

ESA 21: Environmental Science Activities

Activity Sheet
Trees and Carbon

Name:

Professor:

Using the equation and the table of data below, calculate the aboveground biomass of the trees in the three sites sampled. The first value has been provided.

$$\log_{10}M = -1.25 + 2.66 \log_{10}D$$

Site #1			Site #2			Site #3		
Tree	Diameter (cm)	Biomass (kg)	Tree	Diameter (cm)	Biomass (kg)	Tree	Diameter (cm)	Biomass (kg)
Pine	22	209	Pine	11		Pine	36	
Pine	16		Pine	35		Pine	21	
Pine	29		Pine	39		Pine	23	
Pine	24		Pine	7		Pine	31	
Pine	32		Pine	9		Pine	25	
Pine	12		Sweet Gum	8		Pine	12	
Pine	43		Sweet Gum	17		Pine	22	
Pine	28		Sweet Gum	5		Pine	25	
Pine	39		Sweet Gum	12		Pine	17	
Sweet Gum	7		Dogwood	7		Sweet Gum	15	
Sweet Gum	3		Dogwood	5		Sweet Gum	11	
Sweet Gum	21		Dogwood	11		Sweet Gum	9	
Dogwood	3		Dogwood	7		Sweet Gum	38	
Dogwood	8		Hickory	11		Dogwood	17	
Birch	7		Hickory	6		Hickory	12	
Birch	4		Hickory	8		Hickory	5	
			Birch	3		Birch	2	
			Maple	4		Birch	2	
						Birch	2	
Total			Total			Total		

VERSION 1

Calculations:

(a.) Calculate the mean biomass per 100 m² for the three plots _____ kg/100 m²

(b.) Convert biomass per m² to biomass per acre. Since 1 acre = _____ kg/acre
4047 m², multiply the mean biomass per 100 m² by 40.47.

(c.) To calculate the amount of carbon stored in the plant tissues, _____ kg C/acre
multiply the average biomass per acre by 0.45, since studies
have shown that about 45% of the biomass of a tree is carbon.

(d.) While carbon per acre is a useful measurement, most studies _____ kg CO₂/acre
of carbon cycling quantify carbon flux as carbon dioxide, not
carbon. To determine the amount of CO₂ that the trees removed
from the atmosphere, multiply the carbon per acre value by 3.67.
This value is the mass conversion factor for carbon to carbon
dioxide.

This is an important value, as it shows how much carbon dioxide is sequestered in an acre of forest, and how much would be released to the atmosphere if the trees from an acre were cut and then burned or allowed to decay (mulched). We will return to this value later in the module when you determine your personal CO₂ emissions from energy usage, and see how many acres of forest would be needed to “store” your carbon dioxide.

Analysis:

(a.) Let’s now calculate the amount of CO₂ that could be stored on the land occupied by your residence, if it were forested. Choose either the single-family home or apartment sections below. If neither of these categories exactly describes your residence, choose the one that is most appropriate. You will need the conversion factors for square feet and square miles to acres, so they are listed below.

1 mile² = 640 acres

1 acre = 43, 560 ft²

Single-family home:

Measure the area of your home’s lot that is not covered by large trees. If you are unsure of the size of your lot in acres, measure its length and width in feet, calculate the square footage, and convert to acres using the factor above.

Do the same for your entire subdivision. If you don’t know its total acreage, reset the odometer on your car and measure the length and width of the subdivision in miles using tenths of miles from the odometer. Multiply these values together to get the square miles, and then convert to acres using the factor above. Subdivisions are rarely square or rectangular, so you may have to make some estimations and judgment calls in this process.

Apartment complex:

Measure your apartment building's length and width in feet, calculate the square footage, and convert to acres using the factor above. Then divide this value by the number of apartments in the building to determine the each apartment's "share" of the area.

Do the same for the entire apartment complex. If you don't know its total acreage, measure it in miles (as described in section (a.) above) or feet, whichever is most appropriate. Calculate the complex's area in square miles or feet, and then convert to acres.

Using the "Carbon dioxide stored/released per acre" value from your calculations of the KSU sites, calculate the amount of CO₂ that would have been removed from the atmosphere and stored in plant tissues if your lot/apartment and subdivision/apartment complex were forested land. List your answers below.

	Single-family home		Apartment	
	Lot	Subdivision	Apartment	Complex
CO ₂ stored/released (kg/acre)				

(b.) It is estimated that the greater Atlanta area loses 50 acres of _____ kg CO₂ trees per **day** to development. If we assume that the cut trees are burned or mulched, how much CO₂ will this release into the atmosphere in a **year**?

Does this information cause you to consider buying a smaller lot for your next home? Does it change the way you would landscape your current or future home?