The Advanced Land Imager (ALI) on NASA's Earth Observing-1 (EO-1) satellite captured this true-color image on February 15, 2010. A network of bright rectangles of varying shades of green contrasts with surroundings of gray, beige, tan, and rust typical of the arid conditions prevailing in Namibia. The Orange River serves as part of the border between Namibia and the Republic of South Africa. Along the banks of this river, roughly 100 kilometers (60 miles) inland from where the river empties into the Atlantic Ocean, irrigation projects take advantage of water from the river and soils from the floodplains to grow produce, mostly grapes, turning parts of a normally earth-toned landscape emerald green. (North is indicated by arrow)

Problem 1 - Assume that each one of the square cultivated areas is about 300 meters on a side. How large is a single cultivated area in square meters and in acres? (Note: 1 acre = 4,047 square meters)

Problem 2 - What is the total area under cultivation in this region in square kilometers and in acres?

Problem 3 - If a single grape plant covers 4 square meter of land and requires about 5 gallons of water per day, how many grape plants are being supported in this cultivated area, and how many gallons of water per day do they require from the Orange River?

Problem 1 - Each one of the square cultivated areas is about 300 meters on a side. What is the total area of a single cultivated area in square meters and in acres if 1 acre equals 4,047 square meters?

Answer: Since each plot of land is assumed to be square, the area of a single plot is just A = (300 m) x (300 m) = **90,000 square meters**. Then since 1 acre equals 4,067 square meters, we have:

90,000 meters^2 x (1 acre / 4,067 m^2) = **22.1 acres**.

Problem 2 - What is the total area under cultivation in this region in square kilometers and in acres?

Answer: Carefully count the number of green squares in the picture. Count the partial square areas as best as possible. Answers should be near 103. Then multiply by the area of one square determined from Problem 1 to get A = 90,000 m^2 x (103) = 9.3 million square meters. In terms of square kilometers, 1 km^2 = 1 million square meters, so the area is **9.3 km^2**.

In terms of acres, 22.1 acres/square x (103 squares) = **2276.3 acres**. To three significant figures, the answer is also **2280 acres**.

Problem 3 - If a single grape plant covers 4 square meter of land and requires about 5 gallons of water per day, how many grape plants are being supported in this cultivated area, and how many gallons of water per day do they require from the Orange River?

Answer: The total cultivated area is 9.3 million square meters, which represents about N = 9.3 million meters^2 x (1 plant/4 meters^2) = 2.3 million plants. Since each plant requires 5 gallons per day, the total daily irrigation draw from the Orange River would be about 2.3 million plants x (5 gallons / 1 plant) = **11.5 million gallons per day.**