Institute of Educational Sciences
National Center for Education Statistics

REMOTE SENSING TO ESTIMATE K–12 PHYSICAL PLANT
NISS Expert Panel ◦ February 2020

EXECUTIVE SUMMARY

While the National Center for Education Statistics (NCES) collects annually and maintains administrative data on all K-12 schools in the United States, there is no comparable collection of information on schools' physical plant (buildings, grounds and other infrastructure necessary for each school). Yet decision-makers at all levels need this kind of information as they set policy and develop facility plans. Remote sensing imagery could provide an avenue to providing information on a national basis, identifying school buildings and estimating the usable space for teaching/learning and other school activities. NCES charged the National Institute of Statistical Sciences (NISS) with convening a panel of technical experts to consider how to respond to the need to estimate the physical plant for US K-12 schools, what role remote sensing might play, and what resources would have to be located or created to use these data efficiently.

The panel met via teleconferences with an in-person meeting at NCES on 19-20 February 2020.

The panel separated buildings used in instruction from exterior grounds, athletic facilities and parking lots for initial consideration. Staging the data base development and incorporating existing (federal, if possible) data bases would allow NCES to benefit from raw data, image data processing and calculations already developed for other purposes. LIDAR (LIght Detection And Ranging) would provide 3-dimensional rather than 2-dimensional remote sensing images. However, LIDAR research, implementation and applications are far less advanced for purposes similar to the estimation of K-12 school facilities. Therefore, the panel focused on determining the feasibility of a plan that would rely on remote sensing imagery coupled with administrative, observational and other alternative data sources for the creation and maintenance via annual updating of a record of total 2-dimensional space ("footprint") and total square footage "under roof."

A preliminary template for a data record was described that would inventory individual structures and also summarize information for each school or campus in the case of multiple schools on shared or adjoining space. A multiple stage approach was outlined for the acquisition of the remote sensing data, image creation and calculations. Requirements for a systematic updating process were sketched. The panel recognized that the diversity and level of technical skill for this project would require specialized expertise not available within NCES.

Recommendations

1.   Estimation of US K-12 physical plant to be undertaken in stages.

Stage 1 to be limited to comprehensive data for a pilot set of states with both administrative information on buildings for each school (footprint, square footage under roof) and parcel data in a usable form to be integrated with remote sensing imagery. Stage 1 to focus on definition of a data base (and associate primary data base) for two-dimensional information (footprints), and to include validation, development of diagnostics and adjustments, with a view to detection of multi-story buildings, verification and consequent adjustments.

Stage 2 to scale up to national level with incorporation of updating processes.

Stages 3 and 4 to be reconsidered with respect to efficient estimation for multi-story buildings and to available options for detection and inventory of non-structure facilities including athletic fields, playgrounds and parking lots.

2.   Maximized use of existing data bases and existing software.

In particular, the federal data base (USA Structures – being developed at Oak Ridge National Laboratory for FEMA), and data bases with parcel boundaries geo-inscribed can avoid redevelopment of software and instability of data sources over time.

3.   Annual updating including auxiliary information.

A formal system for updating on an annual basis to be built, independent of remote sensing, to reflect changes in school facilities between revisions to remote sensing imagery data.

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