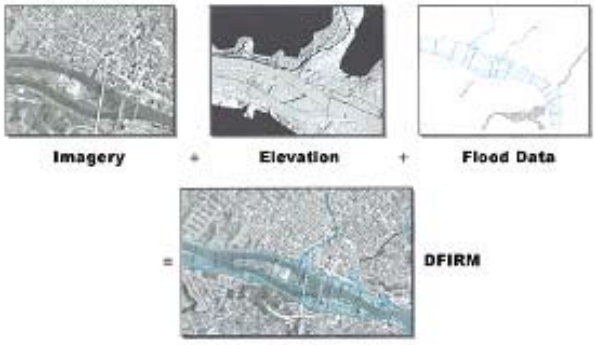

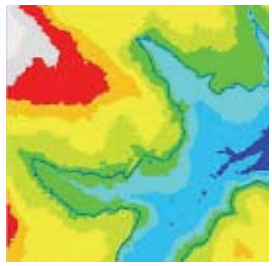

FEMA's Flood Mapping

—Jennifer Walsh and Luwam Yeibio, Office of News and Public Information, Academy of Sciences

Significant loss of life, destroyed property and businesses, and repairs to infrastructure could be avoided by replacing Federal Emergency Management Agency flood maps with ones that contain high-accuracy and high-resolution land surface elevation data, says a new report from the National Research Council. The benefits of more accurate flood maps will outweigh the costs, mainly because insurance premiums and building restrictions would better match the actual flood risks. Coastal region flood maps could also be improved by updating current models and using two-dimensional storm surge and wave models.

Flood maps are used by FEMA to set flood insurance rates, regulate floodplain development, and inform those who live in the "100-year" floodplain of potential hazards, and they require continuous maintenance and revision due to land development and natural changes to the landscape. FEMA's Map Modernization Program of 2003 to 2008 resulted in digital flood maps for 92 percent of the continental U.S. population, most of whom live in areas that had outdated maps or no maps at all. However, after a $1 billion investment, only 21 percent of the population have maps that meet all of FEMA's data quality standards.

For this reason, FEMA and the National Oceanic and Atmospheric Administration asked the Research Council to examine the factors that affect flood map accuracy; assess the costs and benefits of producing more accurate maps; and recommend ways to improve mapping, communication, and management of flood-related data. In response, the committee that wrote the report collected and analyzed information on selected streams in Florida and North Carolina and on the economic costs and benefits of creating new digital flood maps in North Carolina. Information from the North Carolina Floodplain Mapping Program, which has high-accuracy topographic data and maps for nearly the entire state, allowed the committee to compare new and traditional mapping methods among three distinct topographical regions: mountains, rolling hills, and coastal plains.

The costs for improving flood maps would come from collecting, updating, modeling, and analyzing the flood-related data; increasing construction of property and businesses; losing land to development; updating regulations; and informing the public of changes. The committee found that these costs would be outweighed by benefits of more accurate flood maps, including reduced loss of life, property, and businesses; more efficient planning and response for emergency services; and preservation of natural functions of floodplains. In addition, better maps would provide more reliable measures of flood hazard, which would enable more targeted land-use regulations and structures to be insured at appropriate levels. Maps that include estimates of the height flood water will rise or exceed during a 100-year flood provide significantly more benefits than those that do not.

FEMA commonly produces maps using data from the U.S. Geological Survey National Elevation Dataset (NED), which is developed from airborne and land surveys. However, map accuracy would be increased by updating and generating information using high-accuracy topographic data, such as that generated by "lidar," which measures elevation using aircraft-mounted lasers, the committee said. For the three topographical regions studied, differences in ground elevation measurements by lidar and NED were about 12 feet, with the lidar heights measuring both higher and lower than the NED. These differences significantly affect predicting the extent of flooding, the committee stated. Overall, the total areas of floodplains defined from lidar and from the NED were similar in two study regions and differed in shape by 20 percent in one study region. As lidar data coverage is sparse, FEMA should increase collaboration with federal, state, and local government agencies to acquire lidar data throughout the nation.

While improvements to inland flood maps can focus on harnessing available technology, coastal flood maps could be improved by employing better models that enhance understanding of the coastal flooding process. The committee recommended improving the accuracy of base flood elevations by replacing FEMA's one-dimensional model for calculating wave heights, which was introduced in the 1970s, with a two-dimensional wave model. Further enhancements could come by coupling this with a two-dimensional surge model and including models that account for erosion processes, effects on structures, and variations in elevation.

FEMA's transition to digital flood mapping also provides opportunities for better informing the public of flood hazards and risks through maps and Web-based products, the committee noted. To adequately convey risk, the maps and products must show where the flood hazard areas are located and the likely consequences of flooding, such as damage to houses or coastal erosion. Additionally, floodplain residents should know how their land elevation level compares with various possible flood heights, which will offer a finer discrimination of potential risk. Currently, maps that show only floodplain boundaries imply that every building in a designated flood zone may flood and every building outside the zone is safe.