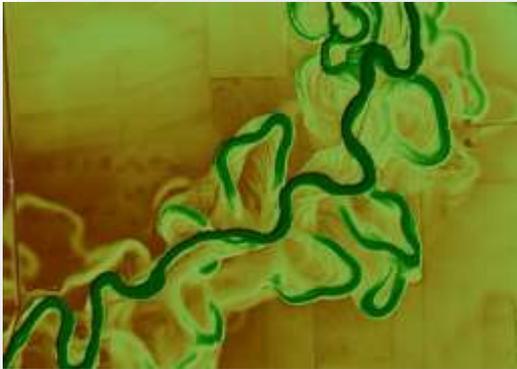
Land Navigation  
and Safety



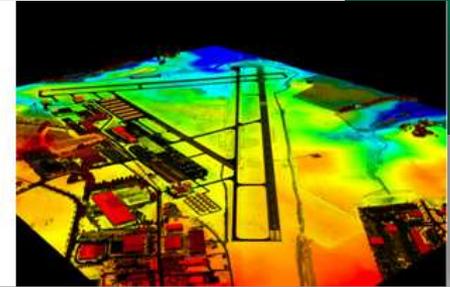
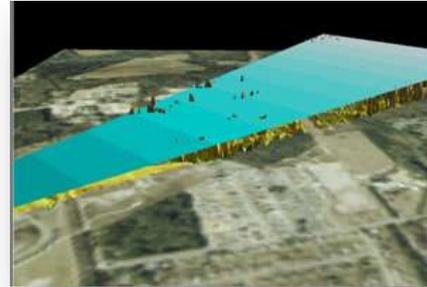
Geologic Resources and  
Hazards Mitigation

# + 3D Elevation Program (3DEP)

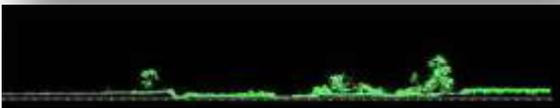
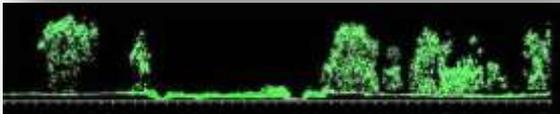
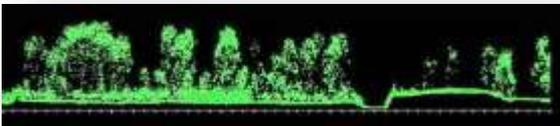
## Mission Critical Applications



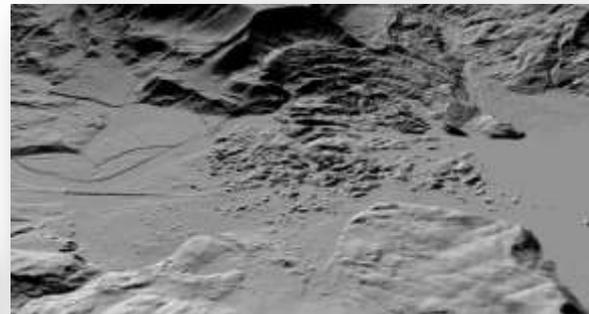
**Flood Risk Management**



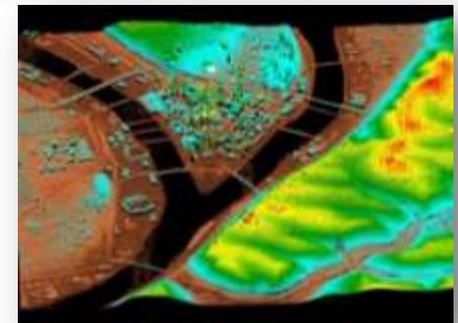
**Aviation Safety**



**Precision Forestry**



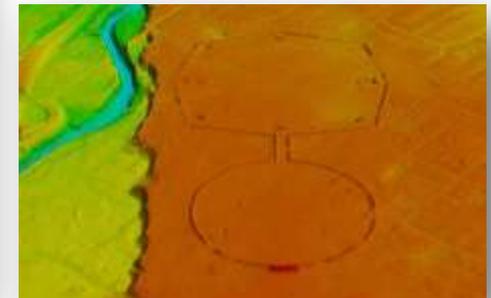
**Geologic Hazards**



**Infrastructure Management**



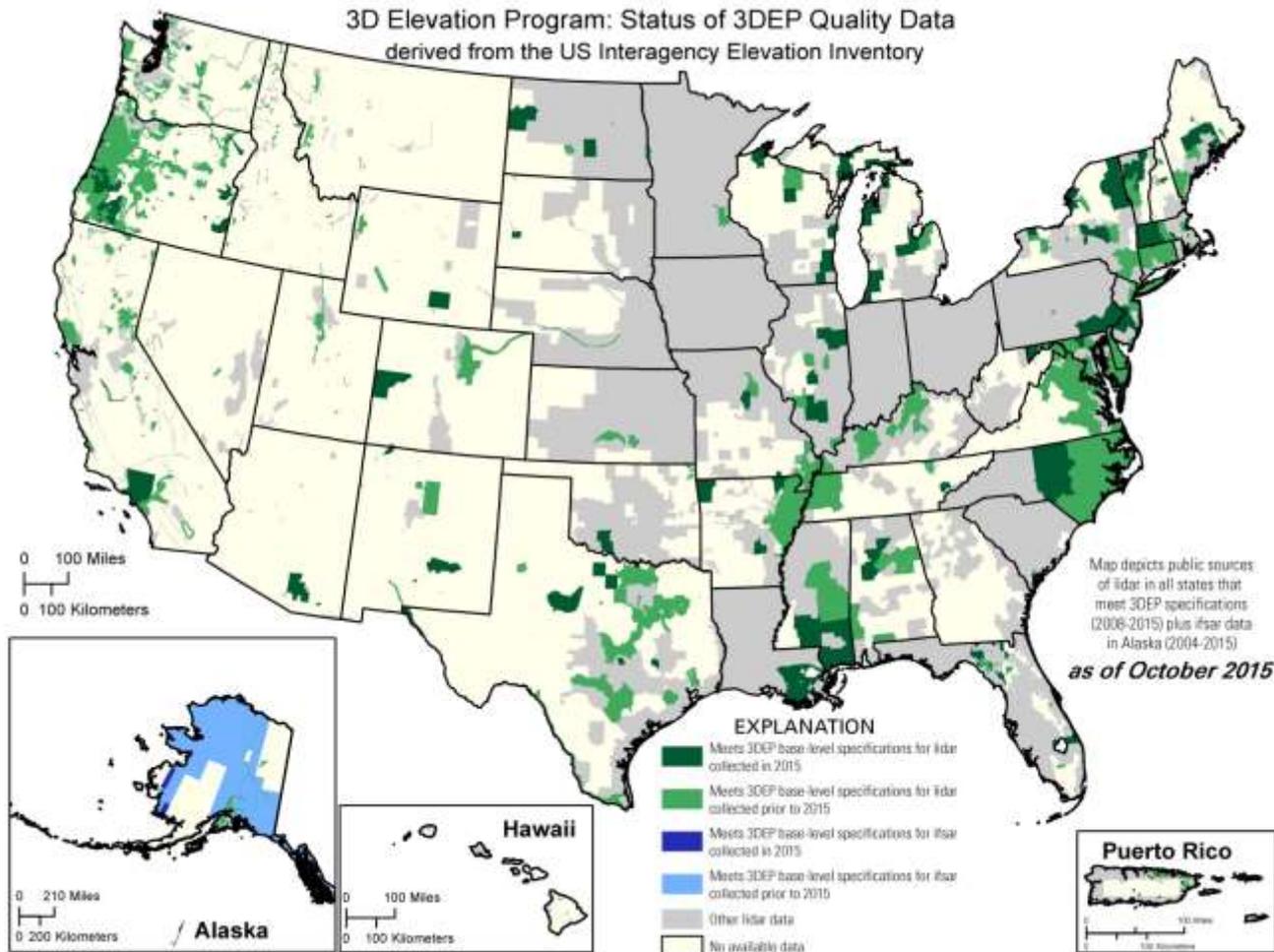
**Alternative Energy**



**Archaeology**

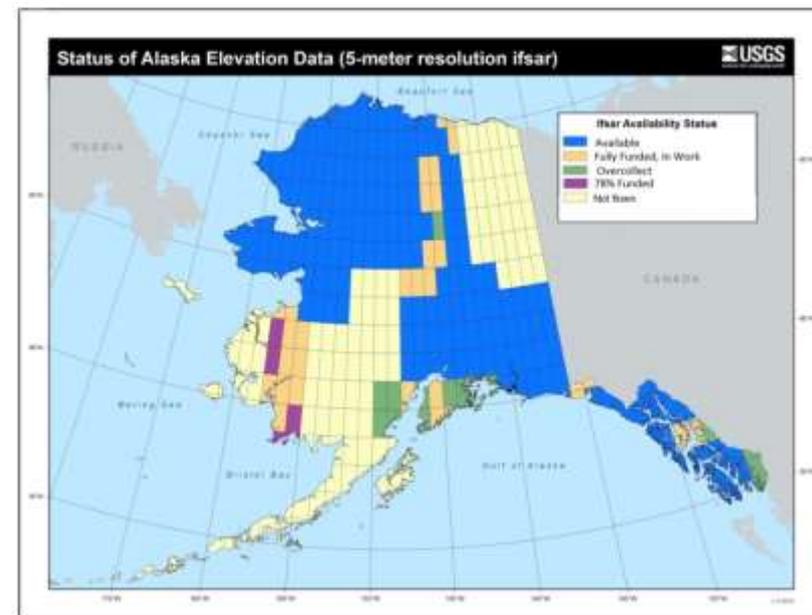
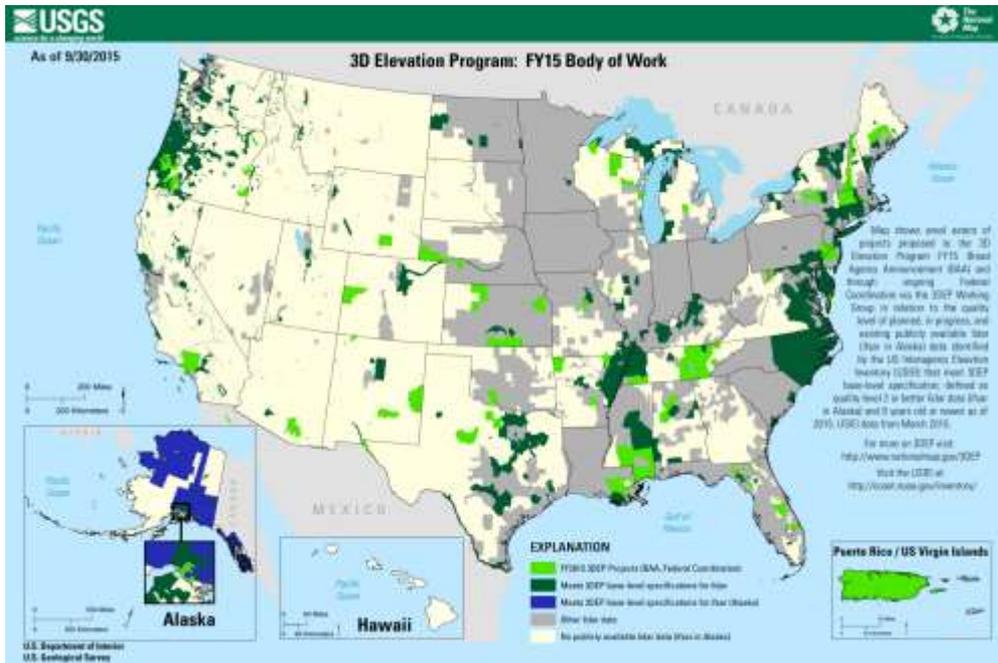
# + U.S. Interagency Elevation Inventory

## Data Acquired through FY 2015



- **3.4% of entire US was acquired to 3DEP quality in FY15** - includes complete, in progress, and planned/funded
- **13.9% of Lower 49 Meets 3DEP quality (2008-2015 only)**
- **63.6% of AK Meets 3DEP quality (QL5 – ifsar)**

# + FY15 3DEP Data Acquisition Summary



- Funding for AK IfSAR from all contributors totaled over \$7.4M
- Total square miles of IfSAR acquired were 69,000, adding approximately 12% coverage, raising the State's overall coverage to 63.4%

## 3DEP Lidar Data Contracted in FY15

### 3DEP Funds \$M

### Partner Funds \$M

### Total \$M

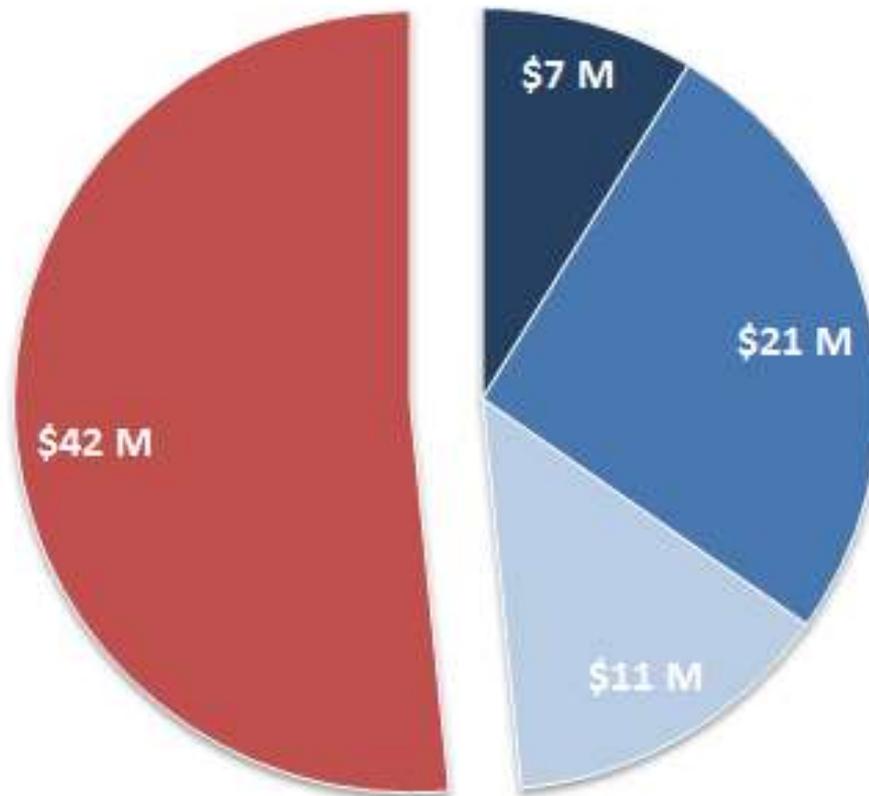
### Sq Miles

3DEP Funds \$M			Partner Funds \$M		Total \$M	Sq Miles
USGS	FEMA	NRCS	Other Feds	Non-Fed		
\$7.2	\$11.2	\$7.1	\$2.5	\$11.0	\$39.0	150,000
\$25.5			\$13.5			

# + 3DEP DATA ACQUISITION Funding

## USGS and ALL PARTNERS

FY15 vs Estimated Funding for 8 Year Program



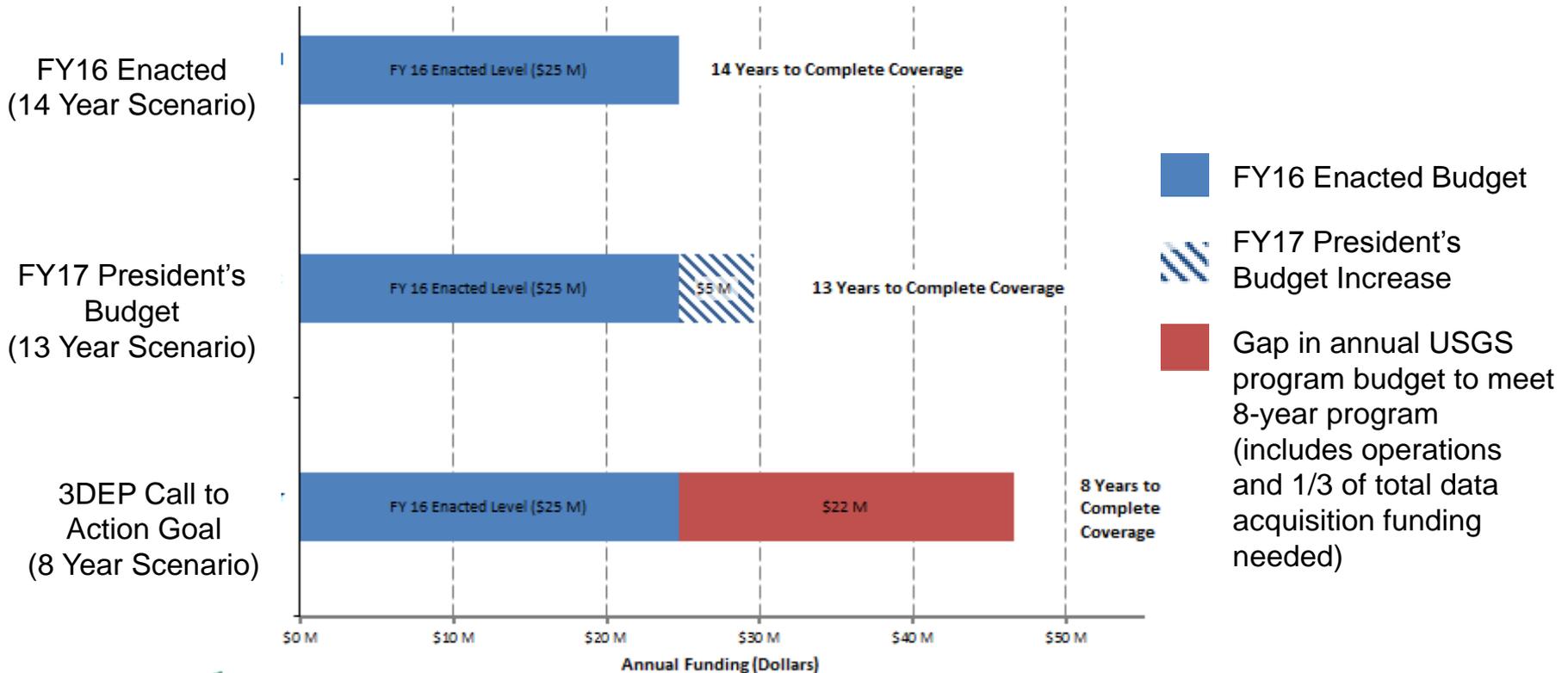
FY15 3DEP Data Acquisition

-  USGS
-  Other Federal Agencies
-  Other Partners (non-Federal)
-  TOTAL estimated data acquisition GAP in annual funding needed for 8 year program

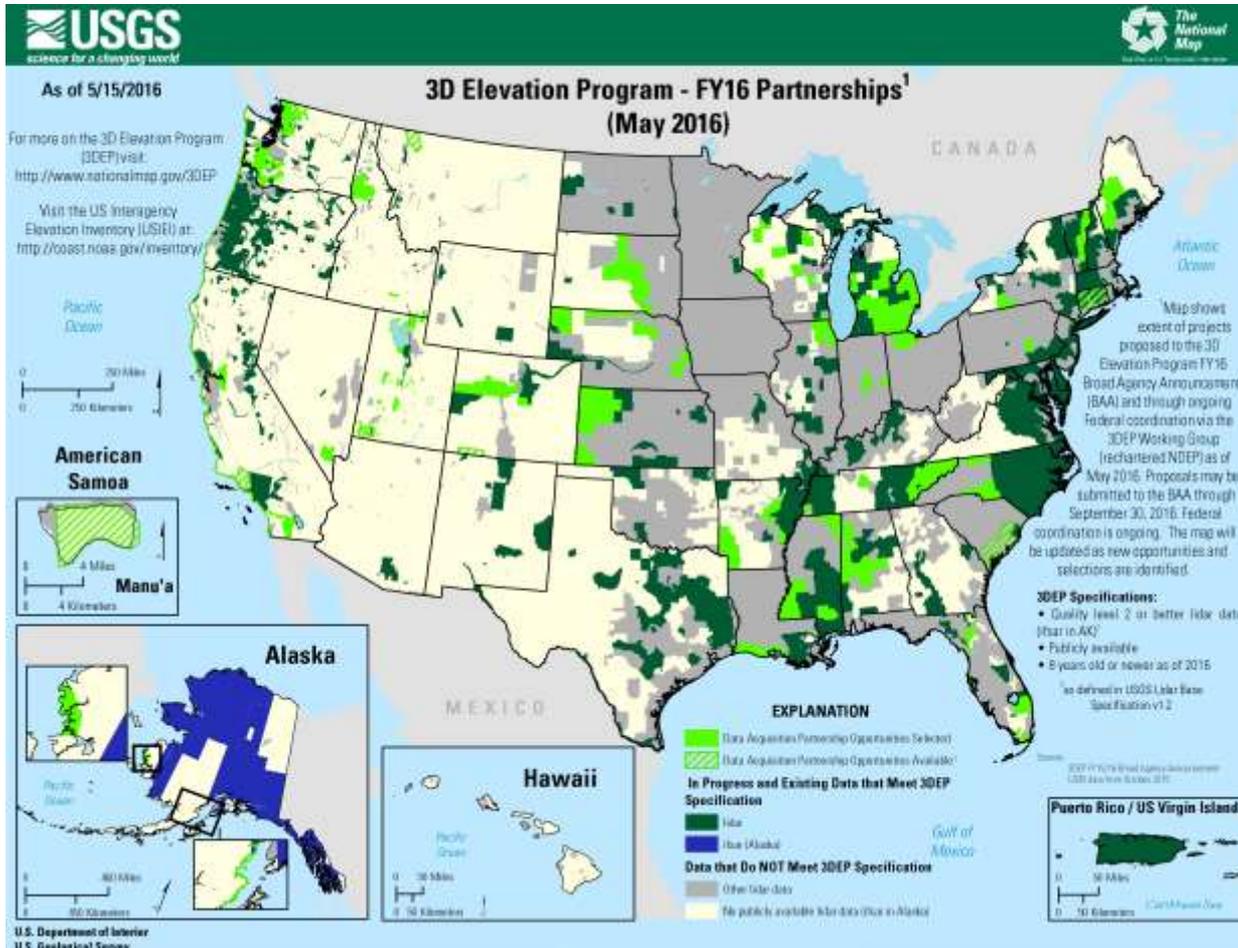
# + 3DEP Funding

## Estimated USGS Program Budget

	FY16	FY17
USGS Base budget (includes acquisition and operations)	\$20.4 M	\$24.7M
Increase (FY16 enacted, FY17 proposed President's budget)	\$4.3 M	\$4.9 M
Total USGS 3DEP budget	\$24.7 M	\$29.6 M



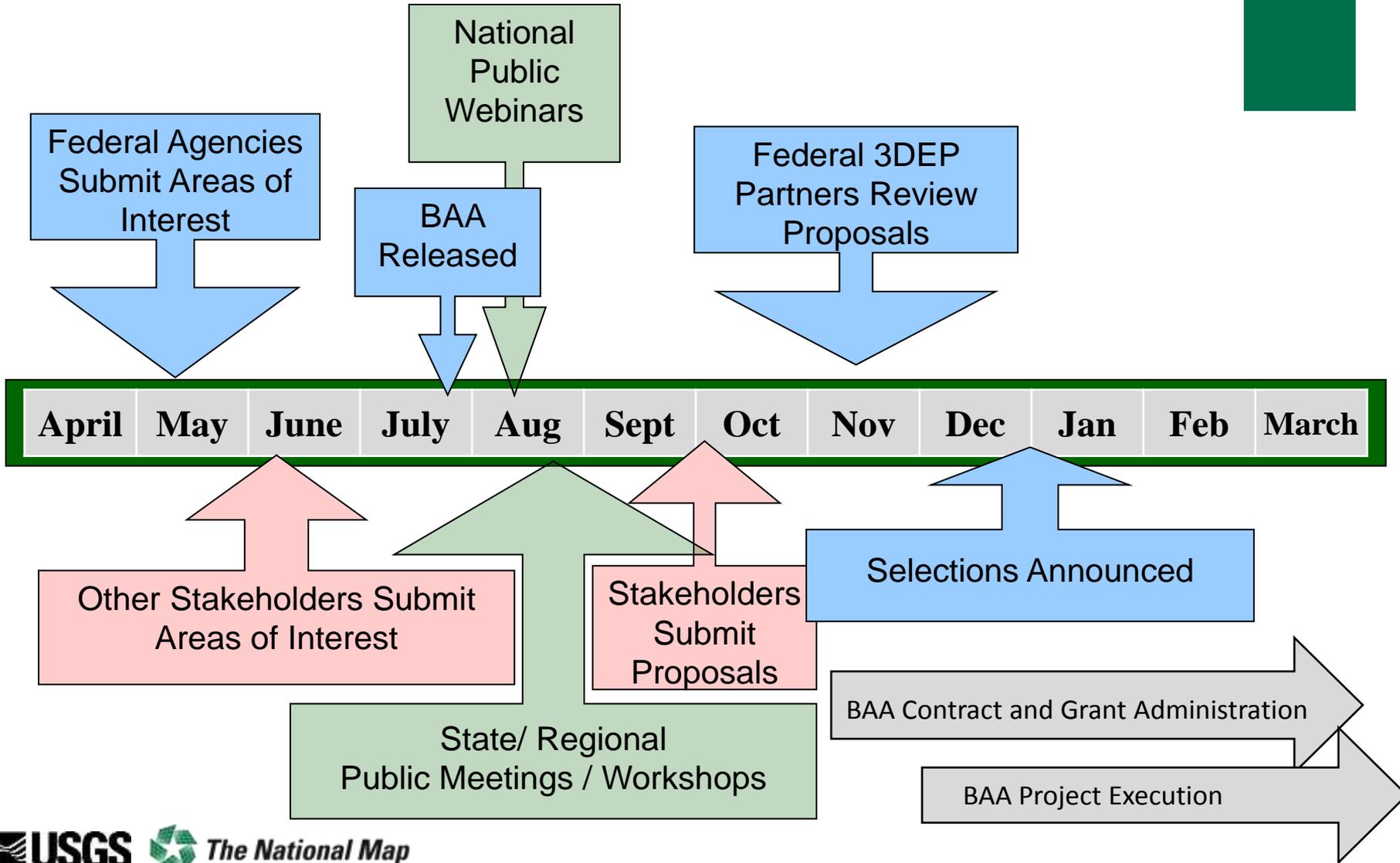
# + FY16 3DEP Data Acquisition In Progress



- Project selection continuing
- Potential to reach 190,000+ square miles in FY16

Grand total	# of awards	Sq. mi.	3DEP USGS, FEMA HQ, NRCS NGCE \$M	Other Partners \$M	Total Cost \$M
	34	143,405	\$11.5	\$21.6	\$33.1

# + 3DEP FY17 BAA Timeline



# + FY17 Broad Agency Announcement (BAA)

## Potential Enhancements

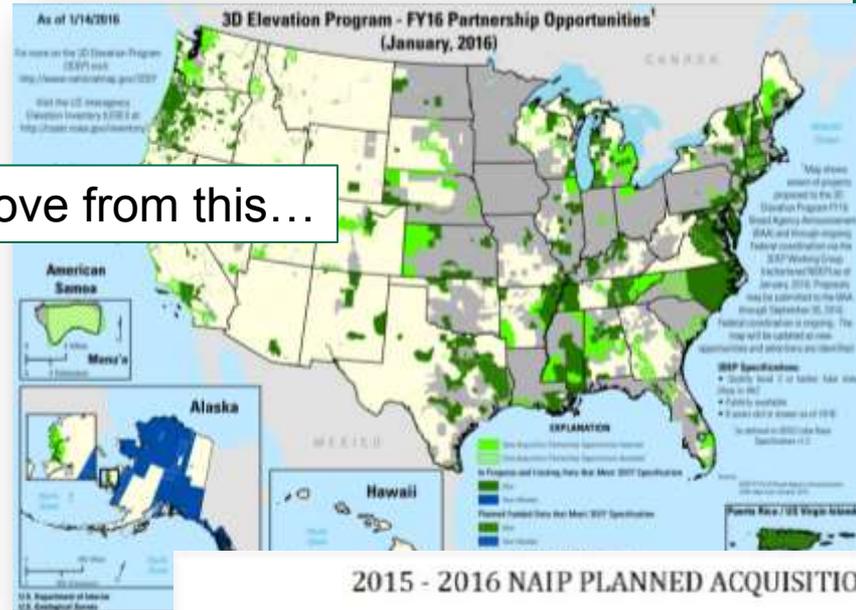
- Further develop business rules to manage Federal and State/Local requirements
- Online application process
- Explore options to make funds available early in the fiscal year
- Revise BAA selection from single round to biannual or multiple selection periods to better address State and Local funding cycles and seasonal acquisition windows
- Options for moving to a more systematic approach

# + Moving to a more systematic approach

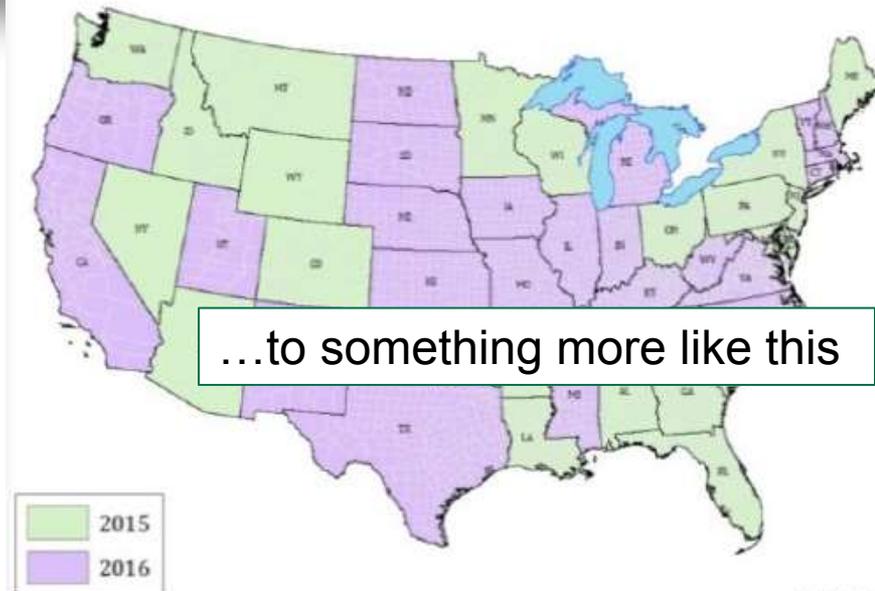
## What needs to change?

- Move from an annual, opportunistic partnering process to a unified multi-year plan
- Move from patchwork irregular acquisition footprints to some defined unit (state, 1 degree cell, watershed, county etc)
- Refine costshare models for working with non-Federal Partners
- Capture more non-Federal investments
- Eventually plan nationwide coverage

Move from this...



2015 - 2016 NAIP PLANNED ACQUISITION



...to something more like this

# + Defined Unit of Data Acquisition

## A Few Options



Watersheds



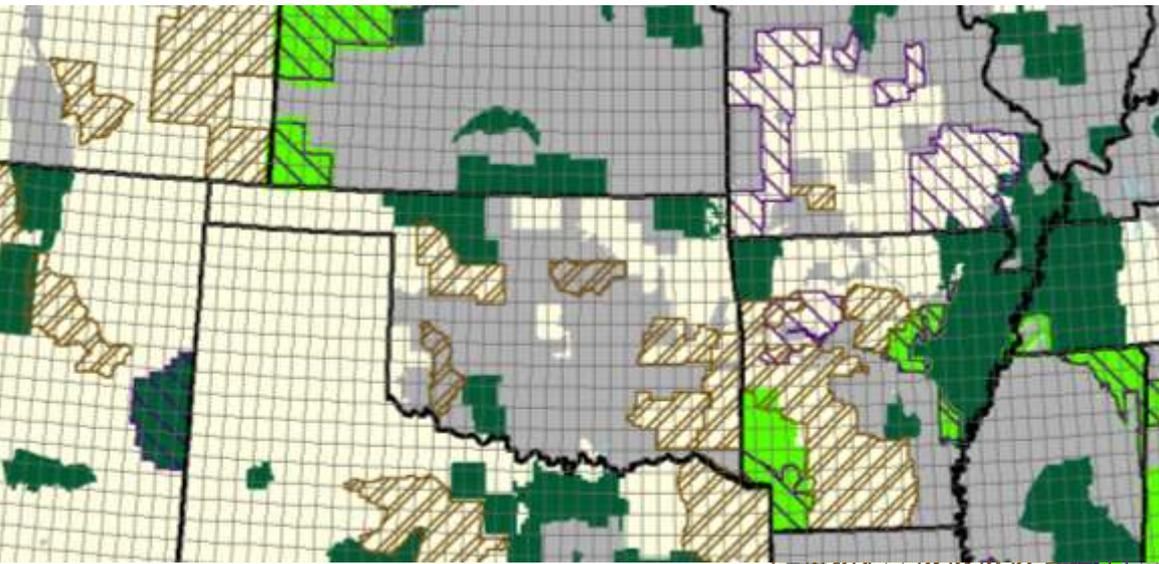
Counties



1 degree cells  
(or 30- or 15-minute cells)

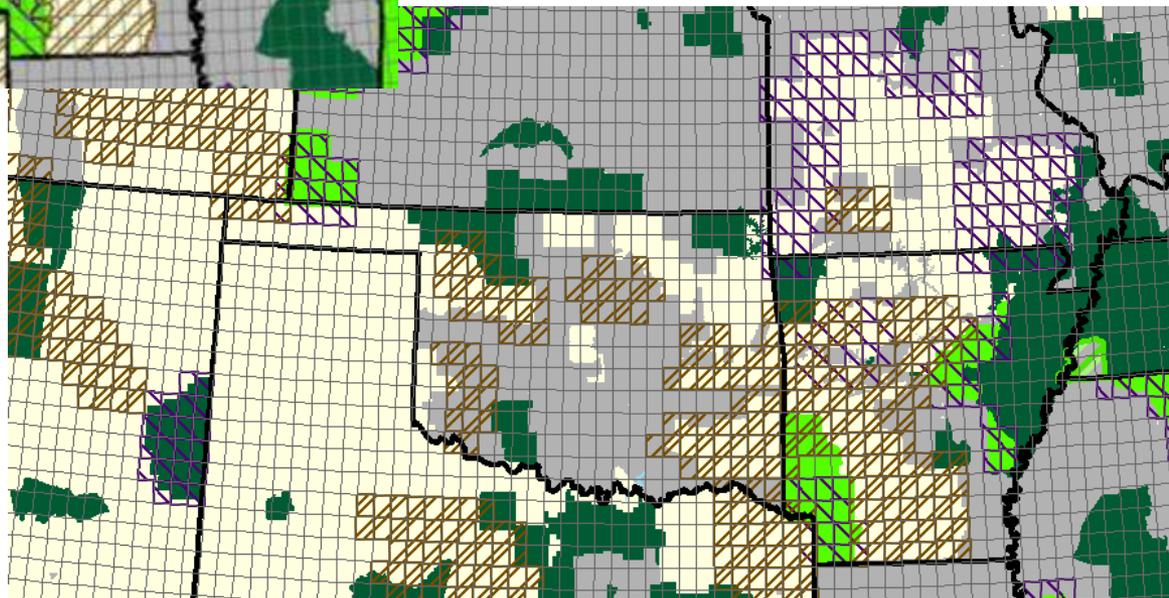
# + 3DEP Multi-Year Data Acquisition Plan

## Theoretical Example for Demonstration Purposes Only



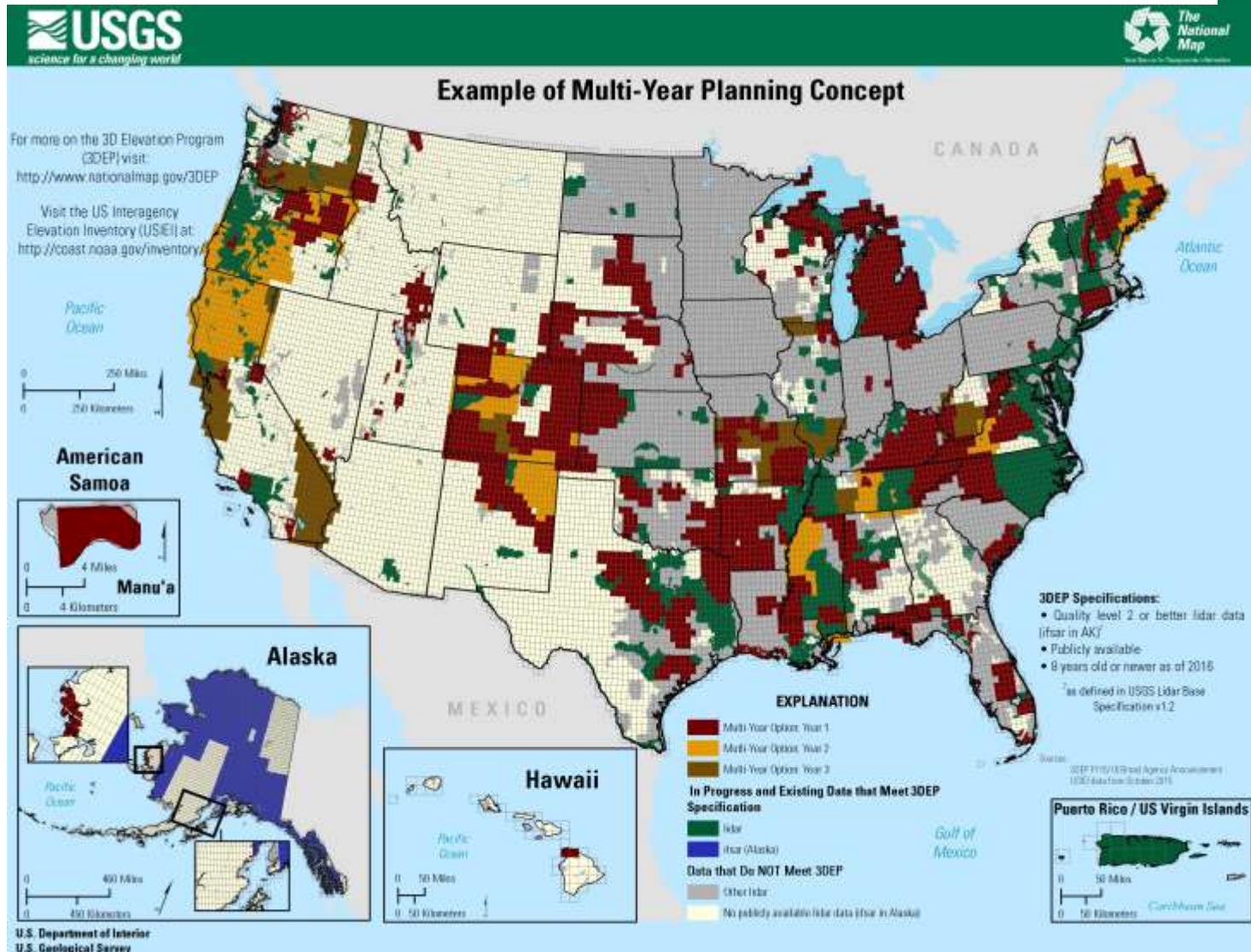
Irregular AOIs  
with 15-minute  
grid overlay

AOIs expanded to  
15-minute grid  
overlay



# + 3DEP Multi-Year Data Acquisition Plan

## Theoretical Example for Demonstration Purposes Only

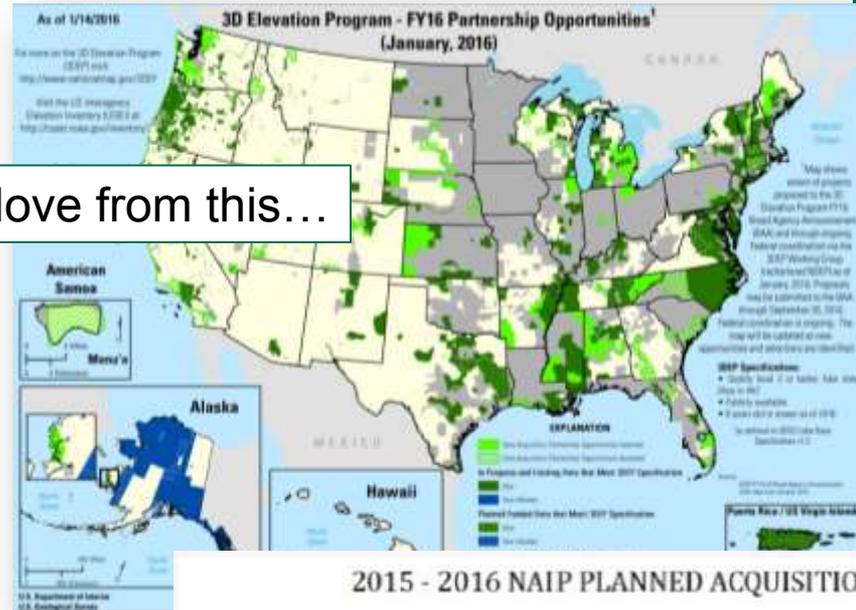


# + Moving to a more systematic approach

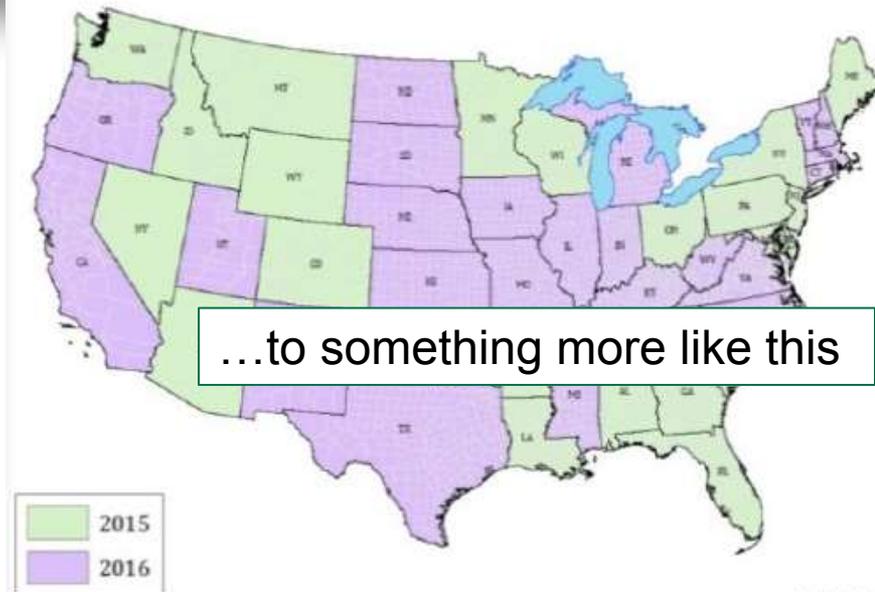
## Benefits

- Increased lead time enables partners at all levels to more effectively plan and participate
- Potential to capture more non-Federal funding
- Defined units facilitate planning and understanding costs
- Improved reporting and justification of investments
- Drives to a plan for national coverage
- Strengthen case for budget initiative

Move from this...



2015 - 2016 NAIP PLANNED ACQUISITION



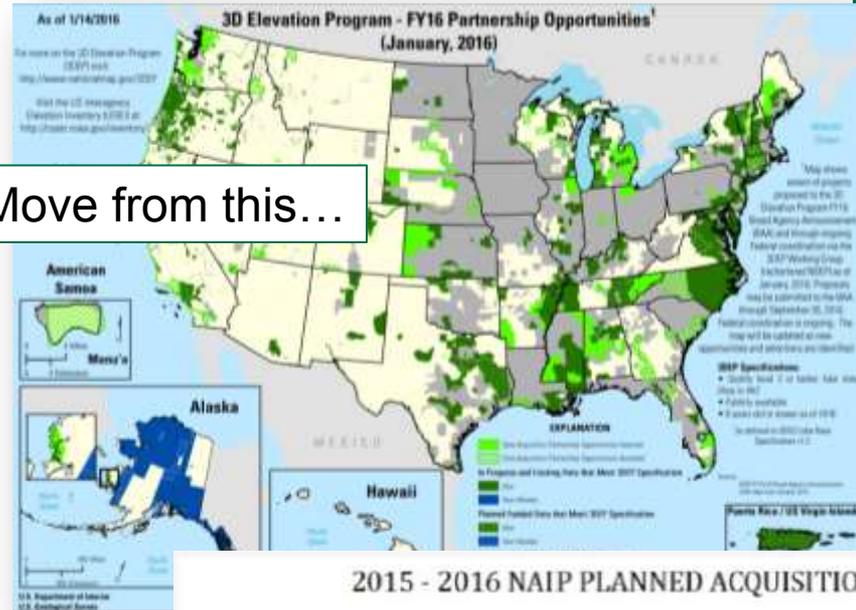
...to something more like this

# + Moving to a more systematic approach

## Challenges

- Agreeing upon a defined unit and dealing with past collections in irregular footprints
- Acceptance of defined unit by other partners
- Requires greater coordination and a more centralized approach within agencies
- Many agencies have one-year funding (but can project based on base budget, ex. USGS)
- Not all agencies may be able to participate initially

Move from this...



2015 - 2016 NAIP PLANNED ACQUISITION



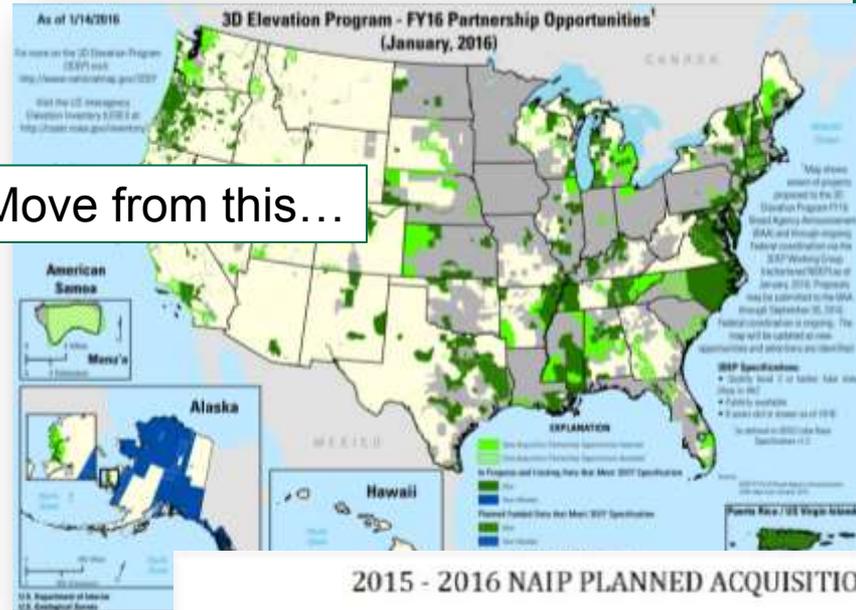
...to something more like this

# + Moving to a more systematic approach

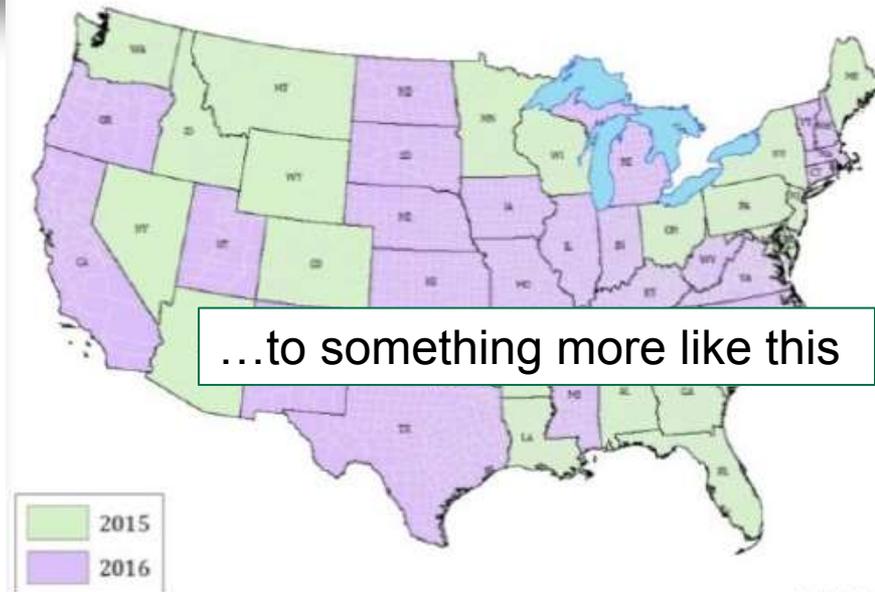
## Next Steps

- 3DEP Executive Forum tasked 3DEP Working Group to develop a multi-year plan, including use of a defined unit of collection
- Report progress at 3DEP Executive Forum in September
- Goal to implement in FY18
- Treat FY17 as transition – expand projects to the defined unit of collection to start the process
- Would like to request NGAC input in fall

Move from this...

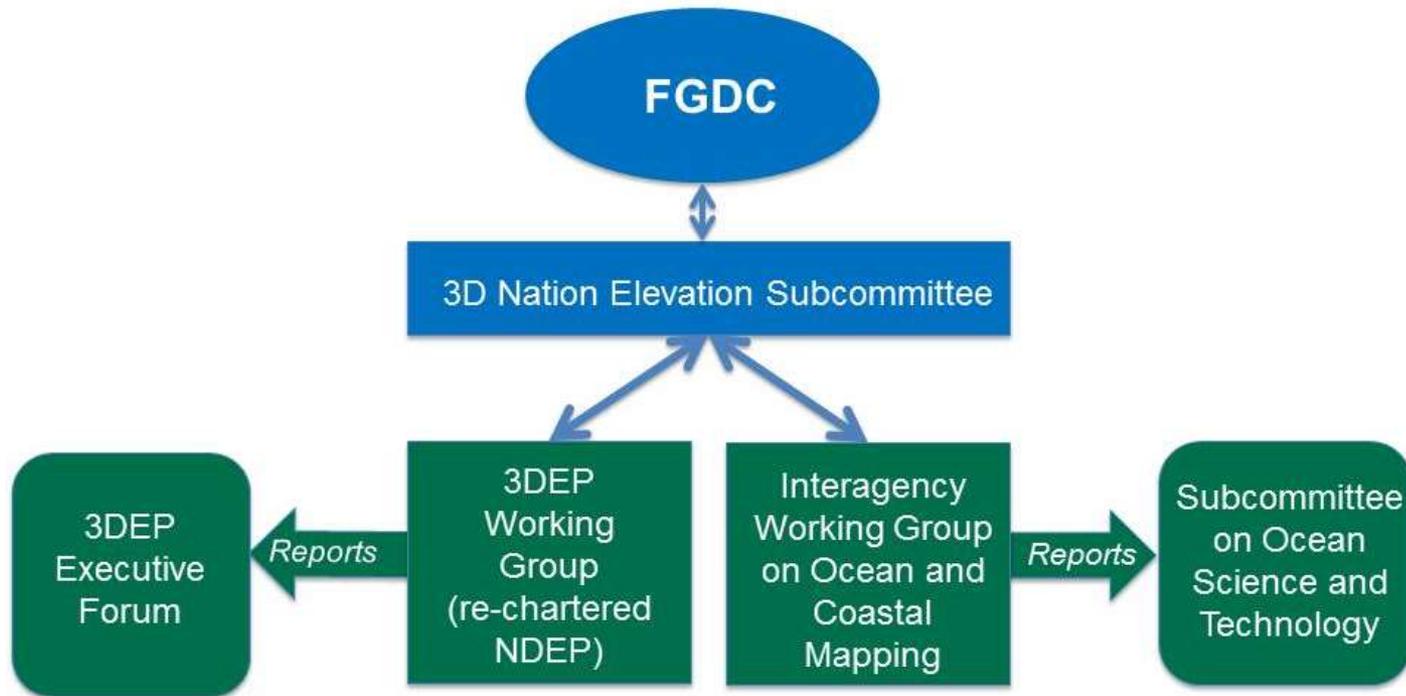


2015 - 2016 NAIP PLANNED ACQUISITION



...to something more like this

# + Elevation Theme Governance



- **3D Nation Elevation Subcommittee** - Charter approved by FGDC Steering Committee in December, 2015
- **Developing a combined MOU for the 3DEP Executive Forum and Working Group** – To formalize structure and relationship



# GeoPlatform Dashboard

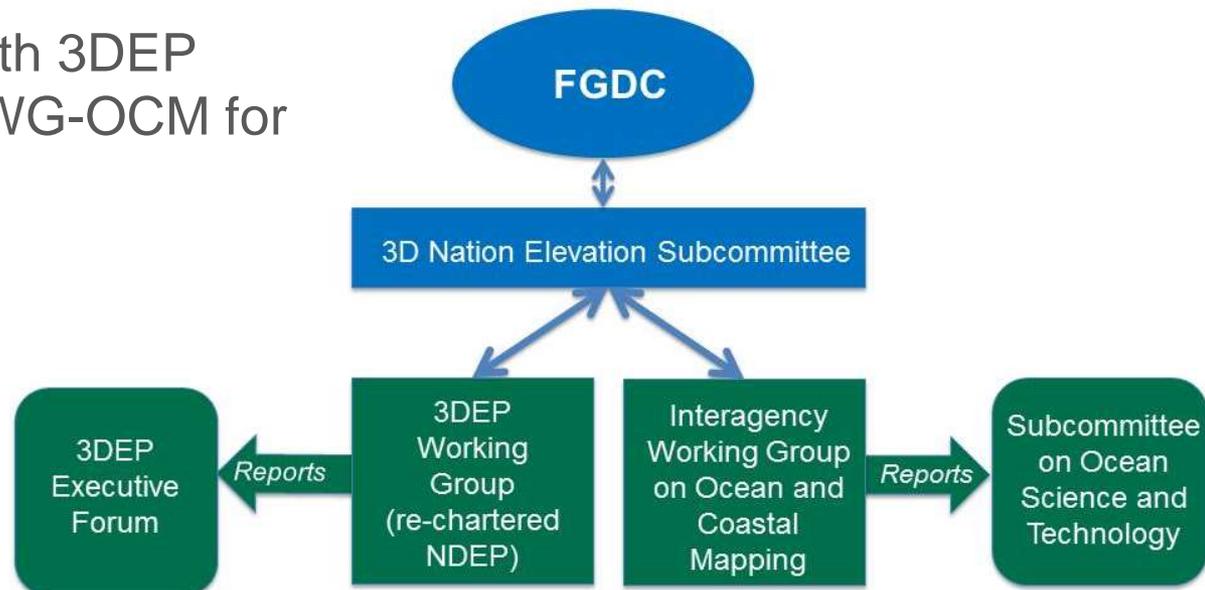
## Elevation Theme

Dataset	General	Define	Inventory Evaluation	Obtain	Access	Maintain	Use Evaluation	Archive	Overall	Theme	Agency
Theme Rollup	4/5	5/5	5/5	4/5	5/5	4/5	5/5	4/5	4/5		
1 meter Digital Elevation Models (DEMs) - USGS National Map	4/5	5/5	5/5	3/5	5/5	4/5	5/5	3/5	4/5	Elevation	DOI-USGS
1/3rd Arc-second Digital Elevation Models (DEMs) - USGS National Map	4/5	5/5	5/5	4/5	5/5	4/5	5/5	3/5	4/5	Elevation	DOI-USGS
5 meter Alaska Digital Elevation Models (DEMs) - USGS National Map	4/5	5/5	5/5	3/5	5/5	4/5	5/5	3/5	4/5	Elevation	DOI-USGS
Digital Elevation Models from NOAA/NGDC	4/5	4/5	5/5	5/5	5/5	3/5	5/5	5/5	4/5	Elevation	DOC-NOAA
Global Multi-Resolution Terrain Elevation Data - National Geospatial Data Asset (NGDA)	3/5	4/5	5/5	5/5	5/5	3/5	2/5	5/5	4/5	Elevation	DOI-USGS
Lidar Point Cloud - USGS National Map	4/5	5/5	5/5	3/5	5/5	4/5	5/5	3/5	4/5	Elevation	DOI-USGS
MultiBeam Bathymetric Data Base (MBBDB)	5/5	5/5	5/5	4/5	5/5	4/5	5/5	5/5	5/5	Elevation	DOC-NOAA
National Flood Hazard Layer (NFHL)	4/5	4/5	5/5	4/5	5/5	5/5	4/5	3/5	4/5	Elevation	DHS-FEMA
NGDC Marine Trackline Geophysics Database	5/5	5/5	5/5	4/5	5/5	5/5	4/5	5/5	5/5	Elevation	DOC-NOAA
NOS Hydrographic Surveys Collection	5/5	5/5	5/5	3/5	5/5	5/5	5/5	5/5	5/5	Elevation	DOC-NOAA
Shuttle Radar Topography Mission (SRTM)	5/5	5/5	5/5	4/5	5/5	4/5	5/5	5/5	5/5	Elevation	DOI-USGS
U.S. Coastal Lidar Elevation Data - Including the Great Lakes and Territories, 1996 - present	5/5	5/5	5/5	4/5	5/5	5/5	4/5	5/5	5/5	Elevation	DOC-NOAA

# + NGDA Strategic Plan

Due June 30

- FGDC's National Geospatial Data Asset Portfolio Management requires a strategic plan for the Elevation Theme
- Co-Leads from NOAA and USGS working on mapping existing plans (National Coastal Mapping Strategy and 3DEP Call for Action) to template – use existing strategies and processes and ensure all datasets are addressed
- Plan will be shared with 3DEP Working Group and IWG-OCM for review by mid-June





# Emerging Lidar

- Geiger Mode (GM) and Single Photon Counting (SPC) lidar are becoming more widely available
  - Higher altitude equates to broader coverage, more efficient data acquisition
  - Greater point density
- USGS initial data assessment with Woolpert and Dewberry identified technical challenges that impact immediate adoption by 3DEP
  - Non-compliance with current lidar acquisition specification
  - Range walk
  - Foliage penetration
  - Absolute accuracies
- USGS will continue to assess these technologies in an incubation period, with the goal to mature these technologies for operational use in 3DEP assuming they meet programmatic and technical requirements – need to understand full lifecycle costs

# + 3DEP 2016 Emerging Lidar Acquisition

‘Incubation collections’ to foster maturation of technologies

Location	Area Square Miles	Sensor	3DEP Investment USGS, FEMA, NRCS	State / Local Investments	Total Project Cost
Illinois	3,358	GM	\$336K	\$739 K	\$1.1 M
South Dakota	11,805	GM and SPC	\$2.8M	\$0	\$2.8 M
North Carolina	4,200	GM	\$362K	\$805 K	\$1.2 M

\* Adjustments in all categories may occur as projects mature

- Collections designated as provisional datasets
  - Waiving specification attributes that do not affect accuracy requirements
  - Communicating with stakeholders the higher level of uncertainty with these projects
- For FY17 planning for limited investment in Geiger Mode/SPC investments
  - Either a total funding or total square mile investment
  - Allows for incremental testing and acceptance of the new technologies
  - Provides flexibility to continue to work with partners interested in Geiger/SPC



# Managing the 3DEP Portfolio

- Additional technologies to assess
  - SfM (structure from motion)- data could be collected from UAS to satellite
  - Topo-bathy sensors- many new instruments are now commercially ready & partners are interested in acquisitions
  - Multi-wavelength lidar (Optech's TITAN)- 3 lasers, 3 detectors
  - Waveform lidar
  - Lidar from other kinematic platforms (UAS, mobile mappers)
  - Imagery-derived elevation models
- Develop a transparent, repeatable process to answer:  
**Does this instrument produce data that meets 3DEP requirements both technically and programmatically?**

+ Thank you!

