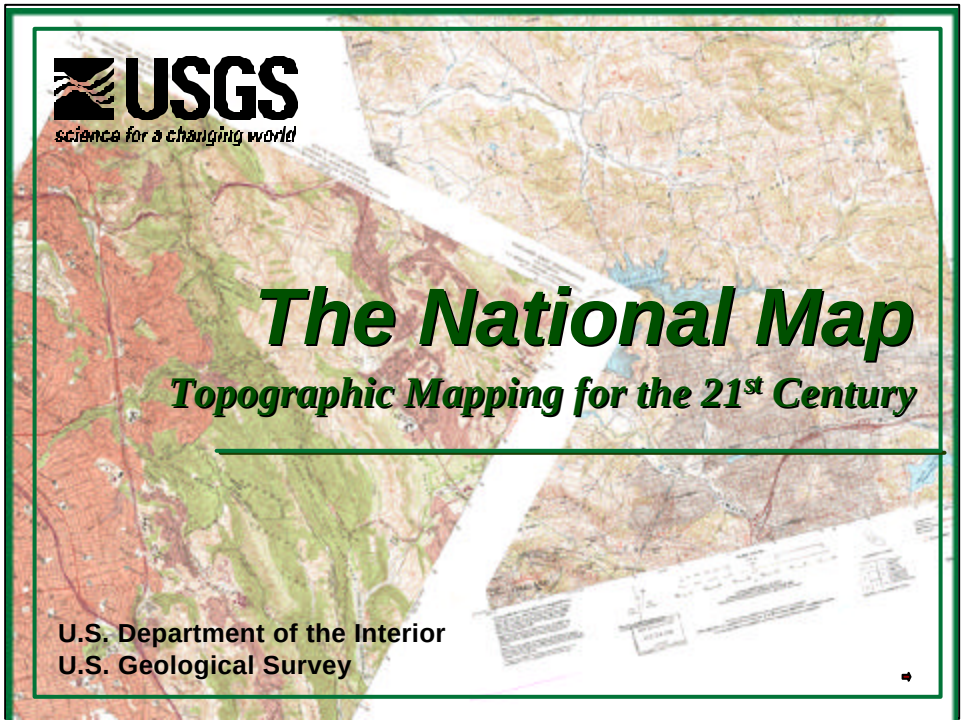
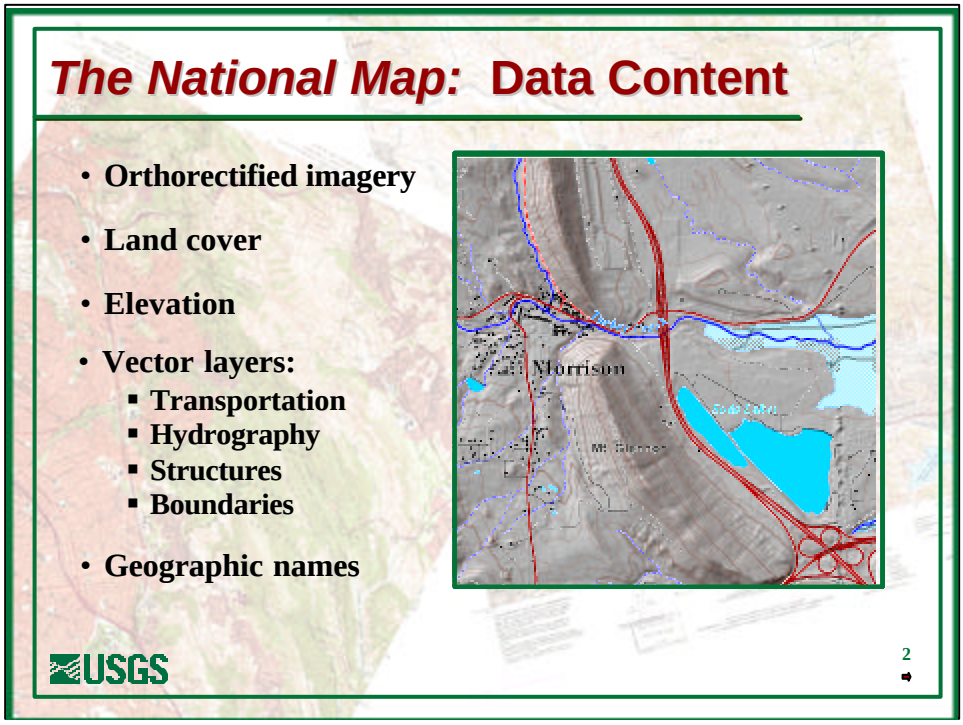


For more than 50 years, the U.S. Geological Survey (USGS) has produced about 55,000 separate 7.5-minute topographic maps of the United States to meet needs for geographic base information. We completed once-over mapping of the Nation in the early 1990's. These maps are a national treasure. It would cost well over one billion dollars to recreate them. Unfortunately, traditional approaches to topographic mapping have not enabled USGS to maintain the currentness of these maps and the usefulness of this massive collection of vital information is jeopardized. The average age of a 7.5-minute map today is 23 years.

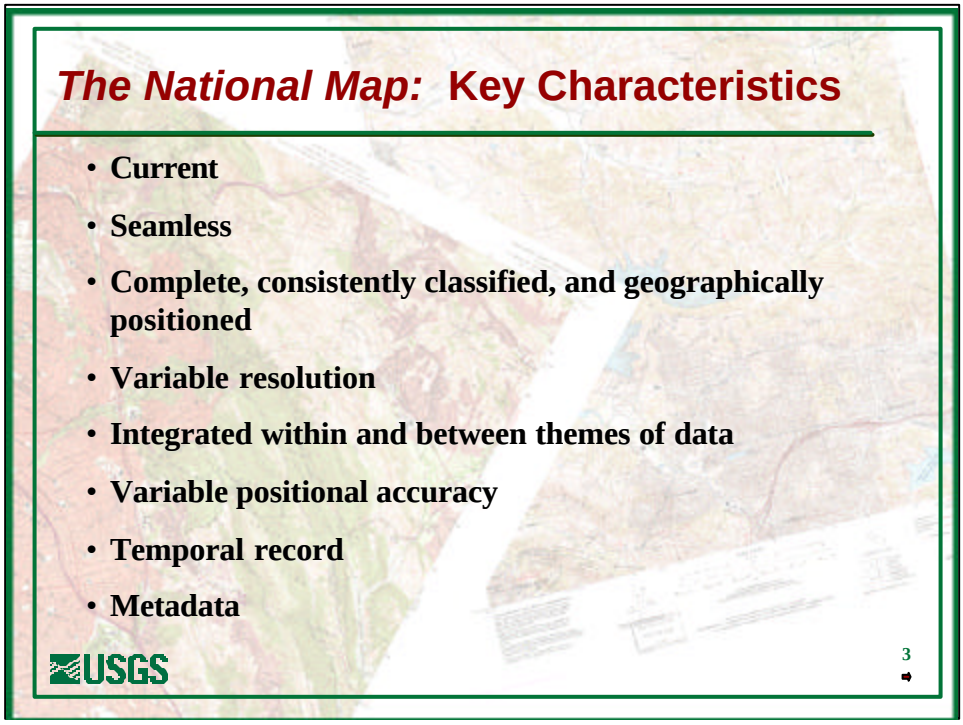
As USGS maps and related digital data have aged, there have been advances in technology and a diffusion of mapping capabilities to other Federal agencies, State and local governments, and the private sector. The broad involvement of many sectors in creating and maintaining base geographic information offers exciting possibilities for addressing needs for current and accurate national base data. As a result, USGS has reconsidered its role and processes for ensuring the availability of this information. Our vision for the 21st century is called "*The National Map*."



Consider the reality of what USGS does now and what we propose to do for the future. The data content of *The National Map* will meet broad user requirements for a foundation of geographic information.

Orthorectified (scale corrected) imagery is a key source of interpreted feature information for *The National Map*, and is an archive medium in its own right for portraying data that does not lend itself to extraction and symbolization. Imagery will come from a variety of sources, including aerial photography and commercial remote sensing satellites. Private firms now have licenses to collect high-resolution satellite data, at 1 meter and even .5 meter ground resolution. In addition, The National Map will serve seamless Landsat satellite imagery to provide intermediate-resolution national coverage. Image data will underpin *The National Map* and give us an accurate and current base to work from.

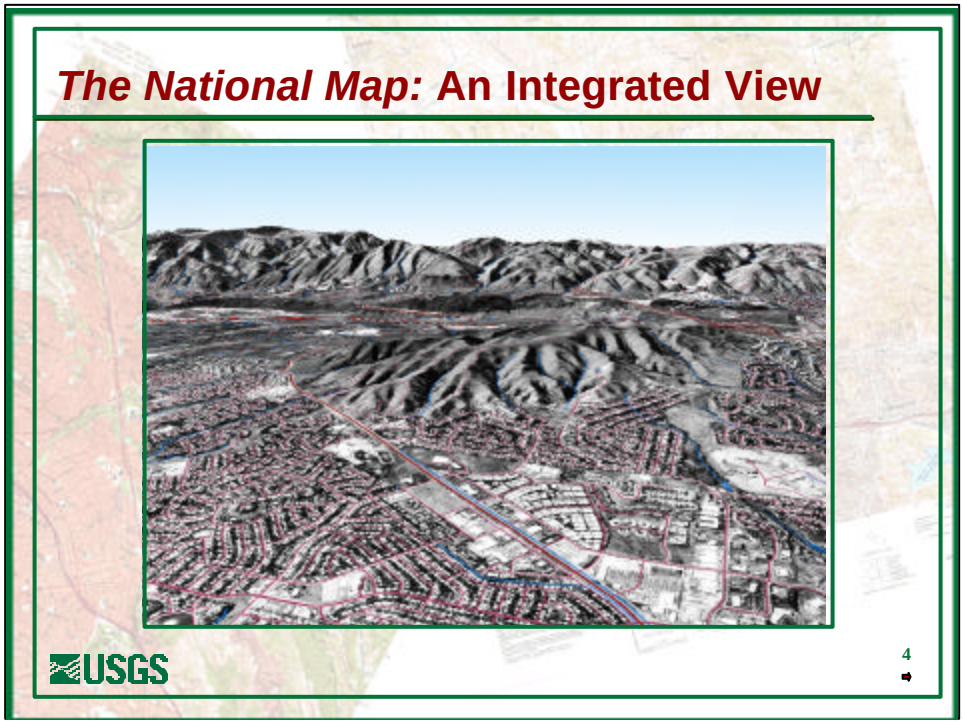
Land cover data classify the land surface into categories such as open water, perennial ice and snow, evergreen forest, and high-density residential. These data are key to scientific studies and to business and government operations. Users want land cover data to be integrated with other USGS products.



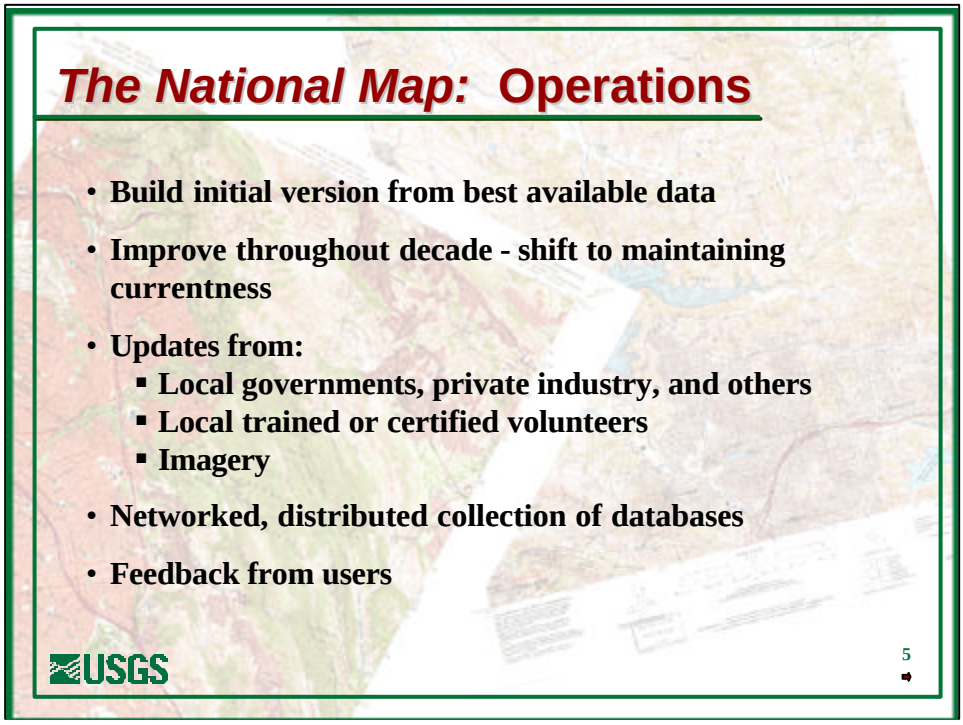
Content will be updated continuously, based on changes on the landscape. Currentness will be measured in days and months, not years.

Base data need to be seamless so that they can support unique applications. People want to be able to obtain and use data for any arbitrarily defined piece of geography. This means that if a user is interested in a county, a township, a State, or the area within one mile of a water well, they need to be able to define the geographic extent of that area in order to extract the data they need. The data must be seamless across the traditional USGS 7.5-minute tiles and across jurisdictional boundaries.

The data must be complete and consistently classified for the same reason. When a user works with data for any geographic area and performs analytical operations on those data, the results must be consistent and accurate no matter where, or how large, the area is. *The National Map* content will not be generalized as is required for map symbolization. Cartographic generalizations, including feature offsets, feature eliminations or aggregations, and feature simplification, that are needed to produce a topographic map product, need to be able to be derived on the fly, so that the actual database remains geographically correct.

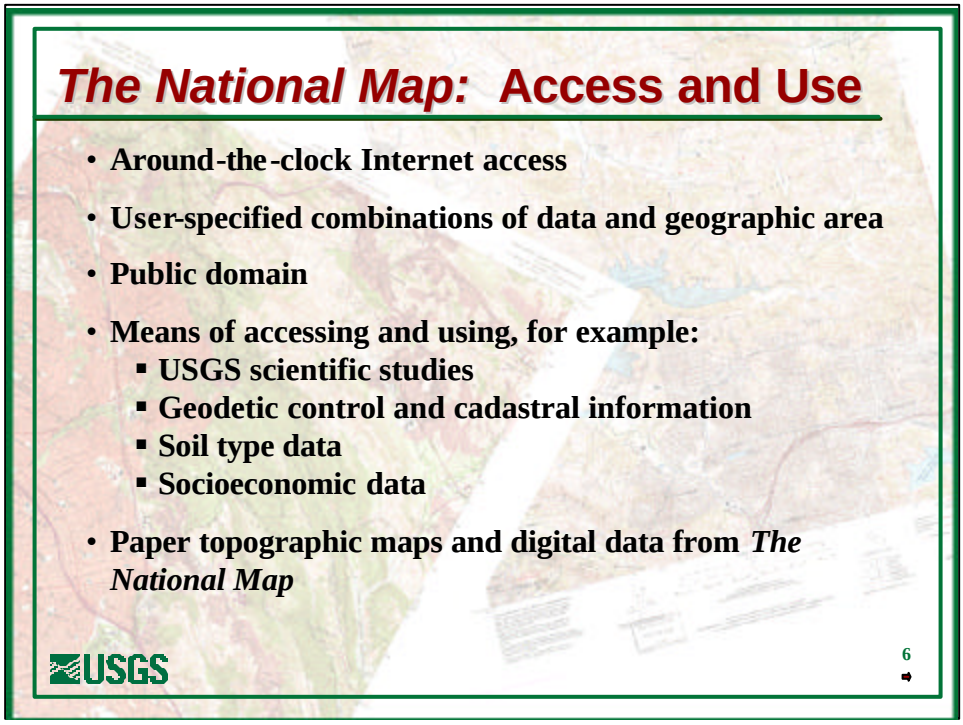


This perspective view of the Lakewood, Colorado area illustrates some of *The National Map* concepts. It takes advantage of the key data characteristics. The terrain is derived from a high accuracy elevation model so that the relationship between roads and streams with the terrain surface slope is correct. This is *The National Map:* a data set in which all the data register, are geographically correct, are complete and current, and are available for whatever geographic area a user defines.



We don't have data with all of these characteristics today. We have to build the initial version of *The National Map* from the best available data. This includes USGS data and data that are currently in the hands of our partners and in the private sector.

As we improve the data, we will shift our focus from establishing *The National Map* to maintaining its currentness. It will take substantial resources in the beginning to put the initial version together. Over time, different skills and resources will be needed to maintain the database. We look to partnerships with other government agencies and creative business relationships with the private sector for some of these skills and to leverage USGS resources.



Data users will expect to be able to access base geographic information day or night, every day, over the Internet. That's already true today.

Users will demand to choose and use unique combinations of data they need for any geographic area of interest.

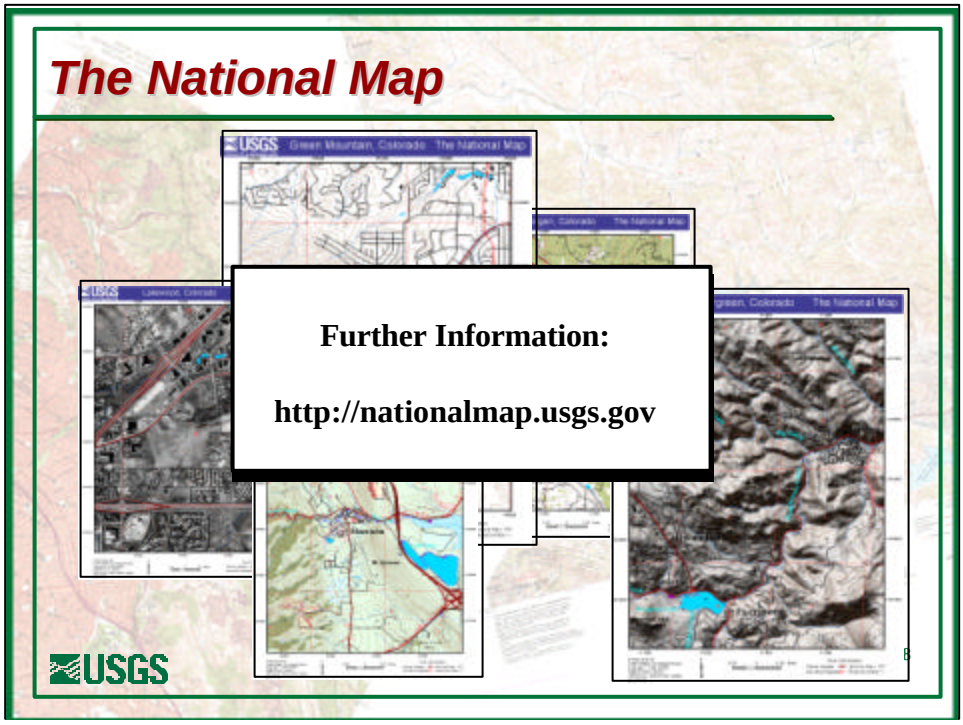
The USGS is committed to keeping *The National Map* content in the public domain. Unrestricted and immediate access, and unlimited use, of *The National Map* is of vital importance. For example, our partners need to be able to derive and market products for *The National Map* data. Government and private agencies responsible for natural disaster response or national defense need *The National Map* data and capabilities for time-sensitive uses. Before privately held data can be incorporated into *The National Map*, the negotiation of appropriate distribution and use rights will be required.

USGS roles are changing dramatically as *The National Map* is created. The USGS will guarantee national data completeness for a level of content consistent with primary series topographic maps and make that available. That's the goal and the vision of *The National Map*. It's a big commitment, but we will depend on partners to help us. Lacking partners, USGS will produce and maintain *The National Map* unilaterally where necessary.

In some, maybe many, cases USGS will not produce, maintain or distribute the data in *The National Map*. We will have established business relationships through which other government organizations or private industry will be the data stewards.

It's very clear that this is a big challenge and that the likelihood of success is greatly enhanced if we collaborate through partnerships with other Federal and State agencies, and the private sector. Our relationships with State geologists and GIS groups are examples of how we have done that in the past.

As an integrator of data, we will ensure that information drawn from diverse sources registers logically and spatially.



These are some important points that sum up what is key to USGS's implementation of *The National Map* vision:

We will seek a better understanding of the capabilities and needs of all sectors of base geographic data producers and users.

Collaboration is essential; creative work share, funding, and data partnerships will make *The National Map* possible.

The USGS will reassess and restructure its programs and operations to align with the vision.

We will seek answers to relevant research questions and take advantage of new technologies.

Our focus will be to promote awareness of and ensure the availability and usefulness of accurate, nationally consistent, and current geographic base data.

We will meet user needs for standard digital data and topographic map products derived from *The National Map*.

By achieving tangible results, including the pilot projects, we will demonstrate and sustain our commitment to the vision.

We will give users the geographic information they need to understand, manage, and respond to their individual needs.

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science for a changing world

Some FY02 National Map Pilots

EROS Data Center: Intermediate resolution

Texas and Delaware: large state investments

Tahoe: Ecosystem Management tie, but using local data

Washington-Idaho: local partnership emphasis

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

Deleware *National Map* Pilot

- Delaware Framework Data: statewide revised DLG coverage, current orthoimagery, high resolution DEMs available
- April 18 Internet Map Service release to public
- ESRI IMS Cooperative Research Development
- USGS map symbology
- User feedback, map generation, other capabilities

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Texas *National Map* Pilot

- Texas Natural Resource Information System, a state agency under the Texas Water Development Board is the primary partner
- Most data components already available and being maintained through Texas StratMap (statewide geographic database)
- USGS Mapping Partnership Office colocated
- ESRI IMS Cooperative Research Development

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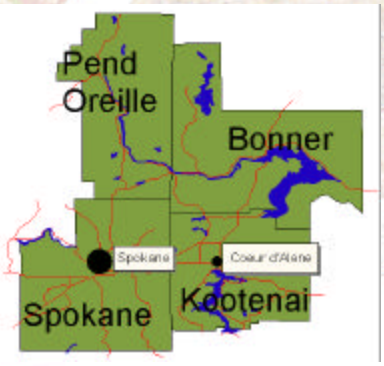
Washington-Idaho National Map Pilot

- Four counties, each with widely varying levels of local GIS sophistication (144 7.5-min quads)



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Washington-Idaho National Map Pilot Local Data Holdings

- Washington Counties
  - Spokane: 120-City, Data Rich
  - Pend Oreille: Some data, 911 centerlines
- Idaho Counties
  - Coeur D'Alene: Data Rich, Growth Issues
  - Bonner: Large Data Need

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Federal Partnerships

- Census: USGS Facilitating Local Roads in TIGER
- Forest Service: Hydro, Roads/Trails, Structures, Boundaries
- FEMA,EPA,USGS: LIDAR CDA River Basin
- EROS Data Center: DOQQ Access

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State Partnerships

- Idaho Transportation Dept: Bonner Co. Roads
- Idaho Dept of Lands: Bonner Co. Structures
- University of Idaho: Web Server Access
- Washington State: Discussions with Emergency Services and Transportation Framework

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Private Partnerships

- Avista Energy: DOQQ Consortium
- Digitalanno: GNIS Names Placement

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Tribal Partnerships

- Coeur d'Alene Tribe: Hydrography, Traditional Names

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County Partnerships – Data for *TNM*

- Kootenai County: Hydrography updated from DOQQs, Transportation, Structures, Boundaries
- Spokane County: Transportation, Structures, Hydrography, Boundaries, cooperative development
- Bonner County: Roads (new GPS data)
- Pend Oreille: Hydrography, 911 Roads
- USGS will produce data where none exists

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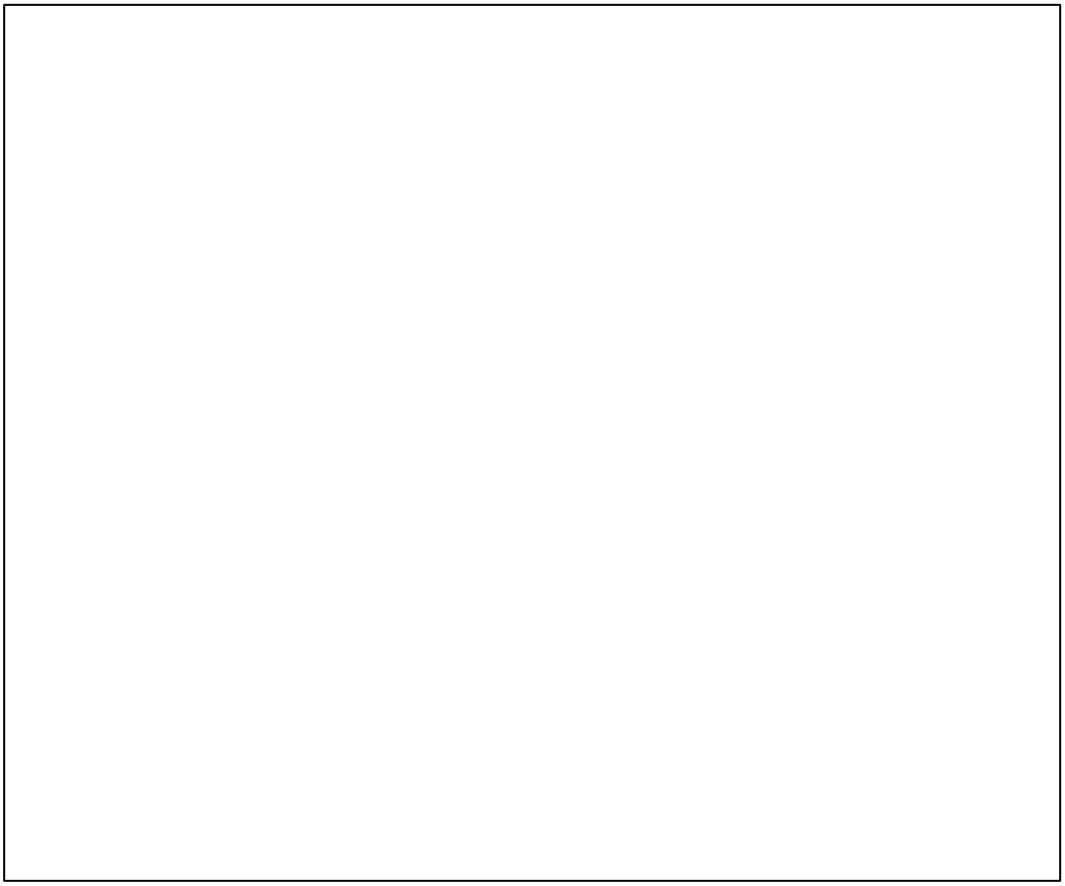

Partnership Funding

- Some data partnership opportunities are available without direct funding from USGS. Others require some funds to facilitate the data exchange process.
  - $56,000 authorized to support the data sharing opportunities in the four counties
  - Agreements are not direct data purchases. Instead, we are building processes that facilitate data sharing over the long term.

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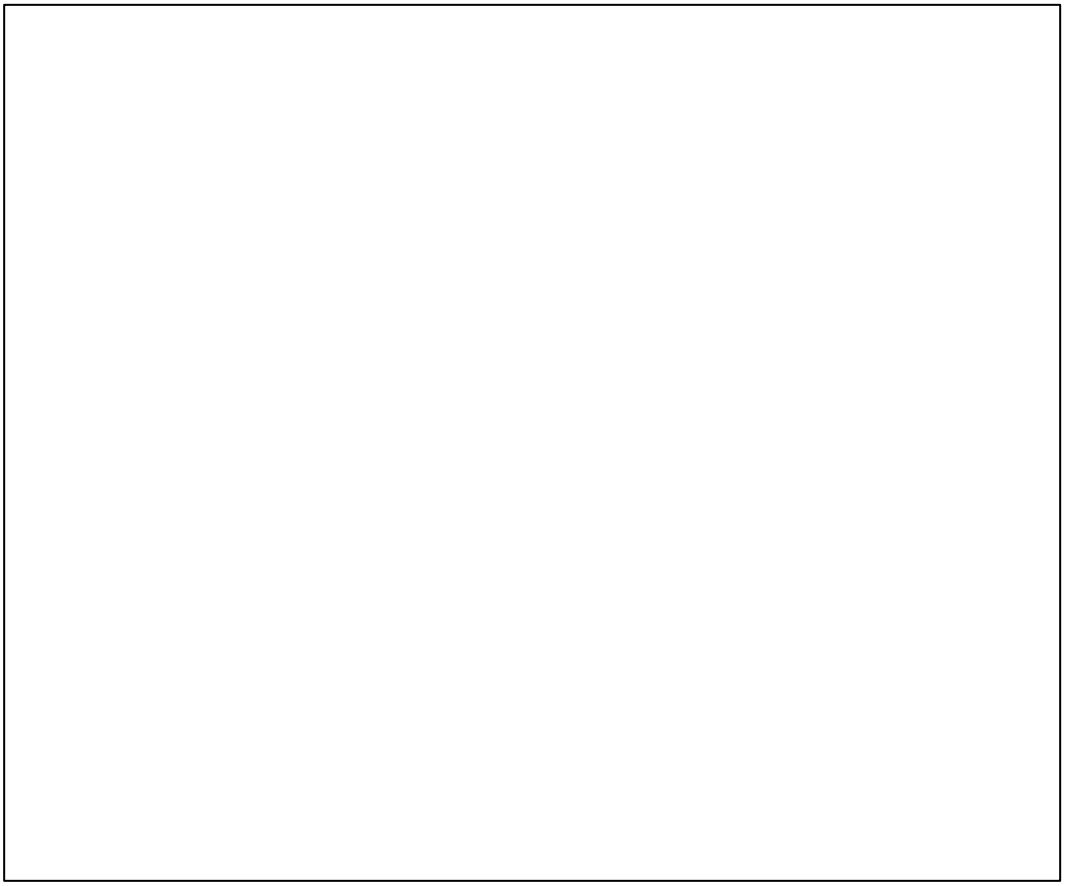

Lessons Learned

- Many Local Partners are willing to enter into data sharing agreements, but we must show them the benefits. Coordinating **local data integration with Census data** is one major incentive.
- USGS must be very innovative in the development of data exchange agreements. Examples: SPOT Data Purchase would indirectly provide access to vector layers, Avista Energy DOQQ exchange agreement based on pointing users to Avista data

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Anticipated FY03 Enhancements

- Pursue Idaho SPOT 2.5-meter Imagery Coop Opportunity– 2002 imagery data to support National Map with updated imagery and additional data-share opportunity
- Refine data sharing processes within WA and ID and OR:State Frameworks, I-Teams, Data Stewards
- Expand use of volunteers: 1) user feedback mechanism 2) GPS collection
- Promote a PNW Mapping Partnership Office

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Partnership Benefits

- The Map Service itself is a benefit to GIS data users, providers, and the local citizens
- USGS has three full-time employees creating data for two counties where little local data exist
- Data exchanges (DOQQs)
- Development of seamless data for regional use that meets a minimum standard (state framework)
- ArcIMS development support

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Anticipated FY03 Enhancements

- Solidify agreements and enhance long term relationships with FY02 partners
- Publish documentation
- Enhance data over the Spokane area to meet Homeland Security requirements (Spokane is 87 on list of 120 cities)

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Proposed FY03 Implementations

- Expansion of FY02 pilot area to six additional adjacent counties for detailed map revision and local collaboration
- PNW implementation – best available free data for remaining Oregon, Washington, Idaho counties

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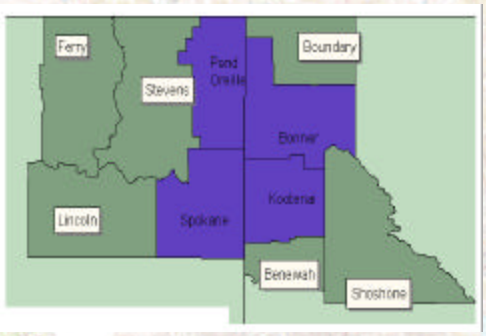
Expand to Six Adjacent Counties



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PNW Rapid Implementation

- Washington, Oregon, Idaho
- Use best available, free data (DLGs, CFFs, IRICC, GRTN, state, local)
- Three server configuration
- Little data editing
- Census coordination for transportation

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Data Content – Transportation

Roads

USGS National Map: Class (Interstate, State, Other all weather, Not all weather) function(truck ramp, cul-de-sac), access restriction(open, private, toll, restricted), Name, Surface type (hard surface, loose surface)

Homeland Security: Choke Points, Truck Routes

Framework: Jurisdiction Anchors

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Data Content – Transportation

Trails

USGS National Map: Name, Function (footpath, snowmobile, bike)

Homeland Security: immigration

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Data Content – Transportation

Other Features

USGS National Map: Ford, Gate, Water Lane (ship, boat, seaplane), Railway, Transmission Line, Airport Runway, Gas Pipeline, Oil Pipeline

Homeland Security: Waste Water Pipeline, High-Tension Line

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Data Content – Elevation, Imagery

USGS responsible federal party for Geospatial Onestop & NSDI

Elevation

10-meter DEM complete in Washington and Oregon, nearing completion in Idaho

LIDAR Data projects ongoing in all three states

Imagery

DOQQ updates in some areas, 1-foot imagery projects planned for several cities to support homeland security

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Data Content - Structures

Residences

USGS National Map: collect all outside developed areas

Homeland Security: all

Building/Structure Clusters

USGS National Map: Amusement Park, Grain Elevator, Tank Farm, Substation, Refinery, Nuclear/Hydro Power Site, Sewage Treatment, Metro Station, Airfield, Mall, Railroad Station/Yard, Memorial

Homeland Security: University, Port Facility, Truck Facility, Fuel Storage Tanks, Pharmaceutical Plant, Ferry Terminal

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Data Content - Structures

Large Commercial/Public Buildings

USGS National Map: all outside highly developed areas, landmark buildings and >80,000 sq. ft. inside built-up area, (landmark = Arena, Armory, Auditorium, Commercial, Community Center, City Hall, County Hall, State Govt, Fed Govt, Grange Hall, Hospital, Worship, Library, Hospital, Military, Museum, Observatory, School, Radio)

Homeland Security: Banking/Finance, Convention Center, Evacuation Facility, Law Enforcement, FEMA, Post Office, Mail Distribution Center, Emergency Mangt Cnt, Soft Drink Plant, Subway/Metro Station, Hotel

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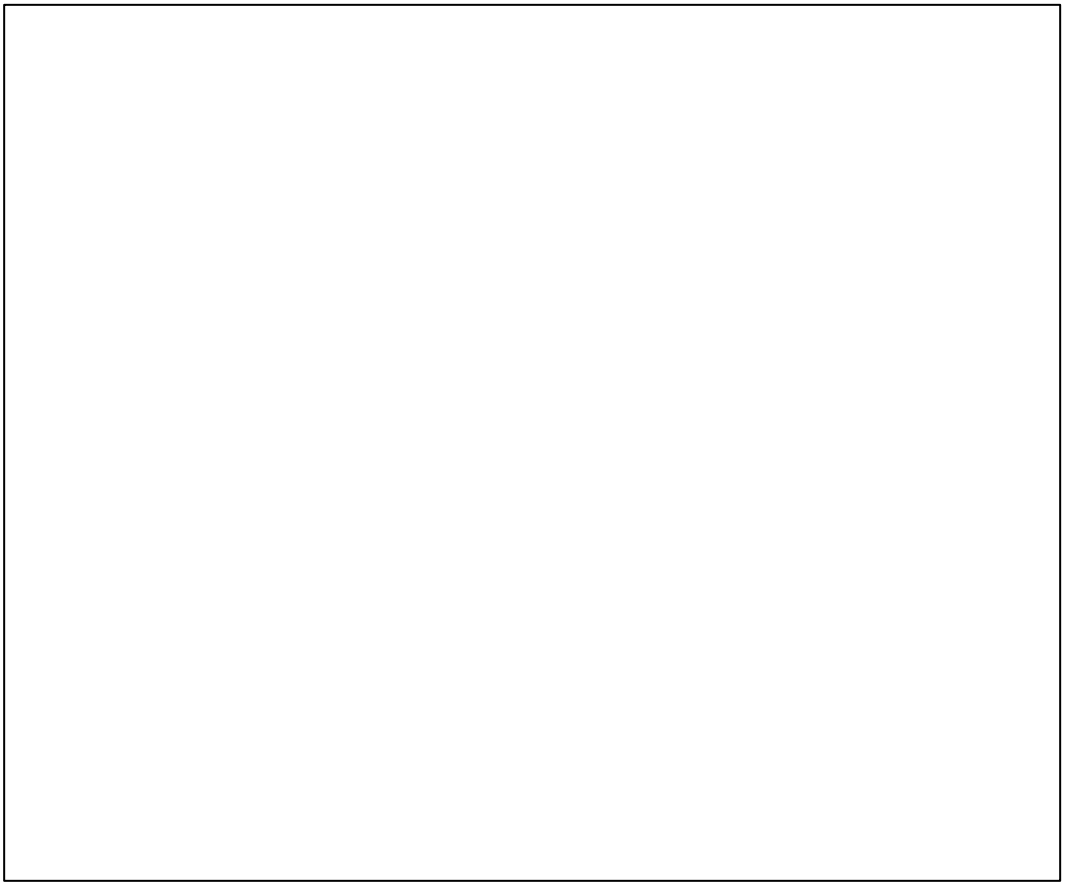

Data Content - Structures

Towers, Grids, Miscellaneous

USGS National Map: Levee, Dam, Aqueduct, Flood Control, Microwave/Radio/Cell Tower, Tunnel, Bridge

Homeland Security: Internet Switches, Telephone Grids, Communication Node, Satellite Downlink Facility, Grocery, Border Crossing, Chemical Plant, Water Valves, Hydrants

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Data Content – Boundaries

Boundary Line

USGS National Map: Status (Approved, Disputed, Historical), Name, Positional Accuracy

Boundary Area

USGS National Map: City (Name, Population), County (FIPPS Code, Name), Minor Division such as township or barrio (FIPPS Code, Name), State (FIPPS Code, Name), Nation (Name), Reservation (Forest, Grassland, Indian Land, Military, Park, Prison, Wilderness, Wildlife

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Data Content – Hydrography

1:24,000 scale NHD and LLID are being created for Washington, Idaho and Oregon (seamless watersheds, permanent IDs, fully routable (USGS responsible federal party for Geospatial Onestop/NSDI)

Primary Features

Lakes/Pond, Reservoir, Canal/Ditch, Stream/River, Well, Spring, Connector, Artificial Path, Dam/Weir

Miscellaneous Features

Anchorage, Playa, Flume, Gaging Station, Gate, Hazard Zone, Bay, Crevasse Field, Fumarole, Inundation Area, Rapids, Reef, Rock, Ocean, Snag, Spillway, Wreck, Wall, Estuary, Wash, Intake/Outflow