

CO₂ Carbon in Different Landscapes (1 of 3)

NAME:

GROUP MEMBERS:

For this worksheet, carbon emissions and sequestration will be measured in metric tons. For shorthand, metric tons are referred to as tons.

Carbon Emissions

Using the data from the Your Carbon Footprint assignment, find the average carbon emissions for your group in tons of carbon dioxide (CO₂).

 Average CO₂ emissions of group (tons/year)

1. Because most sequestration rates are calculated in terms of carbon and not in carbon dioxide, convert your tons of carbon dioxide to tons of carbon. To do this you'll use the formula below. Multiplying by 12/44 (or 0.2727) removes the weight of the two oxygen atoms (16 each) from the total weight of each carbon dioxide molecule (44).

$$\frac{\text{Average CO}_2 \text{ emissions of group (tons/year)}}{\text{Average CO}_2 \text{ emissions of group (tons/year)}} \times \frac{12}{44} = \frac{\text{Average C emissions of group (tons/year)}}{\text{Average C emissions of group (tons/year)}}$$

2. If everyone in your state acted the way you do, find the total emissions for your state. To do this, take your group's average carbon emissions and multiply by the population of that state. Your teacher will give you this information.

$$\frac{\text{Average emissions of C (tons/year)}}{\text{Average emissions of C (tons/year)}} \times \frac{\text{State population}}{\text{State population}} = \frac{\text{Total C emissions of state (tons/year)}}{\text{Total C emissions of state (tons/year)}}$$



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Carbon Sequestration

Since there are multiple land uses that can sequester carbon, you need to determine the relative abilities of each of these land uses in carbon sequestration: southern pine forest, mixed forest, cropland, grassland, and urban forest. Complete the chart below, using land area provided by your teacher.

Land Use Type	Area in State (hectares [ha], in thousands)	Multiply	Carbon Sequestration Rate (tons/ha/yr)	Equals	Amount of Carbon Sequestered (tons/yr)
Southern Pine Forest (Binford et al., 2006)		×	3.80	=	
Mixed Forest (Turner et al., 1995)		×	1.90	=	
Urban Forest (Norwak & Crane, 2002)		×	0.80	=	
Cropland (Morgan et al., 2010)		×	0.10	=	
Rangeland/Grassland (Morgan et al., 2010)		×	0.07	=	

- Total the amount of carbon that is sequestered by your state's land uses by adding the total carbon sequestered from the last column in the table.

Total C sequestered in state (tons/year)

Comparison Emissions and Sequestration

- Is there a deficit in carbon sequestration or an excess of potential in your state? To find out if your state has the ability to sequester all of the carbon that it emits on average, subtract the total carbon sequestered in step 3 from the total carbon emitted by the population in step 2.

_____ - _____ = _____

Total C emissions of state (tons/year) Total C sequestered in state (tons/year) Difference (tons/year)

- If your answer to step 4 is negative, that means that your state is not in a deficit and that on average the state has the ability to sequester all of the carbon that it emits. What factors might make a state able to sequester the carbon emitted by the population?

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3. If the answer to step 4 is positive, your state is in a deficit and cannot sequester the total carbon emitted, what could be done to increase the amount of carbon sequestered in your state?

4. If your state is in a deficit and any neighboring states are not, would you recommend that your state rely on the land uses of another state to sequester your carbon? Is it fair to the population of the other state to be responsible for your carbon emissions? Should you pay that state to sequester your carbon?

Table 1. Population and Land Use Areas for Southeastern States

States	Population ¹	Southern Pine ²	Mixed Forest ³	Cropland ⁴	Rangeland ⁴	Urban Area ⁴
	(thousands)	(in thousands of hectares)				
Alabama	4,779	3,865	5,393	1,256	1,069	461
Arkansas	2,915	2,251	5,338	3,334	1,333	238
Florida	18,801	2,993	4,025	1,117	2,249	1,640
Georgia	9,687	4,475	5,548	1,869	523	997
Kentucky	4,339	79	4,969	3,084	1,423	323
Louisiana	4,533	2,326	3,559	1,795	753	440
Mississippi	2,967	3,237	4,671	2,249	832	246
North Carolina	9,535	2,325	5,197	1,960	498	954
Oklahoma	3,751	446	4,671	5,196	7,571	298
South Carolina	4,625	2,455	2,855	810	322	498
Tennessee	6,346	379	5,263	2,436	847	645
Texas	25,145	2,144	23,118	13,806	41,171	1,880
Virginia	8,001	1,187	5,250	1,316	997	629

¹ United States Census Bureau, 2012
² United States Forest Service, 2013 (area given is longleaf/slash pine and loblolly/shortleaf pine forest types)
³ United States Forest Service, 2013 (area given is the total forestland minus the longleaf/slash pine and loblolly/shortleaf pine forest types)
⁴ United States Department of Agriculture, 2012 (land use definitions found in the Economic Research Service Glossary at <http://www.ers.usda.gov/data-products/major-land-uses/glossary.aspx>)