

(a) After months of careful study of all available data I published an estimate in *Scientific American* (April, 1958) that the net annual production of plant material for the earth amounts to 5×10^{17} kilocalories. This corresponds to the annual release of 1.43×10^{17} grams of oxygen. Since then a number of leading students of the subject have told me that they are convinced this is the correct figure, so I'm quite satisfied with this.

(b) The surface area of the earth is $510,101 \times 10^3 \text{ KM}^2$. Thus the 1.43×10^{17} grams of oxygen is produced on $5.1 \times 10^8 \text{ KM}^2$ or an average of 2.8×10^8 grams per square kilometer.

(c) The area of the 48 coterminous United States is $9,363,389 \text{ KM}^2$. This includes our deserts, cities, mountains, etc. It is more productive of plant life than many parts of the world but much less productive than tropical forests or large areas of the sea. If we assume it to be average for the world it would annually produce 2.62×10^{15} grams of oxygen.

(d) The 1966 U.S. petroleum production corrected for imports and exports amounted to 3,628,366,000 barrels of 42 gallons each. We assume a specific gravity of 0.9. This amounts to 5.19×10^{14} grams. Following a petroleum chemist, I take its average composition to correspond to the empirical formula C_7H_{12} (this assumption can be varied widely without noticeably affecting the result). I assume it to be completely oxidized to carbon dioxide and water (this is fair enough because the unburned hydrocarbons spilled and emitted to the atmosphere are eventually oxidized). This oxidation would consume 1.73×10^{15} grams of oxygen.

(e) I (arbitrarily) lump coal and peat together and find for the 1966 U.S. production, corrected for exports, 4.24×10^8 tons or 3.85×10^{14} grams. Assuming 10 percent to be non-combustible and to remain as ash, this gives 3.46×10^{14} grams oxidized annually. Let's assume its composition to be CH (again, the conclusion is insensitive to wide variations in this assumption). This would consume about 1.08×10^{15} grams of oxygen.

(f) For natural gas our 1966 production was 17,116,826 million cubic feet or 3.66×10^{14} grams. We can with negligible error take this to be entirely methane (CH_4). Its complete combustion would consume 1.46×10^{15} grams of oxygen.

(g) For the natural gas liquids our 1966 production was 19,682,722 thousand gallons or 3.66×10^{14} grams. Taking the average composition as C_4H_{10} (again insensitive to variations), its combustion would consume 1.73×10^{14} grams of oxygen.

If we add together these four figures for oxygen consumed we get 4.46×10^{15} grams per year which is 170% of the 2.62×10^{15} grams produced by photosynthesis, indicating that we are vitally dependent on oxygen brought in from outside the coterminous United States by atmospheric circulation.

You asked about the land area of the U.S. occupied by urban society. According to the 1967 H.E.W. Task Force report (A Strategy for a Liveable Environment—"the Linton report" p. 18): "Today, there are 140,000,000 people living on 35,000 square miles of land." This is just about 1% of the total area of the coterminous states including bodies of water.