Lessons Learned from Delaware Lidar

Summary

Using a collaborative approach to obtain lidar data makes sense, reducing agency costs while meeting multiple needs. However, this approach is not without pitfalls, as not all data will fit everyone's needs. Trial and error has taught resource managers in the State of Delaware many valuable lessons when it comes to lidar acquisition.

The statewide lidar coverage came from two separate collection projects undertaken two years apart. At the time these data collection projects were proposed, very few people in the state had experience with lidar data or had the ability to work with extremely large data sets.

It quickly became apparent that knowing what initial users want to do with the data provides only part of the information needed. Understanding potential data uses and the requirements of the end user will help to ensure that the data maintain value by meeting present and future needs.

The availability of statewide lidar data in Delaware was seriously delayed when project participants had to integrate non-standardized data sets and formats. As a result of lessons learned during this process, any future lidar collection project in Delaware will begin by identifying common end user goals. In addition, the following measures will be taken:

- Data specifications and formats will be standardized
- The end user's technical capacity will be considered
- All deliverables will be described adequately to ensure complete delivery
- End users will review the contracts before their final acceptance

The Delaware Story

In 2005, a coalition composed of the Delaware Department of Natural Resources and Environmental Control, U.S. Department of Agriculture, and Delaware Geological Survey contracted with the U.S. Geological Survey and NASA to collect lidar for Sussex County using NASA's Experimental Advanced Airborne Research Lidar (EAARL). In 2007, the lidar for the remaining two counties, Kent and New Castle, were collected by a commercial contractor as part of the statewide orthoimagery collection project.

The need to develop digital flood insurance rate maps was the main driver for the 2005 collection effort. By partnering, the groups were able to share costs and make use of the advanced technology and information that the EAARL lidar would offer. The lidar was collected to Federal Emergency Management Agency (FEMA) standards, with the exception of breaklines (forced boundaries for areas such as water bodies, to aid in processing and interpretation). It was decided that breaklines from the

2002 othophotography project would be combined with the EAARL lidar data to meet the FEMA specifications.

In addition to the coastal hazards application, the Delaware Coastal Program hoped that the high degree of detail captured in the EAARL elevation data could be used for habitat studies or vegetation identification. This benefit, however, was not realized. NASA had developed the EAARL processing software for use in LINUX systems, but all State systems are Windows-based. Therefore, the State of Delaware did not have the proper systems or knowledge to run the EAARL processing software.

Lessons Learned

Agree on data standards. Before partners commit to project-specific deliverables, it is important to consider the various end uses and how the choices made in data processing or delivered products may limit other uses of the data. Project directors developing the contract should include users that are familiar with the capabilities of lidar, not just what has been done with elevation data in the past (topographic maps with contour lines). Parameters should be established by all data users with an eye toward potential future uses before collection and processing begins. These standards should include agreed-upon measurement units, product types, grid spacing, datum, projection, and formats.

Know the end user's technical capacity. The hardware and software capabilities of the end users should be assessed to determine appropriate tiling and file sizes. Partners completing this step will ensure a balance between larger seamless regions (such as quad, county, and state) versus smaller tiles in specific areas to minimize hardware and software needs. Differing data products (points versus digital elevation models) may also require different tiling sizes.

A common format should be used for an entire state. In this case, Sussex County was mapped with the NASA EAARL technology while the data acquisition for Kent and New Castle Counties were completed using different commercially available systems. This caused problems in merging data sets for statewide coverage and in other statewide analyses. The EAARL lidar requires specialized software and a Linux operating system to analyze raw data, while the standard lidar format, used for Kent and New Castle counties, could be analyzed with commercially available Windows-based software.

Ensure all data and products are contract deliverables. When developing a contract, ask all of the end users to review the contracts to ensure that all the desired data and products are listed as deliverables. For example, do not assume that asking for contours implies that the digital elevation models or points will also be delivered. This should include the specification of each data product in the chosen format and, if applicable, resolution.

Metadata and Quality Assurance and Quality Control. Complete and accurate metadata must also be specified with all of the deliverables, because failure to include metadata will reduce the lifespan of the data. An important, but sometimes overlooked, aspect is the quality assurance and quality control of all data sets by a separate contractor, or by the end users, before its final acceptance. Failing to review the

data set in its entirety can lead to future problems, which are much more difficult to address than when the contractor is fully engaged.

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