

THE 2010 JAPANESE TSUNAMI: MIYAGI POPULATION AFFECTED

BACKGROUND

In the early afternoon of Friday, March 11, 2011 a magnitude 9.0 earthquake, the biggest ever on record in Japan, struck 120 km off the northeast coast. A devastating 10-meter tsunami was triggered, causing widespread destruction along the northeastern coast of Japan, and reaching as high as 5 km inland. The city of Sendai, with a population of over 1 million, was one of the hardest hit areas.

OBJECTIVE

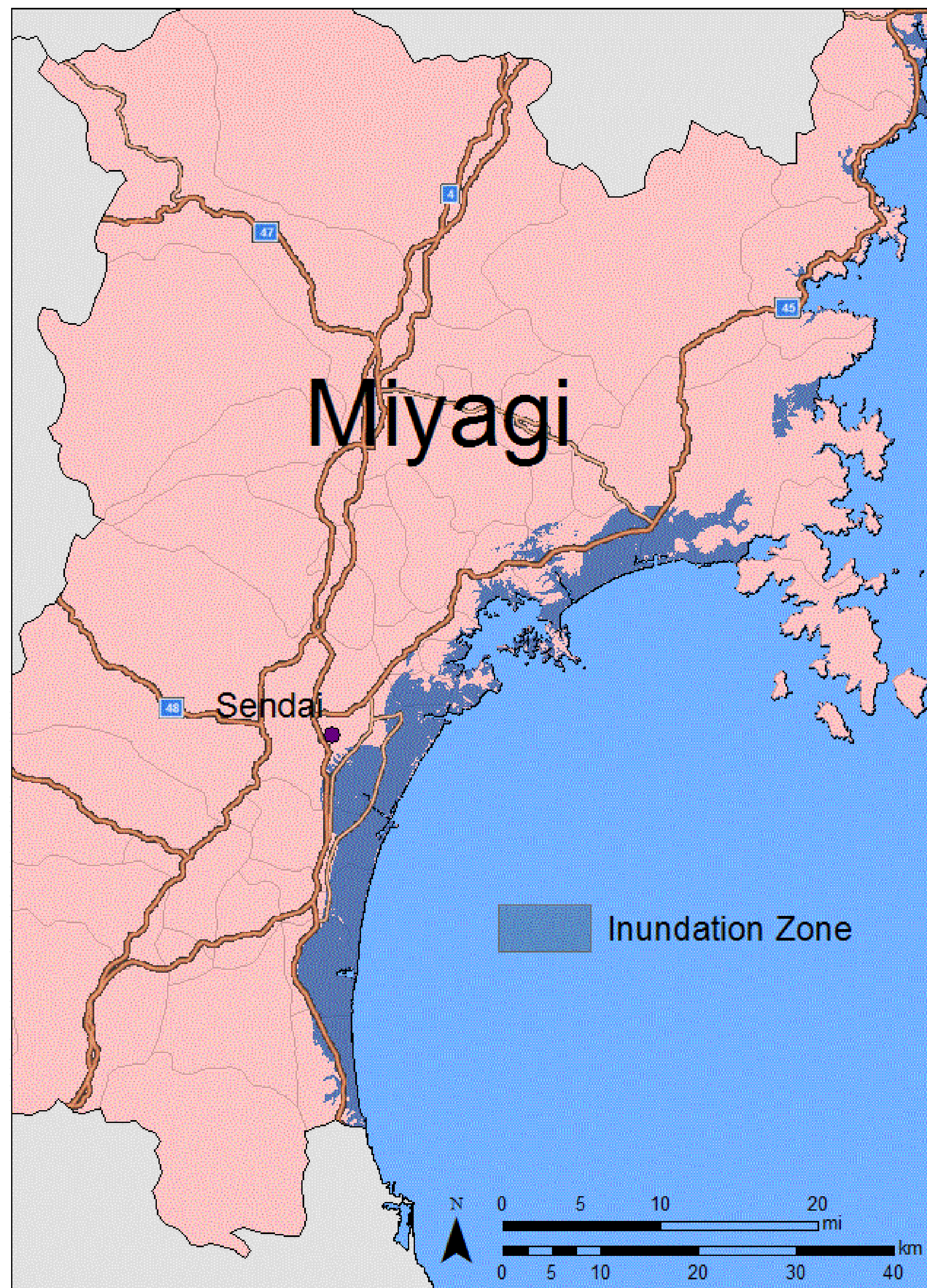
This poster represents a rapid assessment that would take place within days of a disaster in order to inform decision makers and relief workers. The analysis attempts to answer the questions "Which areas were affected by the tsunami, and how many people were in those areas?" for Miyagi Prefecture. For the purpose of this analysis, "population affected" refers to anyone living in the areas where the tsunami came on shore. Some people will invariably be affected much worse than others. This includes both those who died and those who may have only had a few inches of water in their yard. This serves as a starting point for a various needs assessments in the sectors of food, water, nutrition, health, infrastructure, shelter, protection, agriculture, etc.



New York Times Imagery; Before and After

METHODS

Two key assumptions were made based on UN OCHA reports immediately following the tsunami: the maximum wave height was 10 meters, and the furthest inland that the tsunami extended was 5 kilometers. Thus, the inundation zone was defined as the area that was both within 5 kilometers of the coastline and less than 10 meters in elevation.



Inundation Zone in Miyagi Prefecture

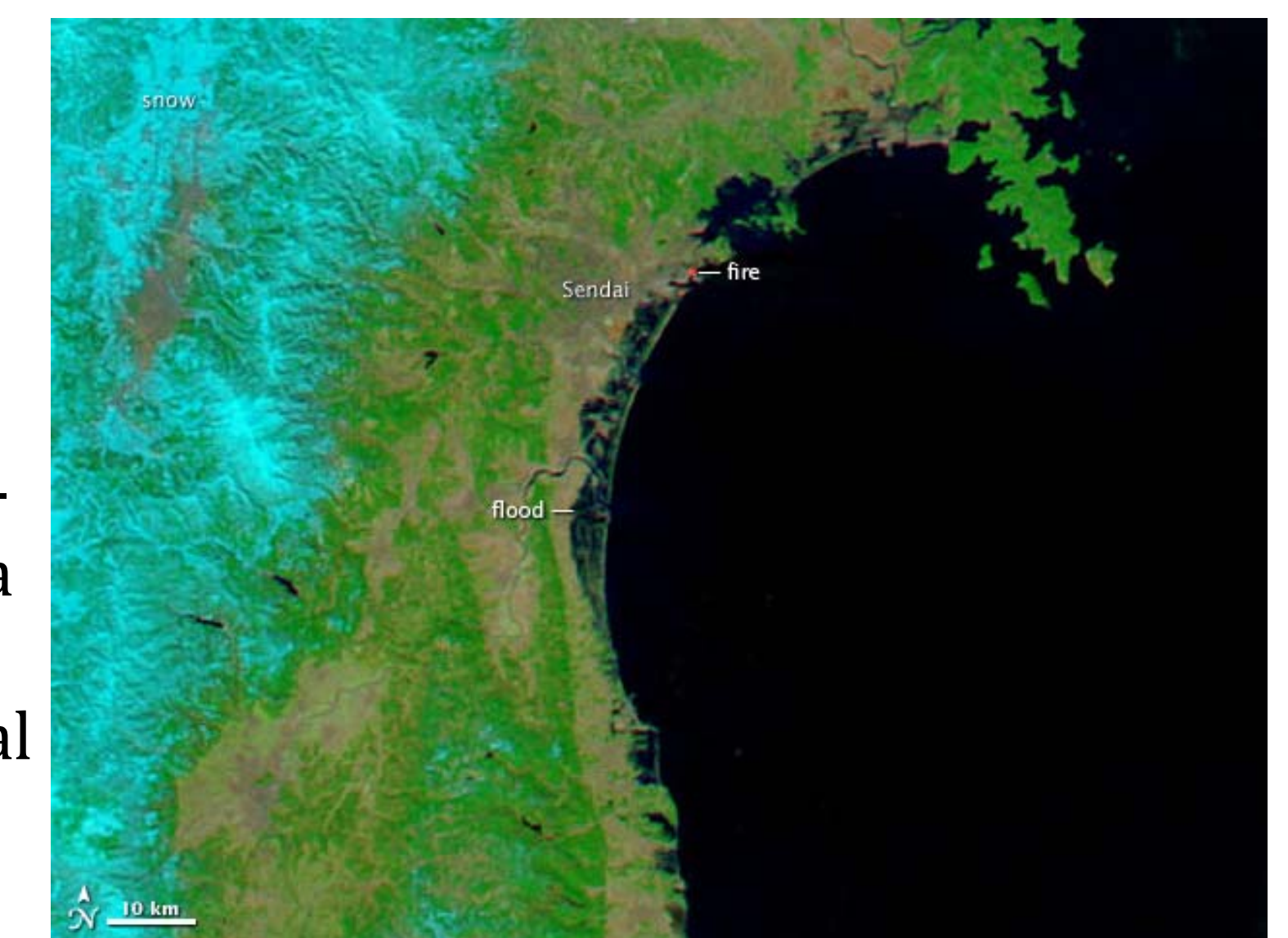
Raster elevation tiles along the northeastern coast of Japan were downloaded and mosaicked together in ArcMap. Next, this elevation data was reclassified into two groups: land less than or equal to 10 meters in elevation was assigned a 1 and land greater than 10 meters was assigned a zero.

Next, given the assumption that the tsunami extended inland a maximum of 5 kilometers, a 5-km buffer from the Miyagi coastline was created.

To create the inundation zone from these two layers, the reclassified elevation data was extracted from the buffer area. In other words, a new layer was created that showed the reclassified elevation that fell only within 5 kilometers of shore.

It became visible to the eye which areas were inundated by the tsunami.

Following this, gridded population data was added to the project, and a spatial overlay was completed. The raster calculator was used to multiply the inun-

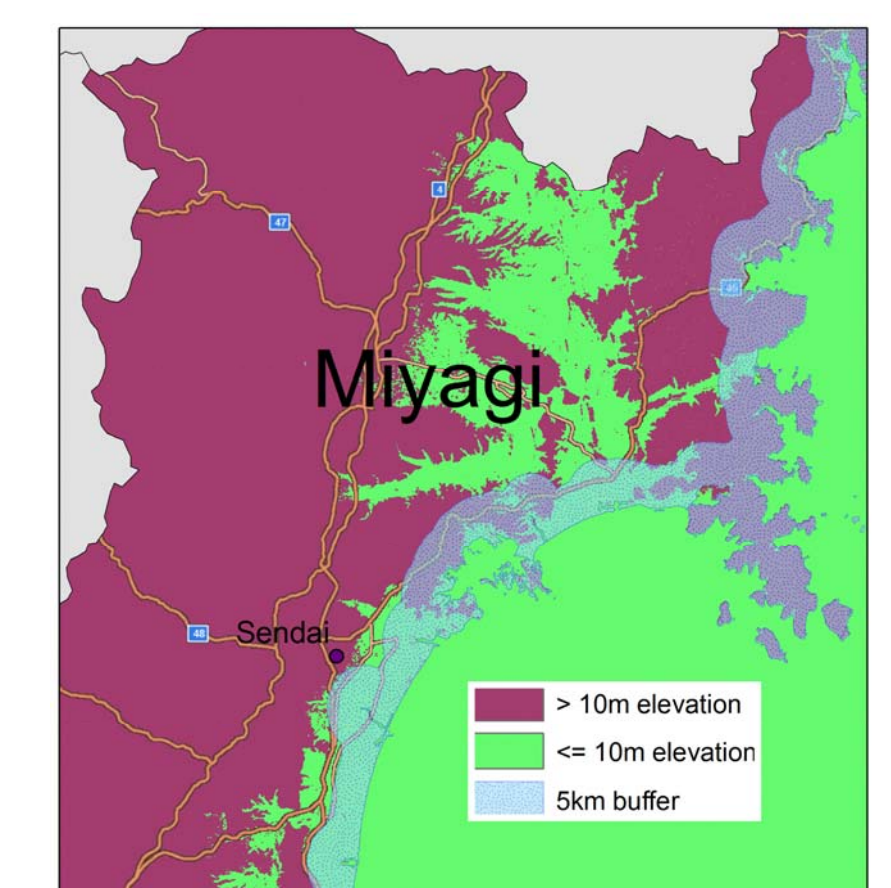


Satellite Imagery of Inundation Zone

Total Population Affected in Miyagi Prefecture

1,314,240

ation zone by the population data in order to determine the number of people in the zone. This is where the elevation zeros and ones came in. For each grid, either a zero or a one was multiplied by the population in that grid. If the elevation of the piece of land in a given grid was less than or equal to 10 meters, then the population in that grid was multiplied by one, thus counting the population. If the elevation was greater than 10 meters, then the population was not counted because it was multiplied by zero. All of the population in the inundation zone was summed, yielding the total number of people affected, in one way or the other, by the tsunami.



Elevation Reclassify

LIMITATIONS

Due to the assumptions made about tsunami height and reach, the inundation zone modeled may not represent reality. However, in comparing to satellite imagery, it comes close. Further, the GPWv3 data is from 2005, which may not be representative of the current population. Also, population data disaggregated at the district level could have been useful in deciding how relief funds are allocated. Also, it would be helpful to have a count of vulnerable persons (those who have a relatively limited ability to cope with a hazard), such as those over the age of 65 and young children.

Data Sources:
 Elevation: ASTER GDEM
 Administrative: GADM
 Population: GPWv3
 Cartographer: Andrew Kennedy
 NUTR302
 Date: May 3, 2011
 Map Projection: UTM 54N

