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The 3D Elevation Program—Summary for Idaho

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 Idaho, elevation data are critical for agriculture and precision farming, natural resources conservation, infrastructure and construction management, geologic resource assessment and hazard mitigation, flood risk management, forest resources management, 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) initiative (Snyder, 2012a,b), managed by the U.S. Geological Survey (USGS), responds to the growing need for high-quality topographic data and a wide range of other three-dimensional representations of the Nation's natural and constructed features. The Idaho LiDAR Consortium provides statewide collaboration and data sharing mechanisms that can be used as a resource by State and Federal partners implementing the 3DEP initiative.

3D Elevation Program Benefits for Idaho

The top 10 Idaho business uses for 3D elevation data, which are based on the estimated annual benefits of the 3DEP initiative, are shown in table 1. The National Enhanced Elevation Assessment (NEEA; Dewberry, 2011) survey respondents in the State of Idaho estimated that the national 3DEP initiative would result in at least $6 million in new benefits annually to the State. The cost for such a program in Idaho is approximately $28 million, resulting in a payback period of 4.6 years and a benefit-to-cost ratio of 1.8 to 1 over an 8-year period. Because monetary estimates were not provided for all reported benefits, the total benefits of the 3DEP to Idaho are likely much higher. On the basis of the NEEA survey results, all levels of government and many organizations in Idaho could benefit from access to statewide high-resolution elevation data.

The NEEA evaluated multiple data collection programs to determine the optimal data quality and data replacement cycle relative to cost to meet the stated needs. For Idaho, approximately 71 percent of the total benefits are realized in agriculture and precision farming, natural resources conservation, and infrastructure and construction management uses alone, as shown in table 1. The status of publicly available lidar data in Idaho is shown in figure 1. By enhancing coordination between the 3DEP and the various

3DEP in Idaho by the Numbers

Expected annual benefits	$6.12 million
Estimated total cost	$27.89 million
Payback	4.6 years
Quality level 1 buy-up estimate	$17.75 million

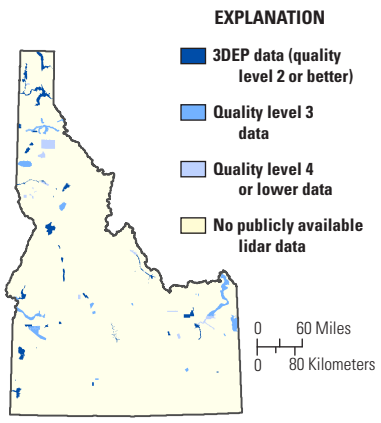

Figure 1. Map of Idaho showing the areal extent and quality level of planned and existing publicly available light detection and ranging (lidar) data in November 2012. See table 2 for quality levels.

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

- Economy of scale—Acquisition of data covering larger areas reduces costs by 25 percent.
- A systematic plan—Acquisition of data at a higher quality level reduces the cost of "buying up" to the highest levels needed by State and local governments.
- Higher quality data and national coverage—Ensure consistency for applications that span State and watershed boundaries and meet more needs, which results in increased benefits to citizens.
- Increase in Federal agency contributions—Reduces State and local partner contributions.
- Acquisition assistance—Provided through readily available contracts and published acquisition specifications.

government and private organizations in Idaho, it may be possible to meet a higher percentage of the needs.

The following examples highlight how 3DEP data can support business needs in Idaho: (1) Seasonal flooding is the most damaging, recurrent, and predictable natural disaster facing Idaho communities. Lidar technology provides communities with better information for reducing flood risk and helps direct mitigation to where it is needed most. Topographic maps developed from lidar data can help provide the most accurate Flood Insurance Rate Maps, which can reduce property owner insurance costs, and in Western States, reduce the size of a mapped flood hazard area by up to 35 percent. (2) When lidar data are readily available, the need for traditional topographic land surveys (including infrastructure and construction site planning and estimating) is minimized. Reducing the time required for project planning provides a cost savings to the public. Lidar data can be used for preliminary highway alignment and design, evaluating existing roadway conditions, and as input to hydraulic modeling for the design of structures (bridges and culverts; fig. 2) to accommodate runoff and flooding from large rain events. A statewide elevation dataset would facilitate communication and interoperability among transportation organizations and foster cooperation at all levels of government.

References Cited

Dewberry, 2011, Final report of the National Enhanced Elevation Assessment (revised 2012): Fairfax, Va., Dewberry, 84 p. plus appendixes, http://www.dewberry.com/Consultants/GeospatialMapping/FinalReport-NationalEnhancedElevationAssessment.

Snyder, G.I., 2012a, National Enhanced Elevation Assessment at a glance: U.S. Geological Survey Fact Sheet 2012–3088, 2 p., http://pubs.usgs.gov/fs/2012/3088/.

Snyder, G.I., 2012b, The 3D Elevation Program—Summary of program direction: U.S. Geological Survey Fact Sheet 2012–3089, 2 p., http://pubs.usgs.gov/fs/2012/3089/.

Figure 2. Lidar data reduces the time and cost associated with highway and other infrastructure projects, especially for preliminary construction plans and design grades. Photograph of Rainbow bridge on Idaho 55 courtesy of Idaho Department of Transportation.

Table 1. Conservative benefits for the top 10 business uses of the proposed 3DEP data identified in the National Enhanced Elevation Assessment for Idaho (Dewberry, 2011).

Rank	Business use	Annual benefits (millions)
1	Agriculture and precision farming	$1.71
2	Natural resources conservation	1.63
3	Infrastructure and construction management	1.03
4	Geologic resource assessment and hazard mitigation	0.62
5	Flood risk management	0.46
6	Forest resources management	0.41
7	Aviation navigation and safety	0.08
8	Renewable energy resources	0.06
9	River and stream resource management	0.05
10	Water supply and quality	0.04
	Other	0.03
	Total	6.12

3D Elevation Program—Continued

The USGS and its partners will acquire quality level 2 or better (table 2) three-dimensional lidar data over the conterminous United States, Hawaii, and the U.S. territories. Interferometric synthetic aperture radar (ifsar) data are being collected at quality level 5 (table 2) in Alaska. The data will be acquired over an 8-year period and will be made available to the public. A number of high-quality elevation-data products will be created to serve a wide range of business needs in government and the private sector.

Table 2. Data quality levels used in the National Enhanced Elevation Assessment (Dewberry, 2011).

[≤, less than or equal to]

Quality level	Nominal pulse spacing (meters)	Vertical accuracy (centimeters)
1	0.35	9.25
2	0.7	9.25
3	1–2	≤18.5
4	5	46–139
5	5	93–185

Next Steps for Implementing 3DEP

Accomplishing the 3DEP initiative's goal of national coverage in 8 years depends on the following factors:

- Increased partnerships among Federal, State, and local governments.
- Partnerships that acquire elevation data to the program's specifications across larger project areas.
- Increased communication about and awareness of the program's benefits and goals.
- Support from government and other stakeholders and users.

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