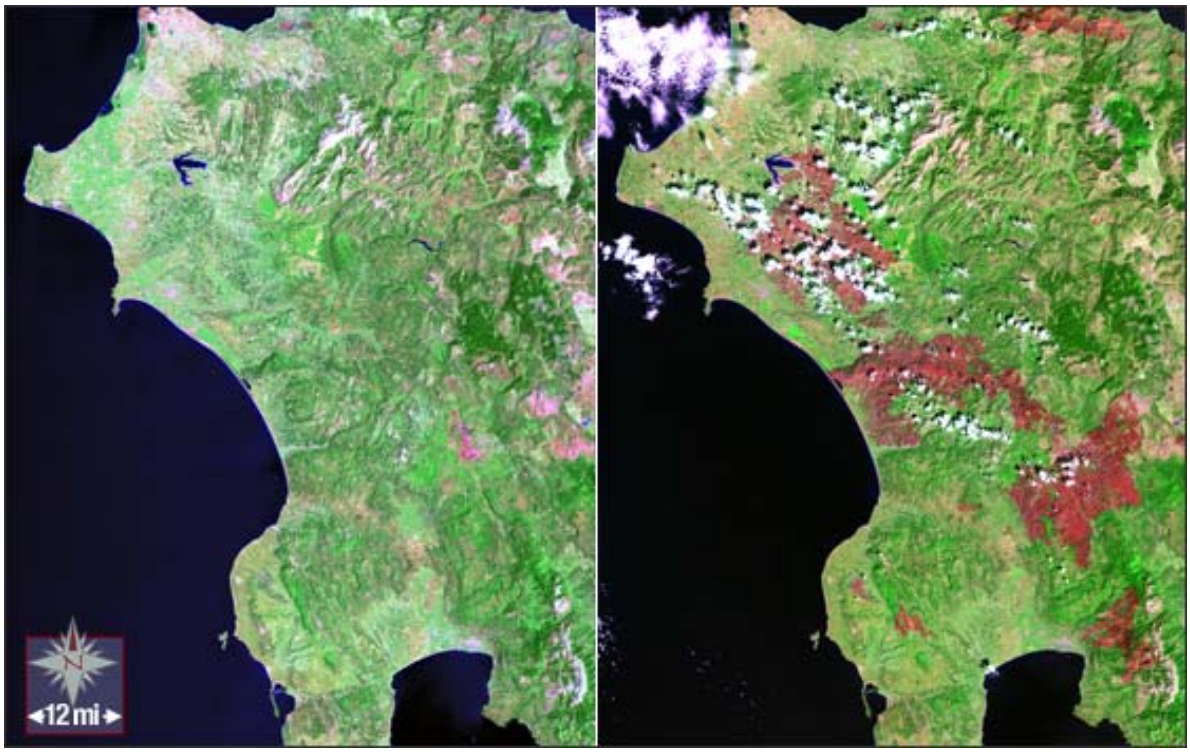
Estimating Biomass Loss from a Large Fire



The fires in Greece during the summer of 2007 devastated large tracks of forest and ground cover in this Mediterranean region. These before (left) and after (right) images were taken on July 18 and September 4 by Landsat-7. The red areas show the extent of the biomass loss from the fires.

Problem 1 - Using a metric ruler, and the conversion 1 mile = 1.61 kilometers, what is the scale of the image in meters per millimeter?

Problem 2 - About what is the total area, in square-kilometers, of this photo of Greece and its surroundings?

Problem 3 - About what was the land area, in square-kilometers, that was burned?

Problem 4 - What percentage of the total area was lost to the fires?

Problem 5 - Suppose that a typical forest in this region contains about 5.0 kilograms of biomass per square meter. How many metric tons of biomass were lost during the fires?

Answer Key

Problem 1 - Answer: The legend on the lower right indicates that 12 miles = 12 millimeters, so in kilometers this becomes 19.4 km /12mm = 1.6 km/mm

Problem 2 - Answer: The field on the right measures 78mm x 98mm = 125 km x 157 km = 19,700 km^2.

Problem 3 - Answer. To estimate the area of irregular regions, divide the image into a suitable number of smaller squares, for example, 5mm on a side (= 8 km on a side or an area of 64 km^2) as shown in the figure below. The full area has 13 squares across and 19 squares vertically, for a total of 247 cells and a total area of 16,000 km^2. Because the drawn cells are slightly irregular, we can re-calculate their average area as 19,700 km^2/247 cells = 80 km^2. The land area is covered by 173 cells for a total area of 173 x 80 = 13,800 km^2. The red areas that were burned total about 30 cells or 2,400 km^2. Students answers will vary depending on how they counted the cells. Students may combine their counts and average them to get a more accurate estimate.

Problem 4 - Answer: 100% x 2400/13800 = 17%

Problem 5 - Answer: 5.0 kg/m^2 x (1,000,000 m^2/km^2) x 2,400 km^2 = 12 billion kg or 12 million metric tons.