



The concentration of carbon dioxide in the atmosphere is a balance between processes that produce it such as burning fossil fuels, human respiration and forest fires, and processes that remove it (called sequestration) such as burying dead leaves and plant respiration.

The picture shows a plot of landscape measuring 1 kilometer on a side. The green trees sequester carbon dioxide at a rate of 1 ton per acre per year. The bare land sequesters it at a rate of 0.2 tons per acre per year.

Problem 1 - Estimate the size of the forested (dark green) area of the picture in square kilometers. If 1 acre is equal to 0.004 square kilometers. How many acres are forested in this picture?

Problem 2 - Estimate the size of the de-forested, bare area of the picture in square kilometers. How many acres have been de-forested in this picture?

Problem 3 - What is the total rate of carbon dioxide sequestration in this particular area in terms of tons per year?

Problem 4 - A typical American home produces about 10 tons of carbon dioxide per year. What is the net production of carbon dioxide from the area shown in this photograph including the impact of the one house?

Problem 5 - The home owner who owns the above property, and the single house shown in the photograph, decides to sell the de-forested area to a developer who builds 50 houses. What is the net carbon dioxide rate?

Problem 1 - Estimate the size of the green area of the picture in square kilometers .If 1 acre is equal to 0.004 square kilometers. How many acres are forested in this picture?

Answer: For an accurate value, students may grid the picture into smaller squares, count the squares, and multiply by the area of a grid square to determine the total area of the irregular region in green. They may also estimate that $\frac{2}{3}$ of the area is covered in green so the forested area is about $\frac{2}{3}$ square km. This equals $0.66/0.004 = 165$ acres.

Problem 2 - Estimate the size of the de-forested, bare area of the picture in square kilometers. How many acres have been de-forested in this picture? Answer: Students may estimate that about $\frac{1}{3}$ of the picture is de-forested, so this equals 0.33 square kilometers or $0.33/0.004 = 83$ acres.

Problem 3 - What is the total rate of carbon dioxide sequestration in this particular area in terms of tons per year?

Answer: The forest removes 1 ton per acre per year $\times 165$ acres = 165 tons per year. The de-forested area sequesters 0.2 tons/acre/year $\times 80$ acres = 16 tons/year, so the total rate is $165+16 = 181$ tons/year.

Problem 4 - A typical American home produces about 10 tons of carbon dioxide per year. What is the net production of carbon dioxide from the area shown in this photograph including the impact of the one house? Answer: In this case, with only one house per square kilometer, the net rate is 181 tons/year - 10 tons/year = 171 tons/year sequestered.

Problem 5 - The home owner who owns the above property, and the single house shown in the photograph, decides to sell the de-forested area to a developer who builds 50 houses. What is the net carbon dioxide rate?

Answer: The deforested land no longer sequesters any carbon dioxide because it has been paved over, so the net sequestration rate is from the forested area only and is 181 tons/year. The 51 houses and families that now occupy this land each produce 10 tons of carbon dioxide each year, so the total production rate from the houses is $51 \times 10 = 510$ tons/year. The net carbon dioxide rate is 510 tons/year - 181 tons/year = 329 tons per year, which goes into the atmosphere.