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The 3D Elevation Program—Summary for Alabama

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 Alabama, elevation data are critical for flood risk management; infrastructure and construction management; wildfire management, planning, and response; natural resources conservation; geologic resource assessment and hazards mitigation; and other business uses. Today, high-density light detection and ranging (lidar) data are the primary sources for deriving elevation models and other datasets. Federal, State, and local agencies work in partnership to (1) replace data that are older 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 National Enhanced Elevation Assessment (NEEA; Dewberry, 2011) evaluated multiple elevation data acquisition options to determine the optimal data quality and data replacement cycle relative to cost to meet the identified requirements of the user community. The evaluation demonstrated that lidar acquisition at quality level 2 (table 1) for the conterminous United States and quality level 5 ifsar data (table 1) for Alaska with a 6- to 10-year acquisition cycle provided the highest benefit/cost ratios. The new 3D Elevation Program (3DEP) initiative (Snyder, 2012a,b), selected an 8-year acquisition cycle for the respective quality levels. 3DEP, managed by the U.S. Geological Survey (USGS), the Office of Management and Budget Circular A–16 lead agency for terrestrial elevation data, responds to the growing need for high-quality topographic data and a wide range of other 3D representations of the Nation's natural and constructed features.

3DEP in Alabama by the Numbers

Expected annual benefits	$20.61 million
Estimated total cost	$17.29 million
Payback	0.8 years
Quality level 1 buy-up estimate	$11.00 million

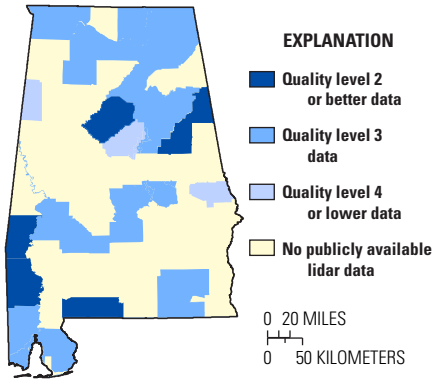

Figure 1. Map of Alabama showing the areal extent and quality levels of planned and existing publicly available light detection and ranging (lidar) data in August 2013. Quality level 2 or better lidar data meet 3DEP requirements. See table 1 for quality level information.

3D Elevation Program Benefits for Alabama

The top 10 Alabama business uses for 3D elevation data, which are based on the estimated annual conservative benefits of the 3DEP initiative, are shown in table 2. The NEEA survey respondents in the State of Alabama estimated that the national 3DEP initiative would result in at least $20.6 million in new benefits annually to the State. The cost for such a program in Alabama is approximately $17 million, resulting in a payback period of 0.8 years and a benefit/cost ratio of 9.5 to 1 over an 8-year period. Because monetary estimates were not provided for all reported benefits, the total benefits of the 3DEP to Alabama are likely much higher. On the basis of the NEEA survey results, all levels of government and many organizations in Alabama could benefit from access to statewide high-resolution elevation data.

For Alabama, approximately 73 percent of the identified business use requirements will be met primarily in flood risk management; infrastructure and construction management; and wildfire management, planning, and response uses alone; as shown in table 2. The status of publicly available lidar data in Alabama is shown in figure 1. By enhancing coordination between the 3DEP and various government and private organizations in Alabama, it may be possible to realize more

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 the end of 2022, depending on funding and partnerships. 3DEP can conservatively provide new benefits of $1.2 billion/year and 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). A shared, common elevation dataset would foster cooperation and improve decision-making among all levels of government and other stakeholders.

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.

than the cited conservative benefits and attain the higher potential benefits for many business uses.

The following examples highlight how 3DEP data can support business uses in Alabama: (1) The availability of more accurate statewide elevation data would reduce onsite data-collection costs and the amount of time required to complete some phases of a flood risk project. The quality of analyses and study results would be improved as a result of the more accurate elevation data. Comprehensive lidar coverage enables detailed modeling of the overflow from streams and other water bodies as a result of large storm events and Gulf coast overland storm surges. With an enhanced ability to predict surface-water movement along high risk coastal areas, communities and agencies have the ability to design improved evacuation route plans (fig. 2) to better protect the public should a disaster strike. (2) Sinkholes affect much of Alabama, and relevant geospatial data are of great use. The current statewide sinkhole dataset was derived from topographic maps that have several limitations, including low resolution for elevation (based on contour interval) and age (some data are derived from maps that are decades old). Lidar provides a much more current and detailed elevation dataset, thus allowing identification of smaller and more recently developed sinkholes—valuable hazards data that could be used for infrastructure planning and developing, sinkhole mitigation, and in some cases, emergency response.

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.

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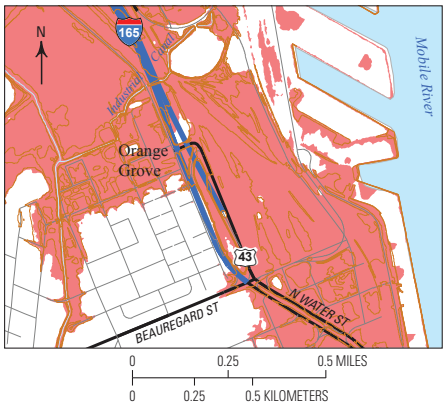

Figure 2. In the past, the City of Mobile, Alabama, determined evacuation zones solely on topographic map elevation contours. With the availability of lidar data, modeling the overflow of streams and water bodies due to flooding can be incorporated into this process. This will help to determine the most effective evacuation routes for people living in a flood prone area. The pink shading indicates flood depth of up to 8 feet. Modified from City of Mobile Geographic Information Systems Department hurricane evacuation elevation map; used with permission.

Table 2. Conservative benefits for the top 10 business uses of the proposed 3DEP data identified in the National Enhanced Elevation Assessment for Alabama (Dewberry, 2011).

Rank	Business use	Annual benefits (millions)
1	Flood risk management	$5.66
2	Infrastructure and construction management	5.63
3	Wildfire management, planning, and response	3.75
4	Natural resources conservation	1.86
5	Geologic resource assessment and hazard mitigation	1.21
6	Agriculture and precision farming	1.17
7	Water supply and quality	0.43
8	Forest resources management	0.40
9	Aviation navigation and safety	0.11
10	River and stream resource management	0.10
	Other	0.29
	Total	20.61

3D Elevation Program—Continued

The USGS and its partners will acquire quality level 2 or better (table 1) 3D 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 1) in Alaska. The data will be acquired over an 8-year period and will be made available to the public. By using this acquisition scenario, a number of high-quality elevation-data products can be created to serve a wide range of business uses in government and the private sector.

Table 1. 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 for the program from government and other stakeholders.

For Further Information

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