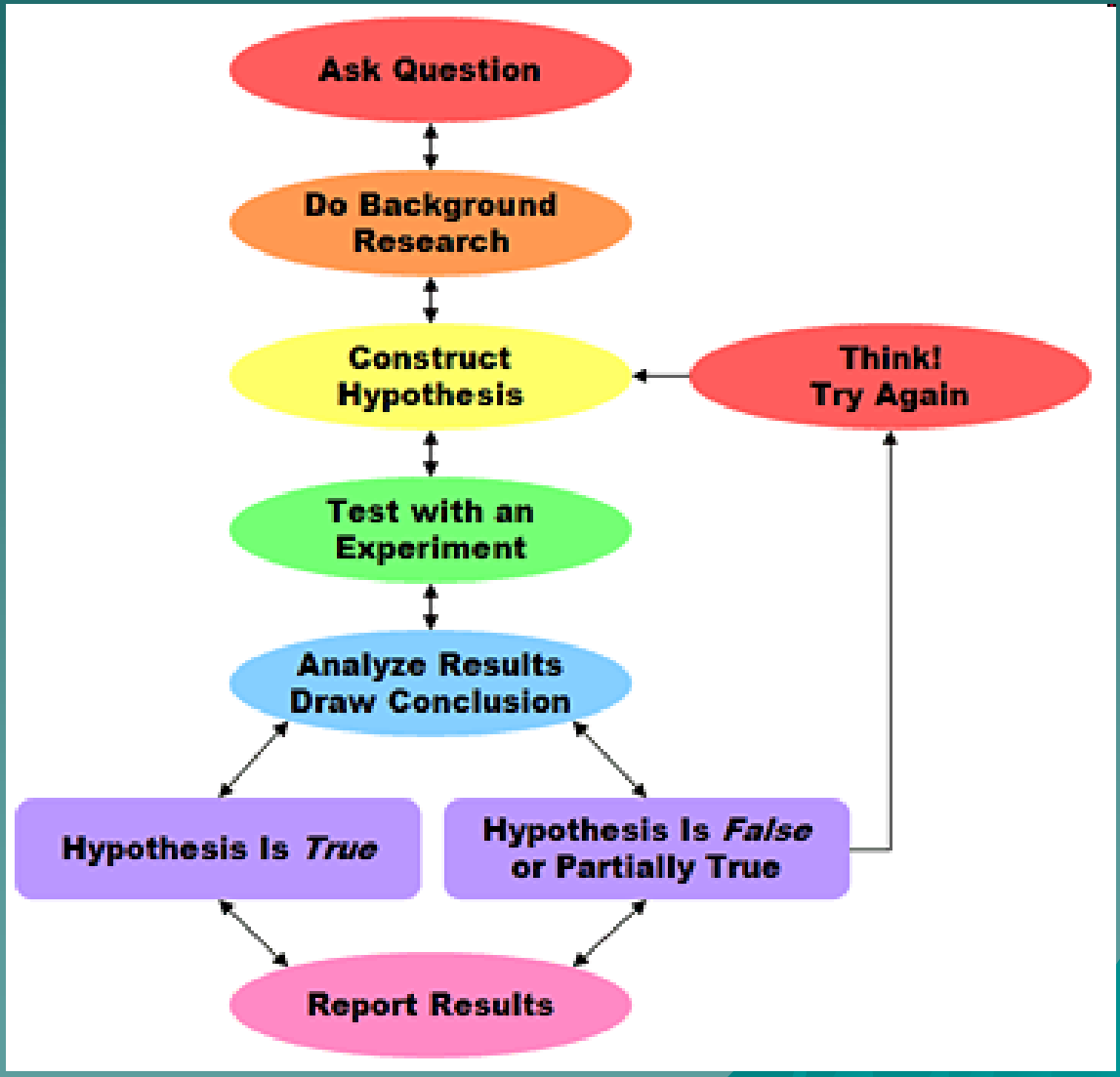
Scientific Method

How can we tell a Hard boiled egg from a raw egg without breaking them?

Activity

- The class will be broken up into groups.
- Each groups will receive 2 eggs. One is raw and the other is hard boiled. The eggs will be labeled A and B
- Within your group, you will come up with a way to figure out if the egg is cooked or raw without breaking it open, and at the end we will test your predictions by cracking the eggs.

What is the Scientific method?



Form a Hypothesis…

- Variables
  - Independent variable: What is staying the same in the expriment.
  - Dependent variable: What is affected or changed by the dependent variable.
  - What are the dependent and independent variables in your experiment?

Perform your experiment

- Now that you have formed a hypothesis, take some time to test it out.

- What are your results?

Results

- Each group will bring which egg they think is hard boiled to the front, and we will test to see if your hypothesis is correct.

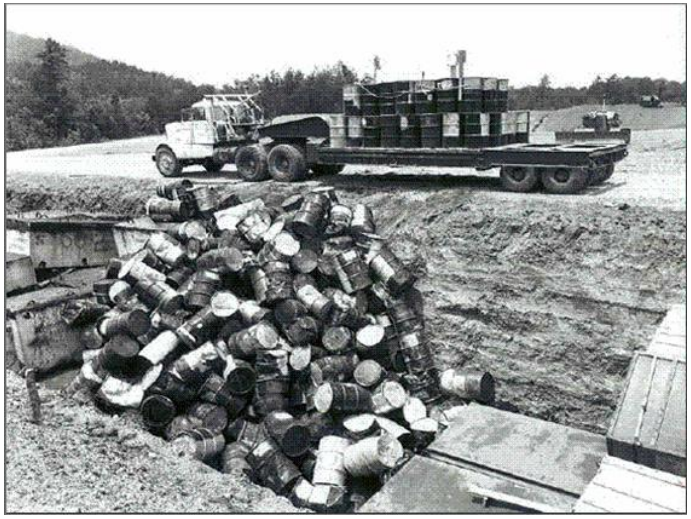
Accidents Can Happen

Bhopal, India 1984
A leak of methyl isocyanate gas and other chemicals from the plant resulted in the exposure of hundreds of thousands of people.

The **Chernobyl disaster** was a nuclear accident that occurred on 26 April 1986 at the Chernobyl Nuclear Power Plan in Ukraine. An explosion and fire released large quantities of radioactive contamination into the atmosphere, which spread over much of Western USSR and Europe.

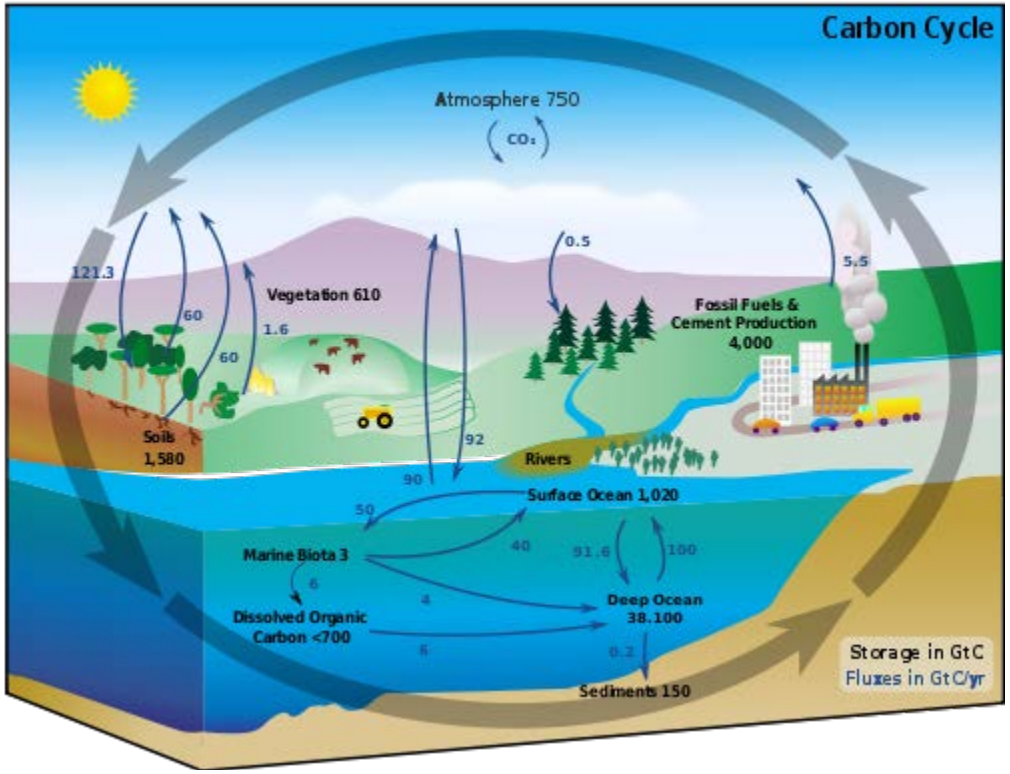
Baia Mare cyanide spilll, **2000**
leak of cyanide near Baia Mare, Romania, into the Somes River by the gold mining company Aurul.

Waste Disposal



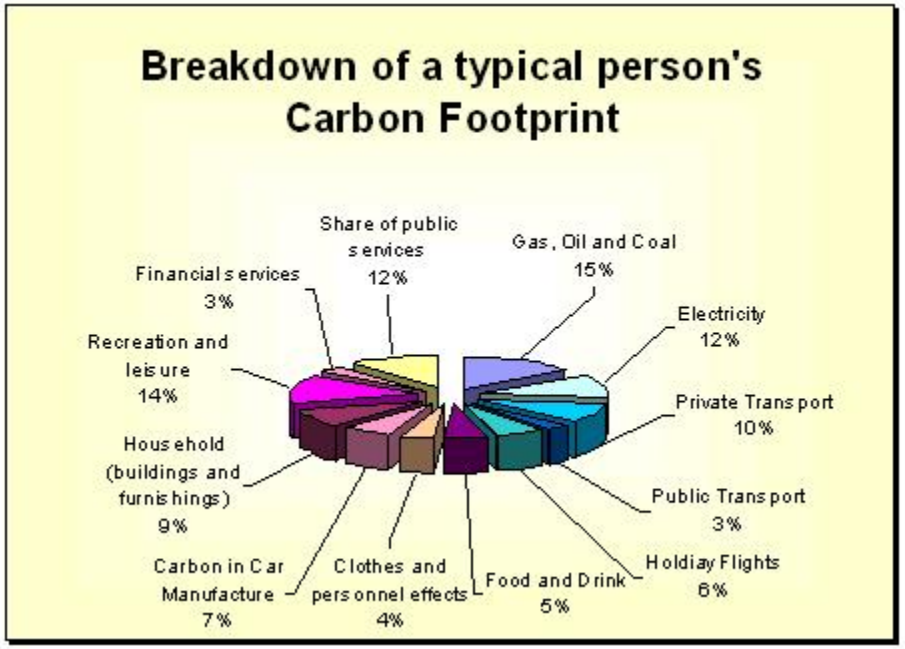
Carbon Cycle

The **carbon cycle** is the biogeochemical cycle by which carbon is exchanged among the biosphere, pedosphere, geosphere, hydrosphere and atmosphere of the Earth. It is one of the most important cycles of the earth and allows for carbon to be recycled and reused throughout the biosphere and all of its organisms



Carbon Footprint

A **carbon footprint** is "the total set of greenhouse gas (GHG) emissions caused by an organization, event, product or person."Greenhouse gases can be emitted through transport, land clearance, and the production and consumption of food, fuels, manufactured goods, materials, wood, roads, buildings, and services. It is often expressed in terms of the amount of carbon dioxide emitted.



Reducing Carbon Footprint

What are some of the possibilities to reduce everyday pollution?

Reduce, Re-Use, Recycle

Reduce

- avoid products with excessive packaging
- production of the packaging uses additional energy
- extra volume and weight will have to be transported (by lorries, aircraft, ships etc.)
- packaging will be thrown out and will need to be collected from your home by a large waste disposal truck
- packaging then takes more space at land fill sites

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Re-use

- Everyone should try and re-use products for as long as feasibly possible. It is amazing how often people buy certain products and use them only once or twice, even though they can be re-used many times. For instance can you think of some items of clothing you have worn only once?

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- Recycling uses less energy and produces less pollution than making things from scratch.
- For example:-
- Making Aluminium cans from old ones uses one twelfth of the energy to make them from raw materials.
- Making bags from recycled polythene takes one third the Sulphur Dioxide and half the Nitrous Oxide, than making them from scratch.

Reduce, Re-Use, Recycle

Give an example of everyday items that can be reduces, re-used and/or recycled?

What are the Different Types of Pollution?

Think of a way that you may be affected directly by pollution. How is this affecting you? What is the source of this pollution?

Air Pollution

- Any contamination of the Atmosphere that changes its natural Chemical composition.
- Sources include
  - Vahicle or manufacturing exhaust
  - Forest fires, volcanic eruption
  - Building contruction/demolition
  - What other sources can you think of?

Water Pollution

- This includes ANY contamination of water that changes its purity
- Sources of water pollution
  - Organic decay in water
  - Improper Waste disposal
  - Leeching of Soil pollution

Soil Pollution

- Sources include
  - Hazardous waste and sewage spill
  - Use of heavy pesticides
  - Strip Mining , Deforestation

Light Pollution

- This is in Large cities like New York, when the amount of light prevents us from seeing details of the night sky.

Noise Pollution

- Prolonged Exposure to high levels of noise can cause hearing loss
- Common sources include
  - Concerts
  - Car / Bus / Trains / Planes
  - Construction / demolition

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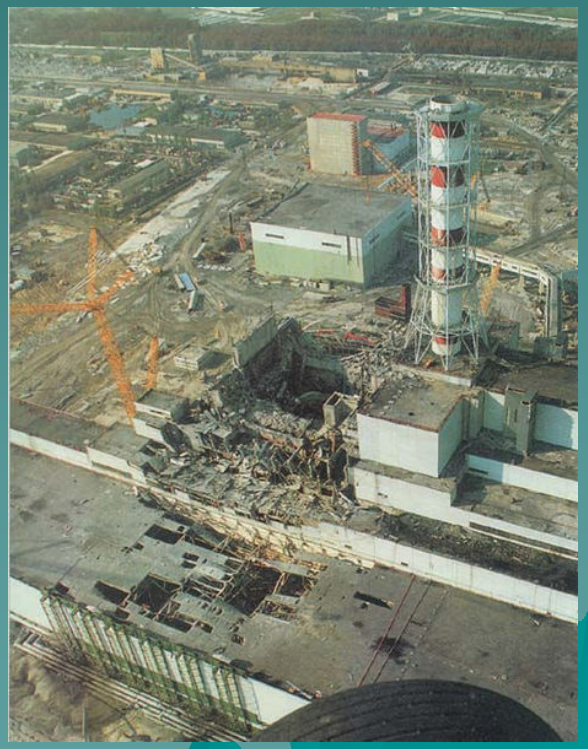

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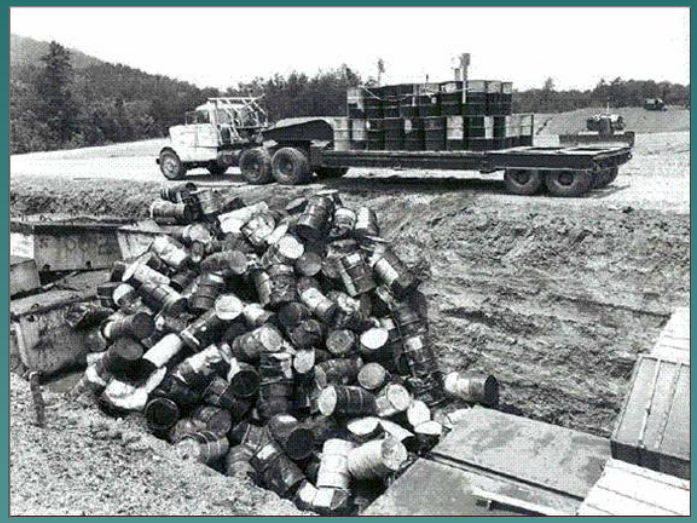

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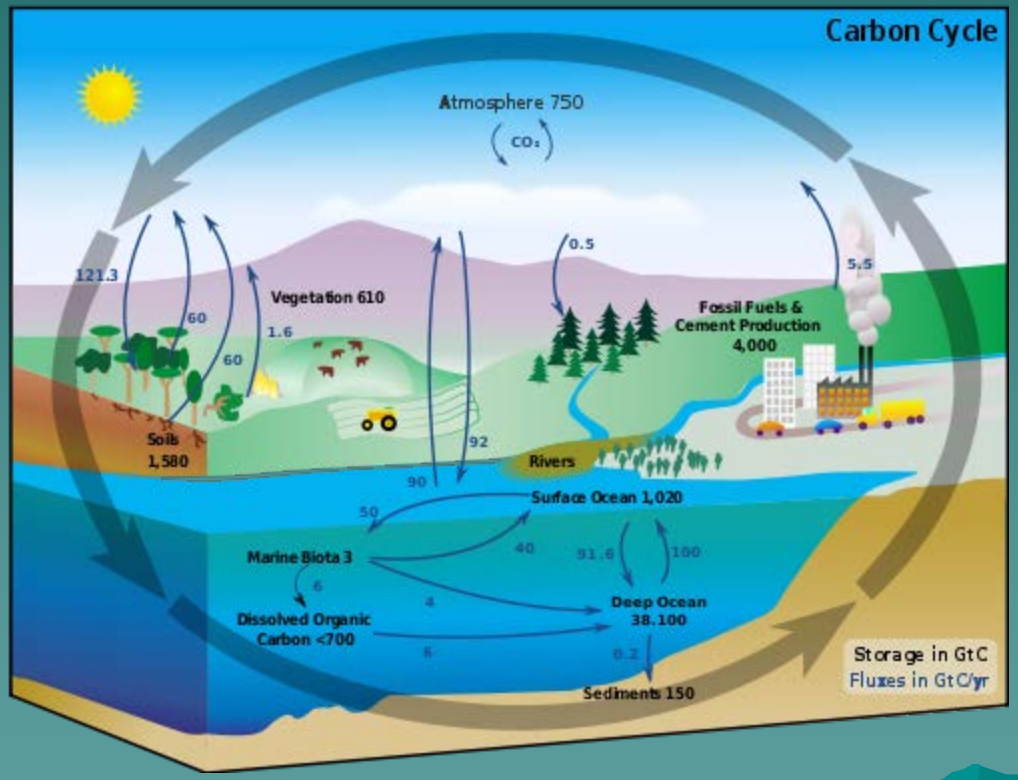

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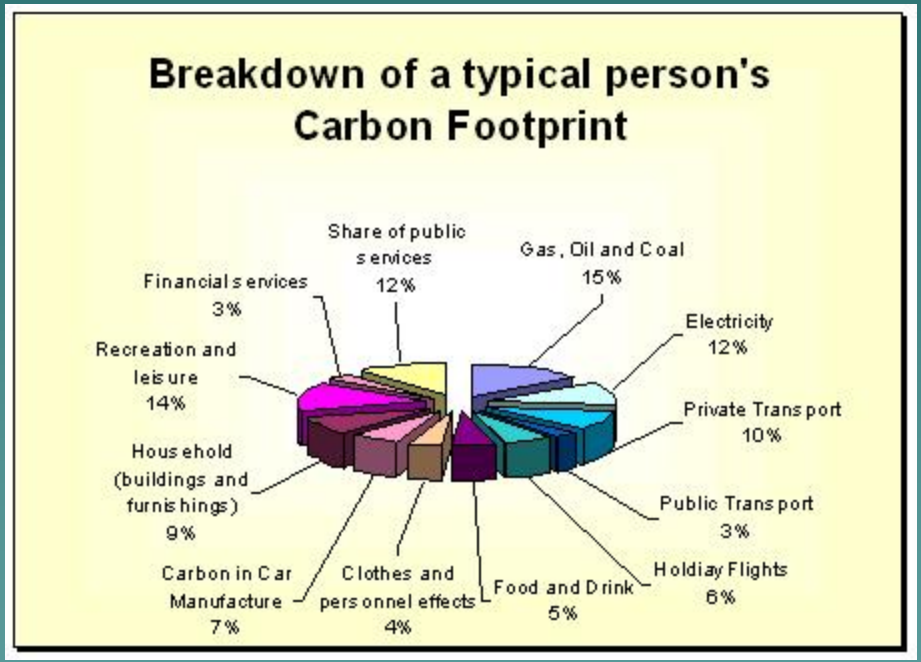

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Tree Measurements: Population Density

Photosynthesis:

- Schematic representation of the photosynthetic reaction is given by:

$$6CO_2 + 6H_2O \xrightarrow{\text{Sun}} C_6H_{12}O_6 + 6O_2$$

From the photosynthetic reaction 0.264kg of CO_2 are sequestered to produce 0.180kg of tree. The weight of the Carbon Dioxide that needs to be sequestered to produce the tree is:

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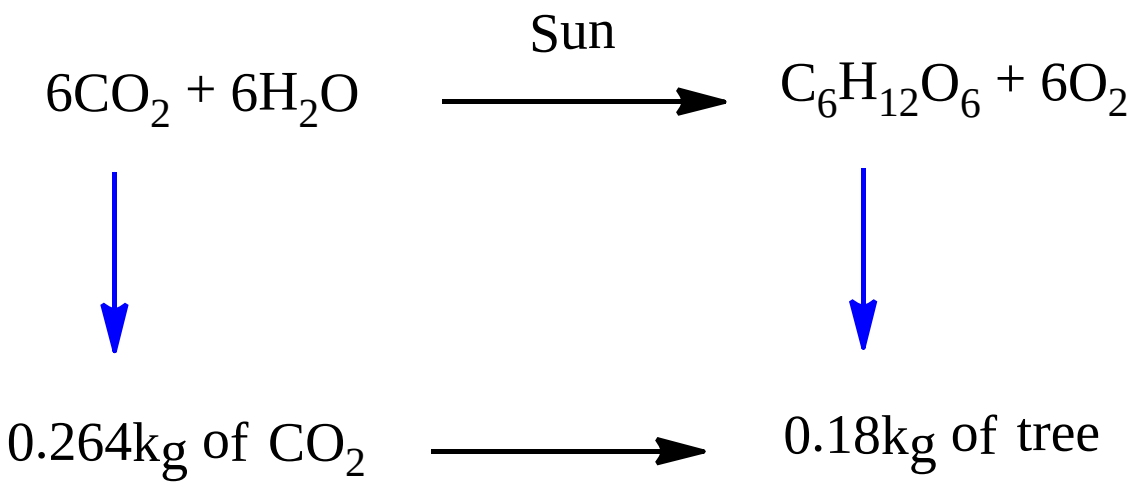

Respiration

$$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + \text{biologically stored energy}$$

Average person eats around 2000 Food Calories/ Day. Assuming that he gets all of his needed energy from eating sugar (glucose). The person will produce his needed energy through the respiration reaction. He will need 0.52kg/day to produce the energy that he needs and in the process he will release 0.7kg of CO_2/day.

Respiration

$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O$ + biologically stored energy

0.52kg of glucose $\longrightarrow$ 0.7kg of CO_2

Sources of Error

- We will be using an average of population density for the whole neighborhood and dividing it by the areas we measured trees and counted cars in to get a general estimate for the number of people.

- What are possible sources of error that we may encounter?

Mapping

Do Now: Create a map of anything you want (class room, hometown, city, etc.)

NYC Subway Map

NYC Brooklyn Bus Map

NYC Brooklyn Bus Map

Map should include the following:

-Title

NYC Brooklyn Bus Map

Map should include the following:

-Title
- **North Arrow**

NYC Brooklyn Bus Map

Map should include the following:

-Title
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- **Scale**

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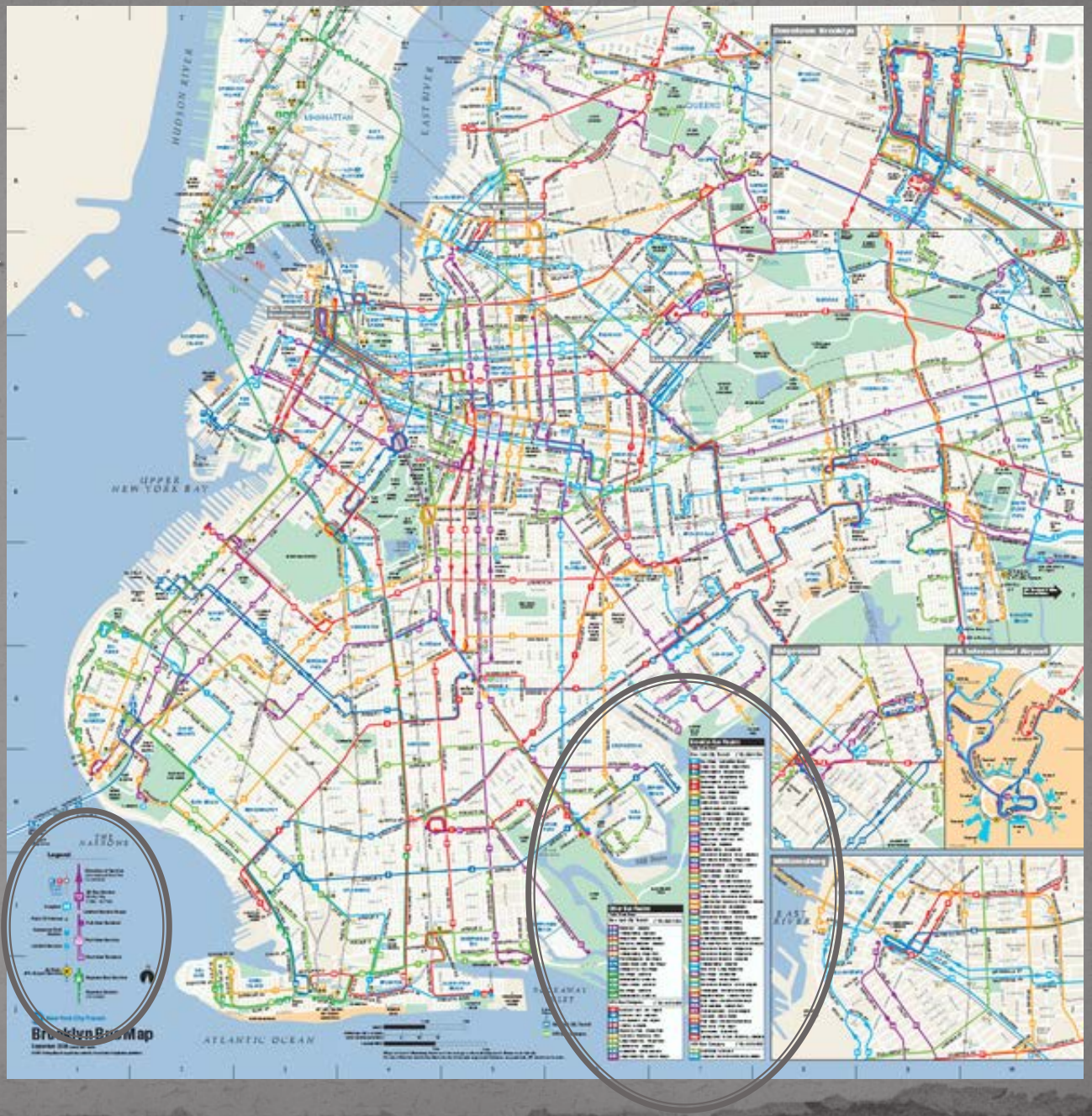
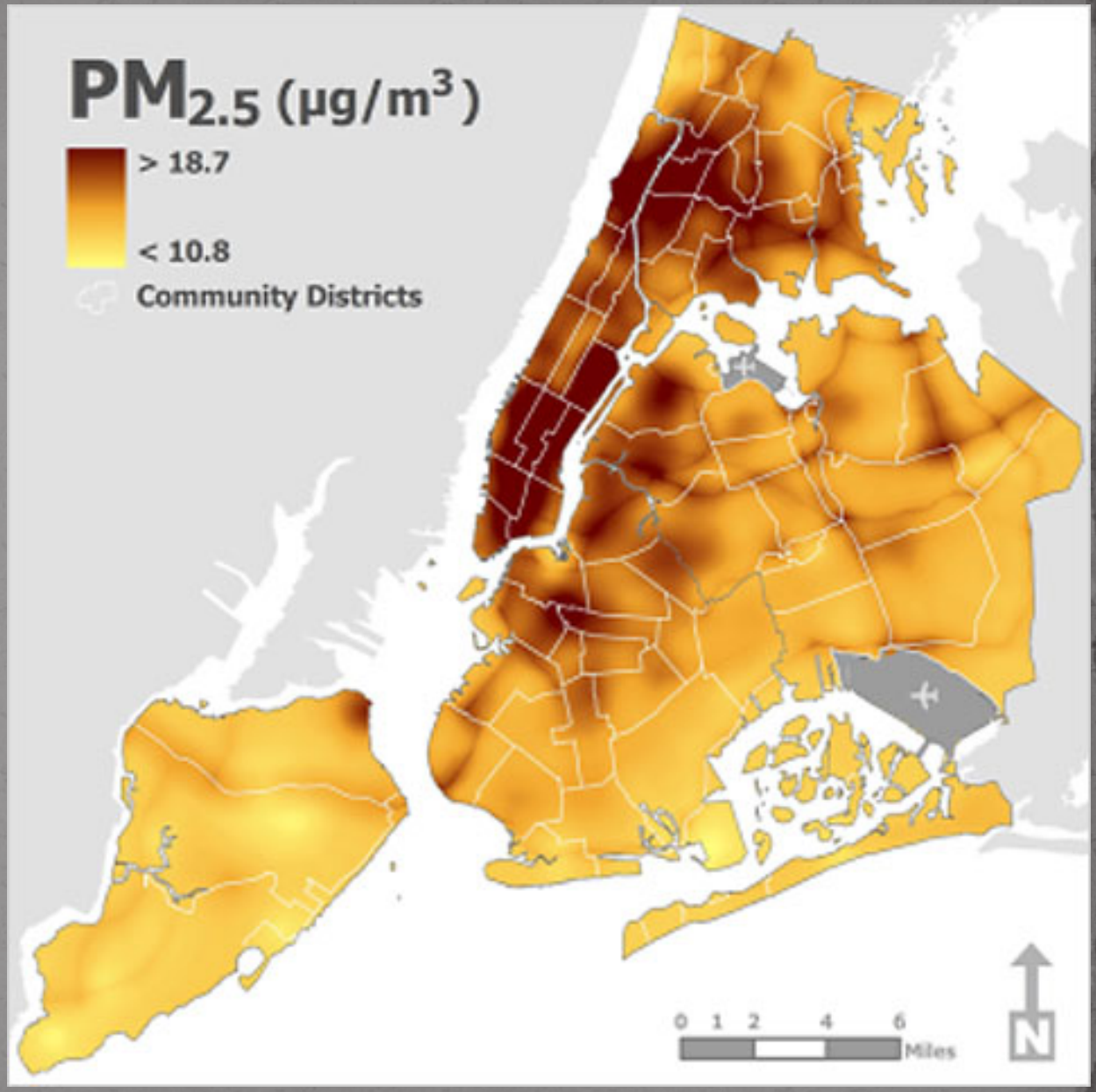


Pollution in NYC



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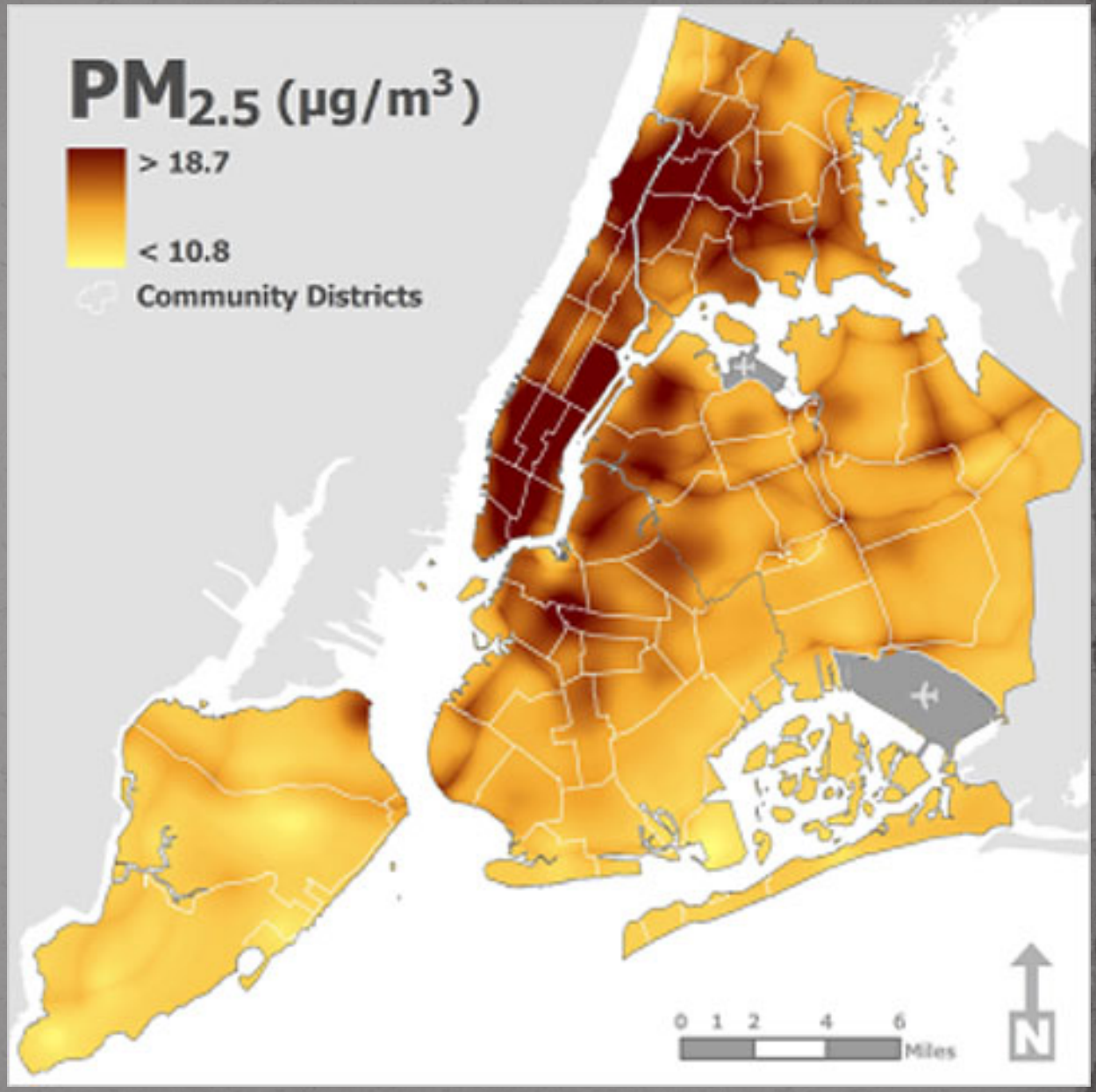

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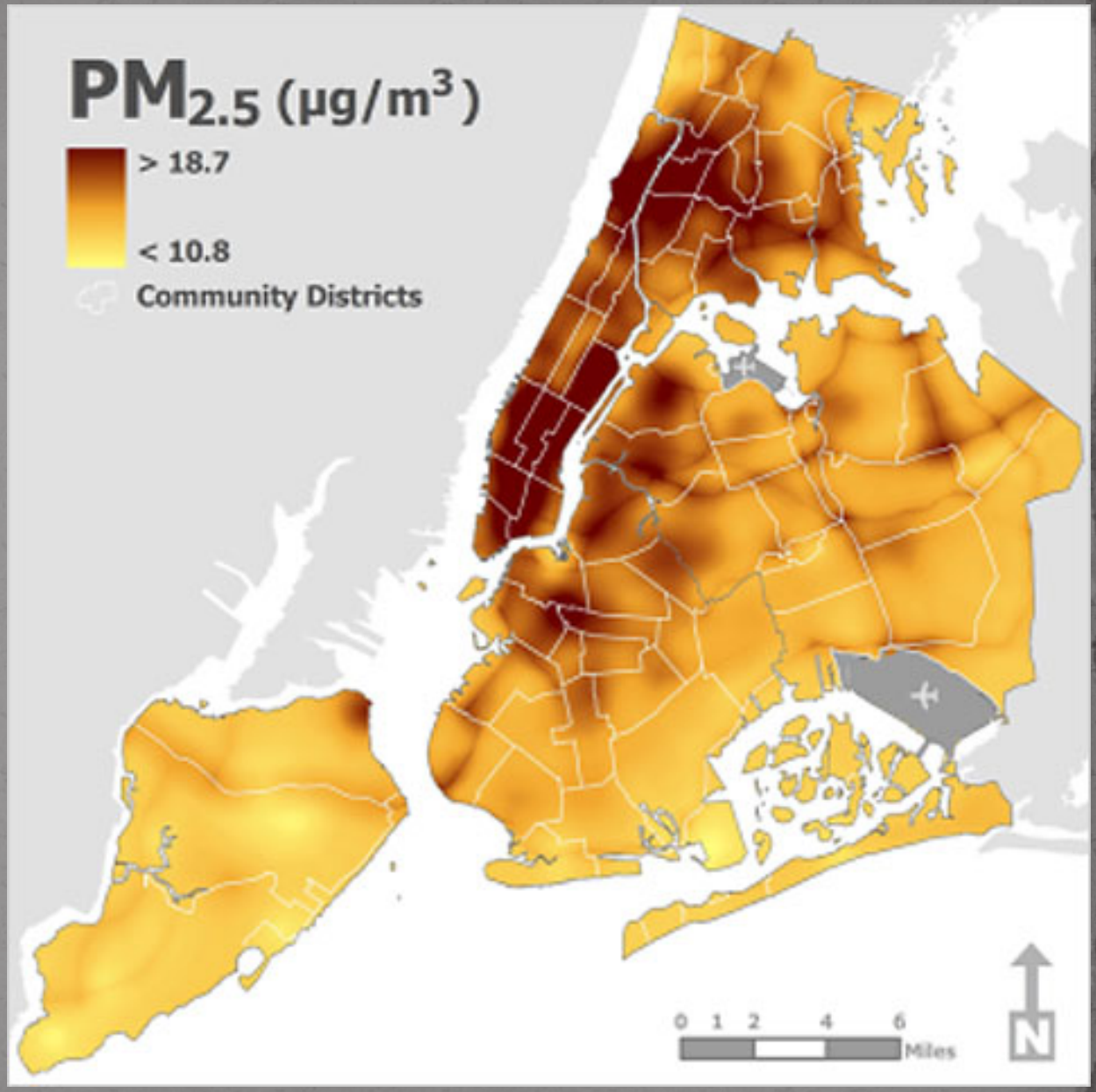

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PM- **Particulate Matter**- are tiny subdivisions of solid matter suspended in a gas or liquid (air pollution, water pollution, etc)

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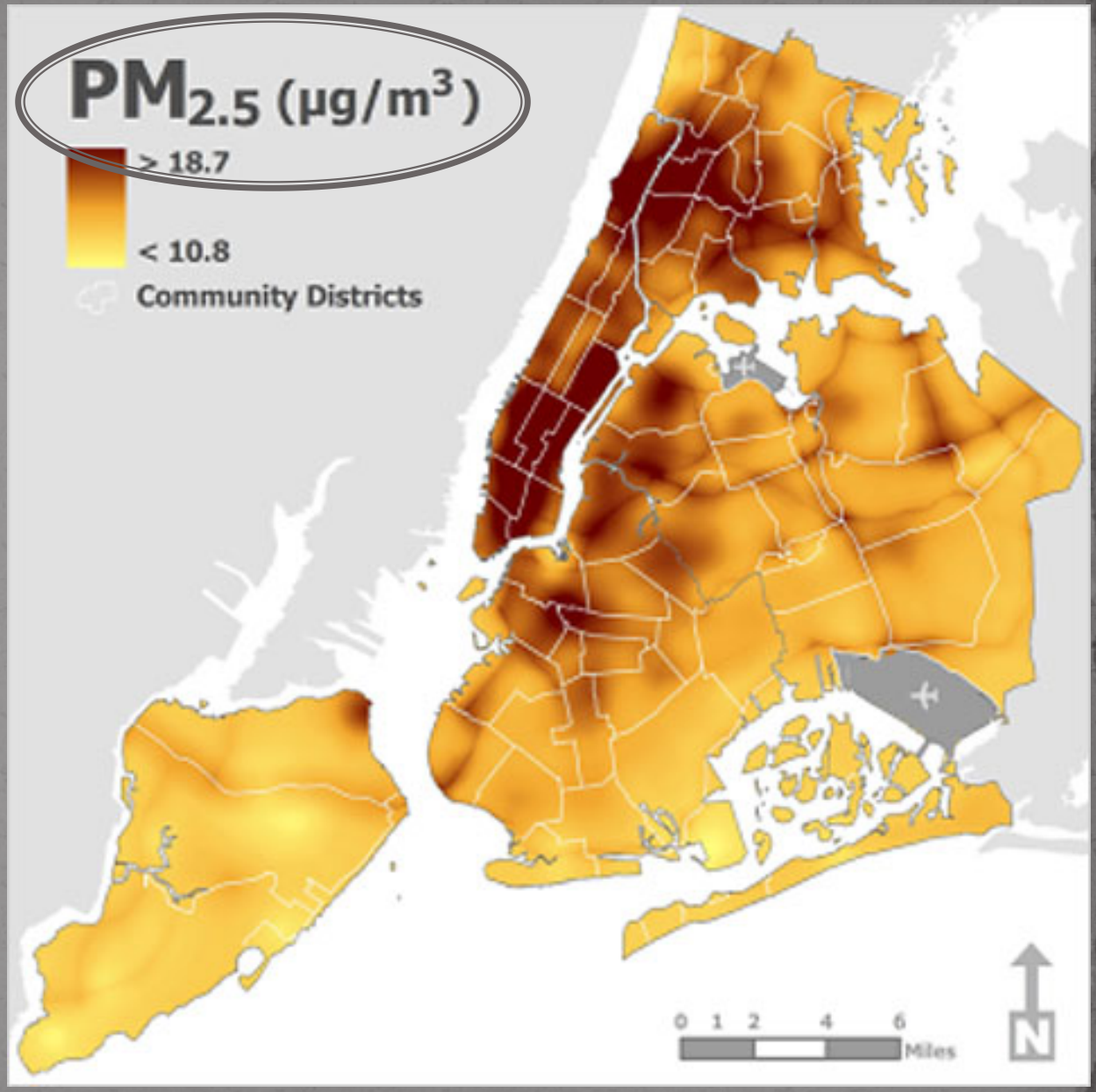

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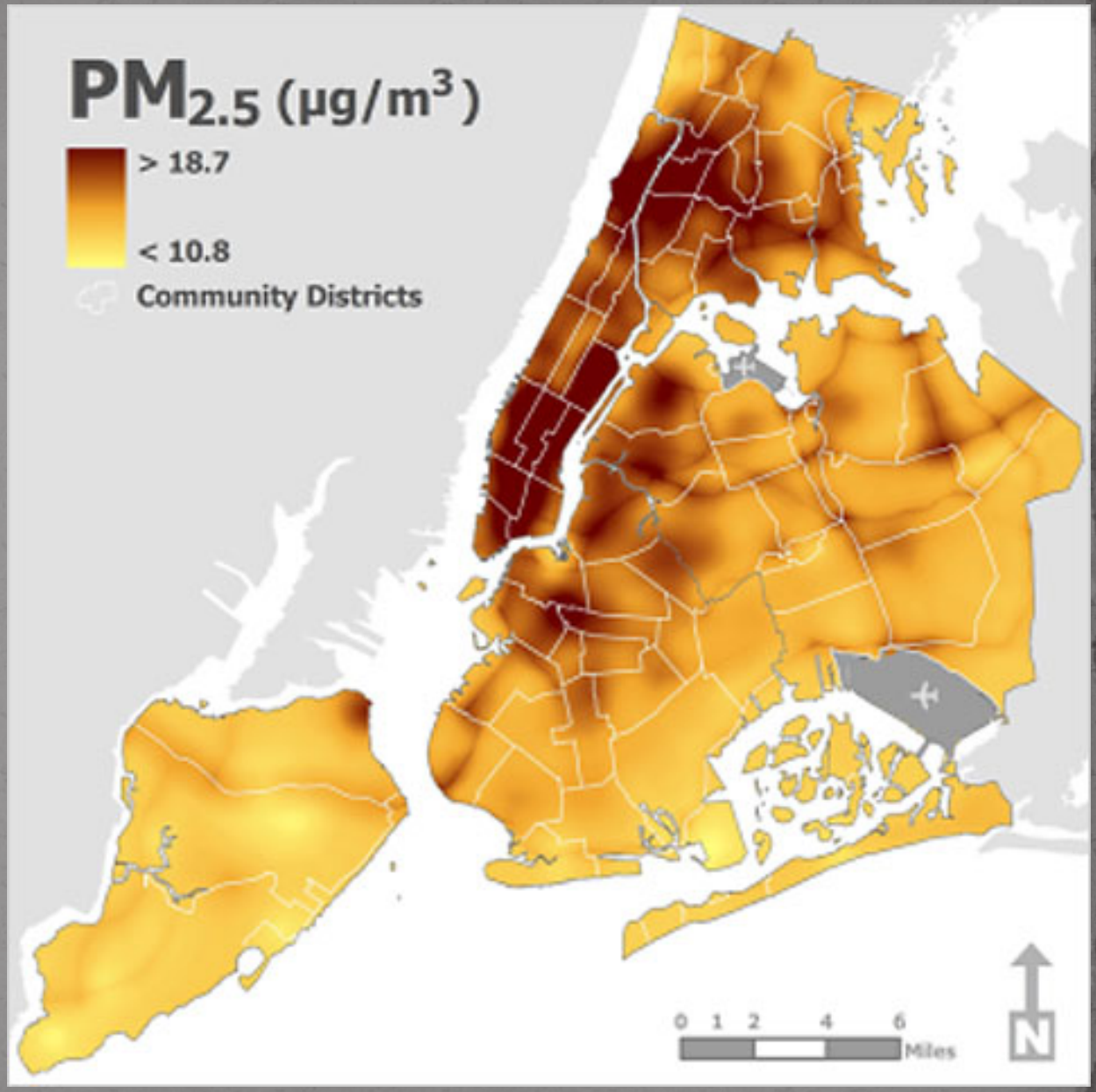

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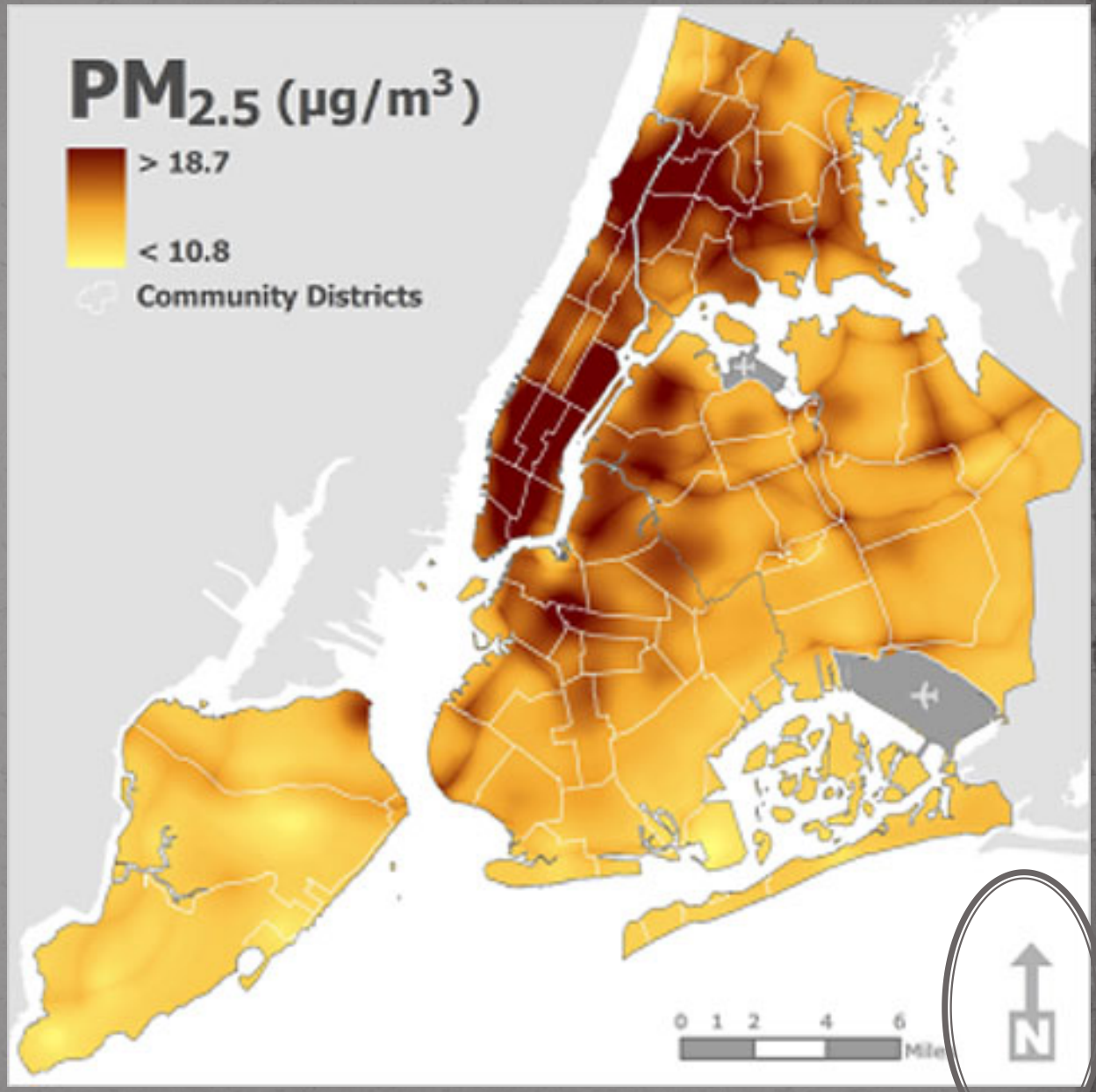

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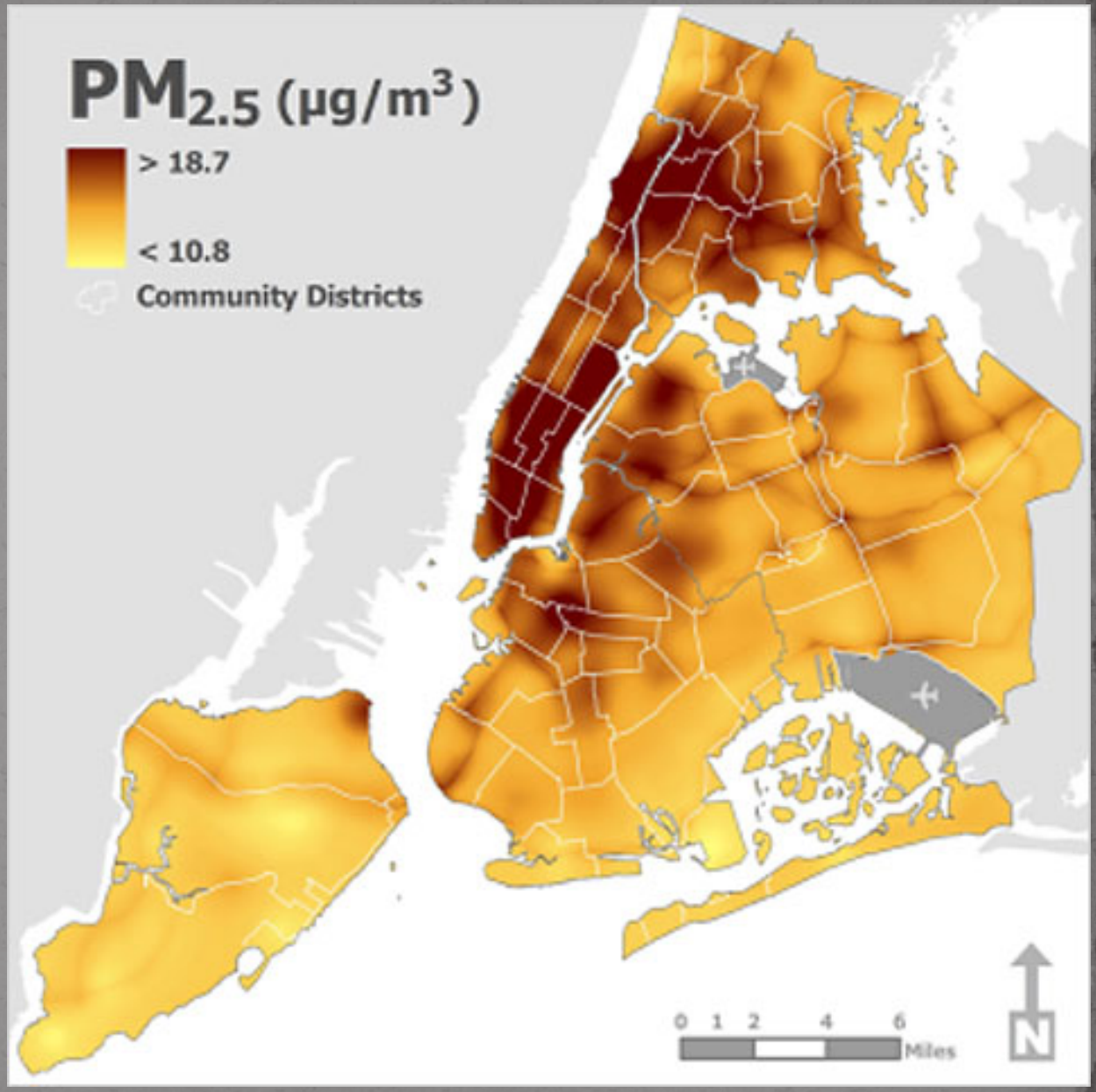

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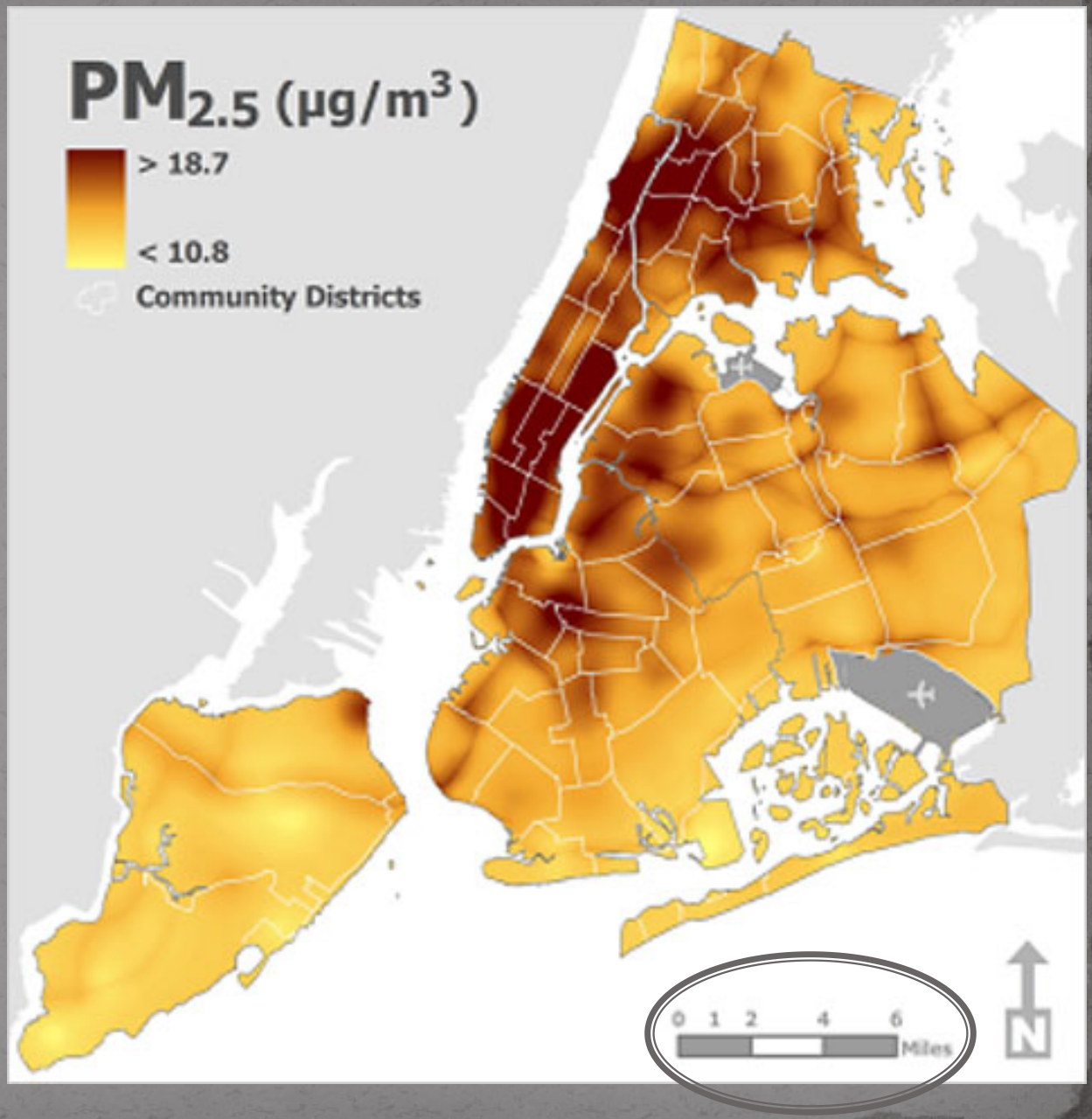

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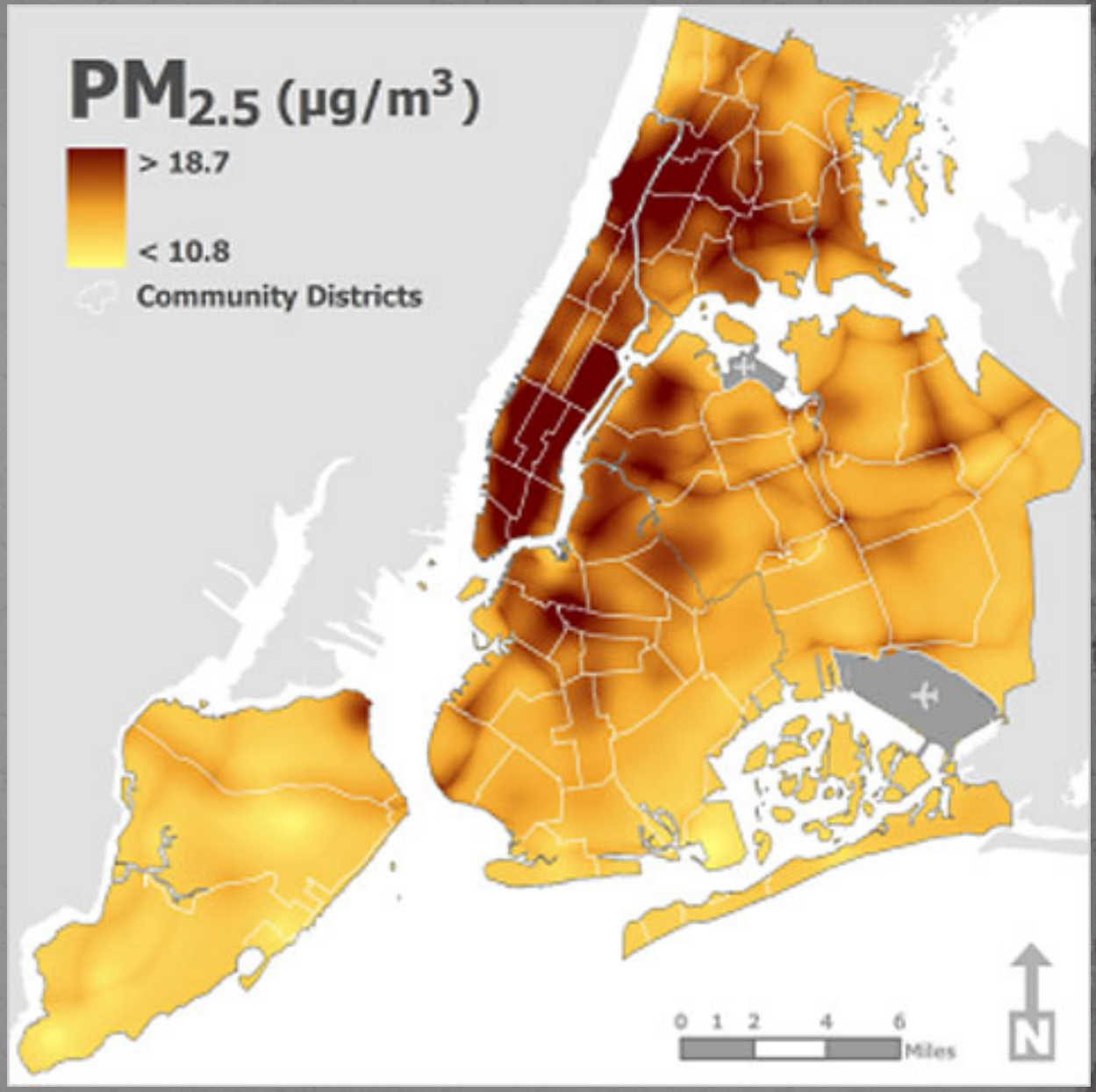

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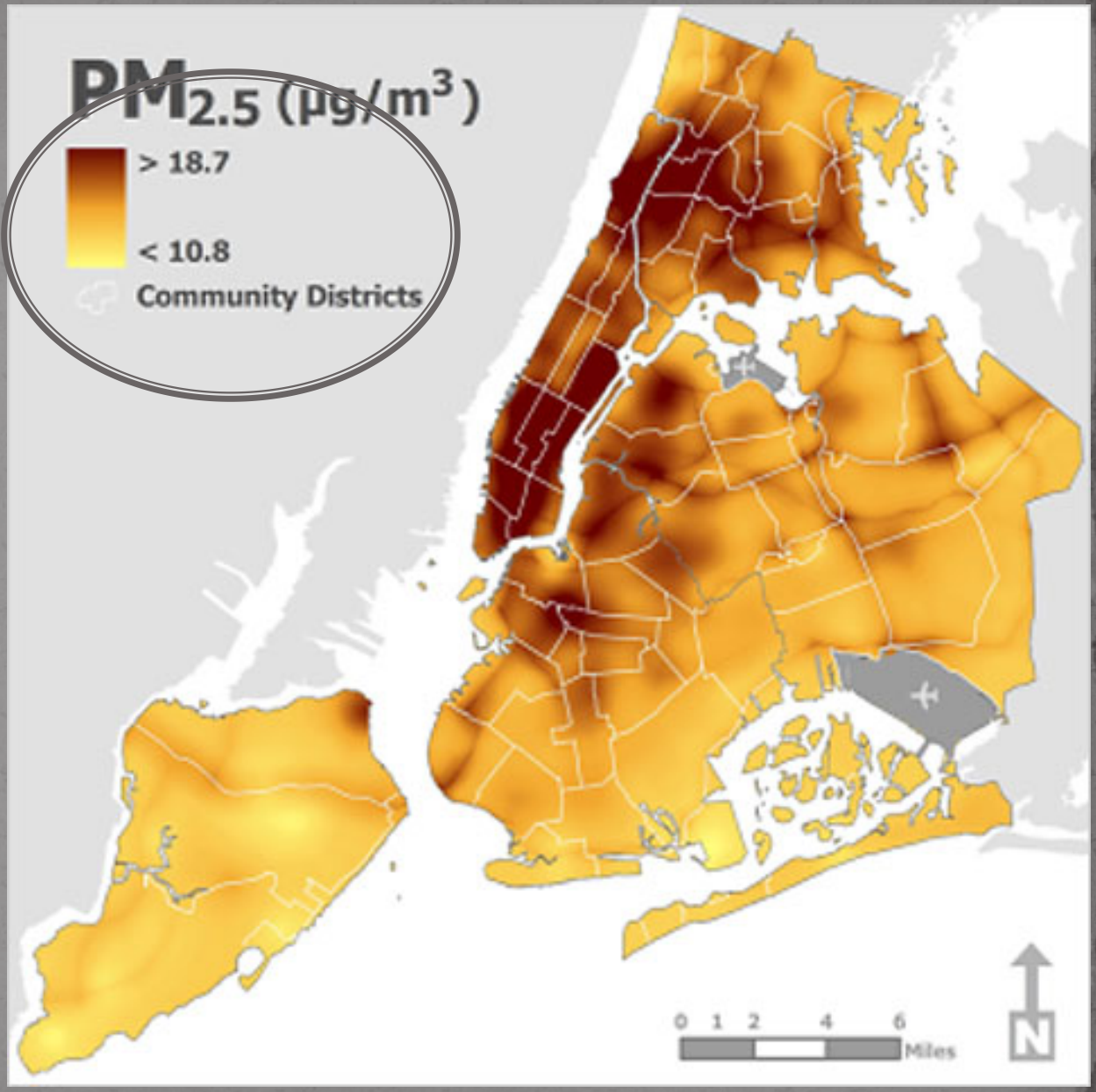

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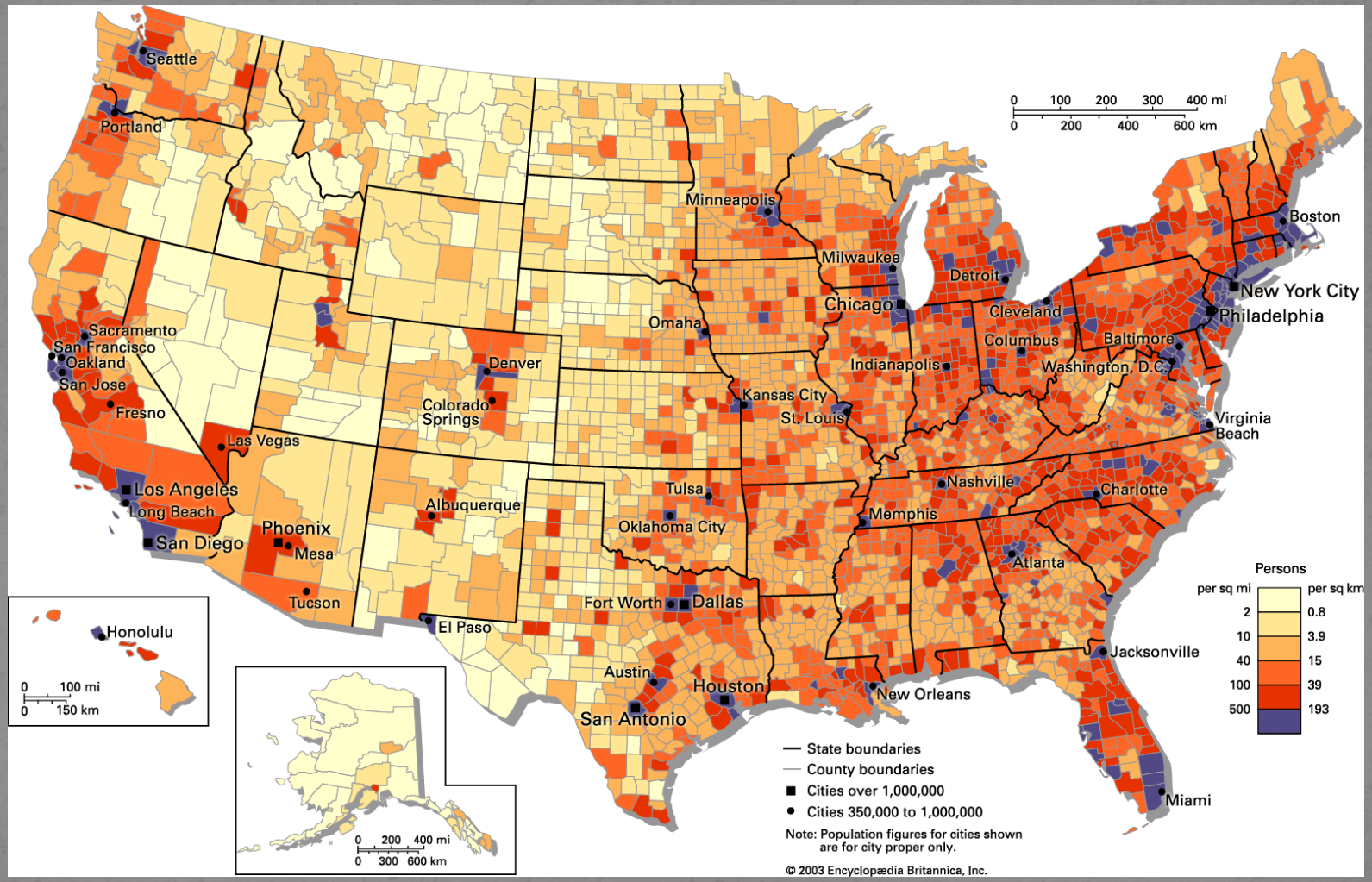
Seattle
Portland
Sacramento
San Francisco
Oakland
San Jose
Fresno
Las Vegas
Los Angeles
Long Beach
San Diego
Phoenix
Mesa
Tucson
Albuquerque
Denver
Colorado Springs
El Paso
Minneapolis
Omaha
Kansas City
St. Louis
Tulsa
Oklahoma City
Fort Worth
Dallas
Austin
Houston
San Antonio
Milwaukee
Chicago
Detroit
Indianapolis
Cleveland
Columbus
Nashville
Memphis
Atlanta
Jacksonville
New Orleans
Miami
Charlotte
Baltimore
Washington, D.C.
Philadelphia
New York City
Boston
Virginia Beach
Honolulu
0 100 mi
0 150 km
0 200 400 mi
0 300 600 km
0 100 200 300 400 mi
0 200 400 600 km
Persons
per sq mi
per sq km
2
0.8
10
3.9
40
15
100
39
500
193
State boundaries
County boundaries
Cities over 1,000,000
Cities 350,000 to 1,000,000
Note: Population figures for cities shown are for city proper only.
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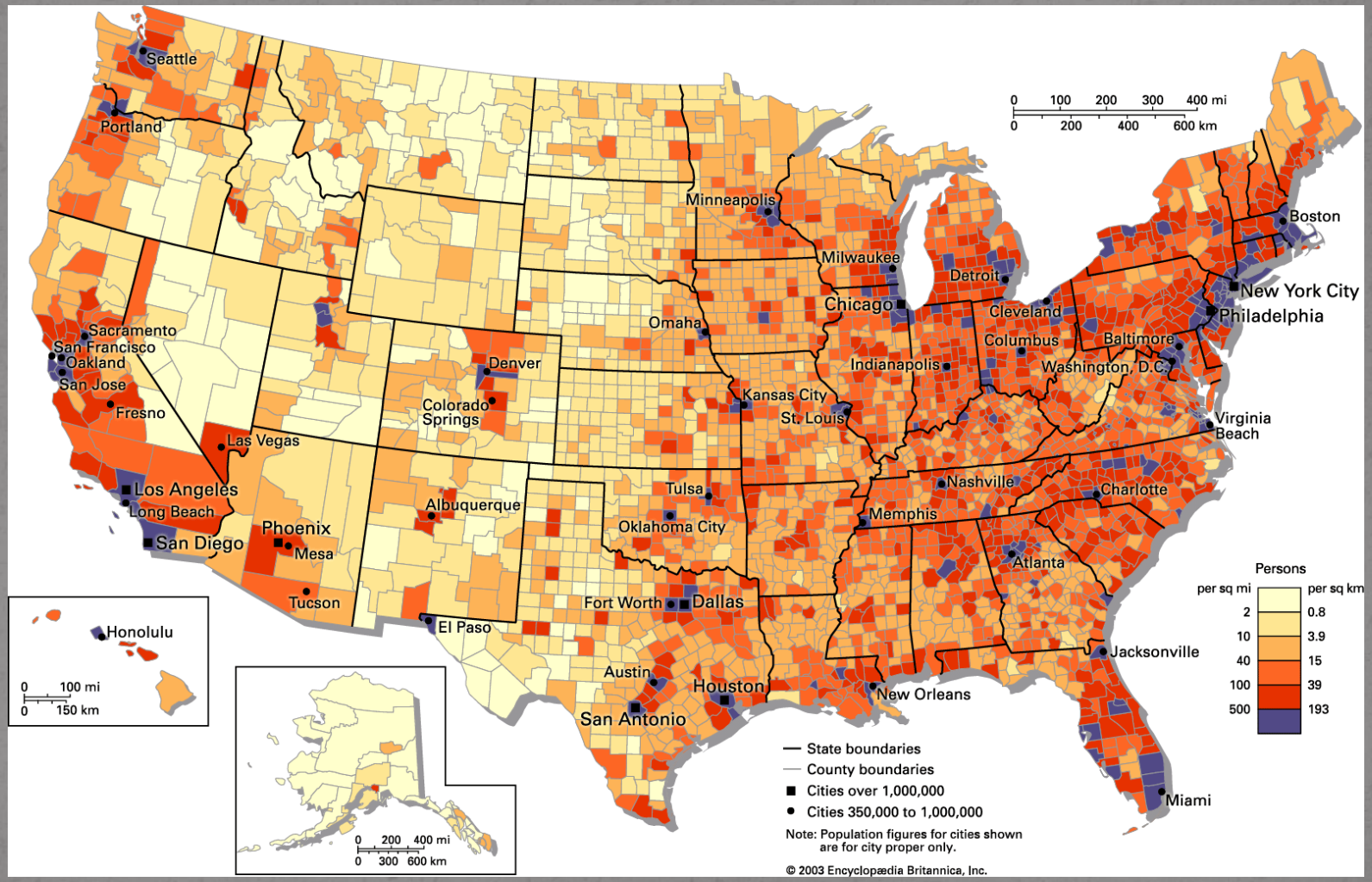
Map of Population in the US



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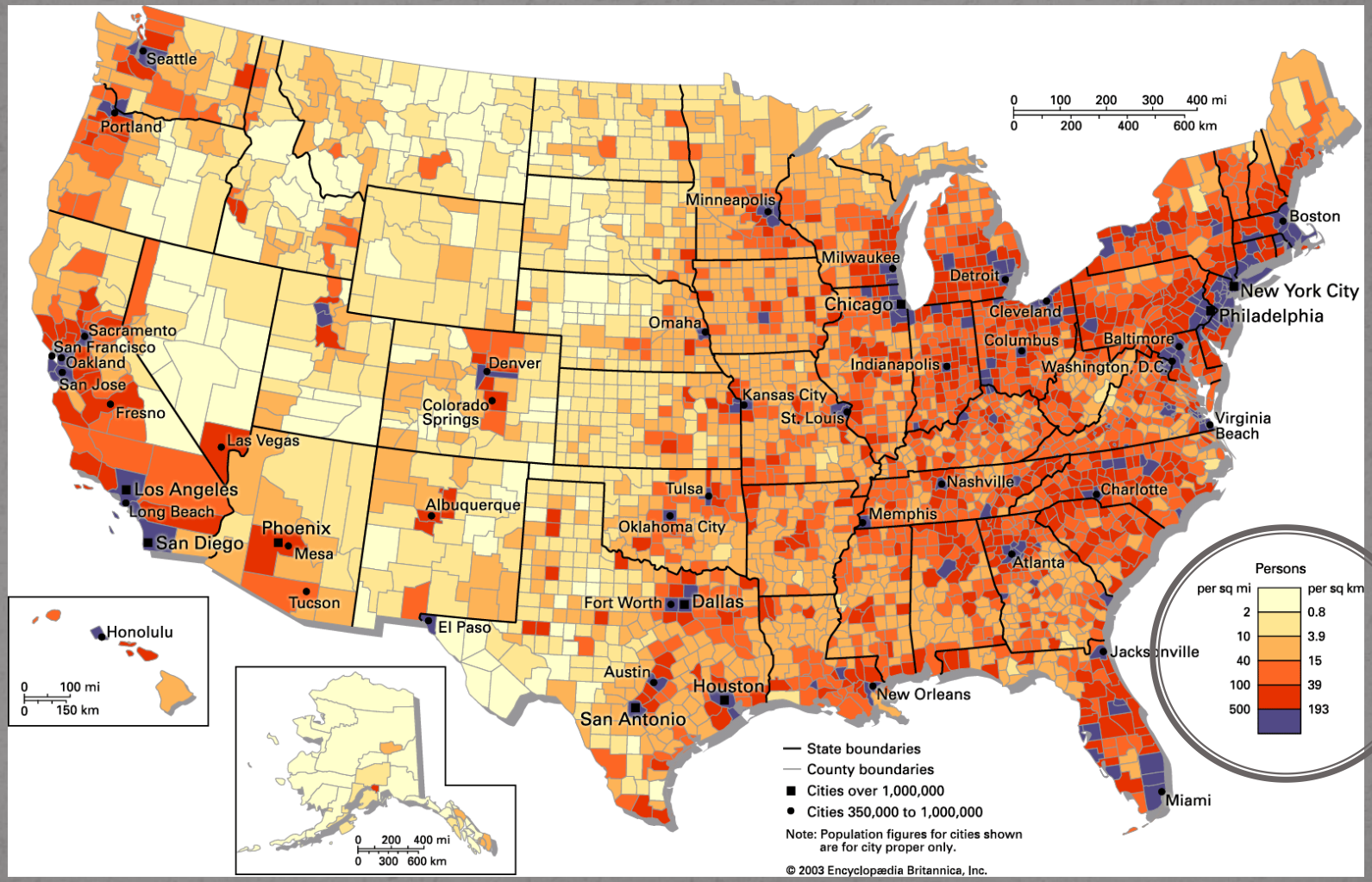

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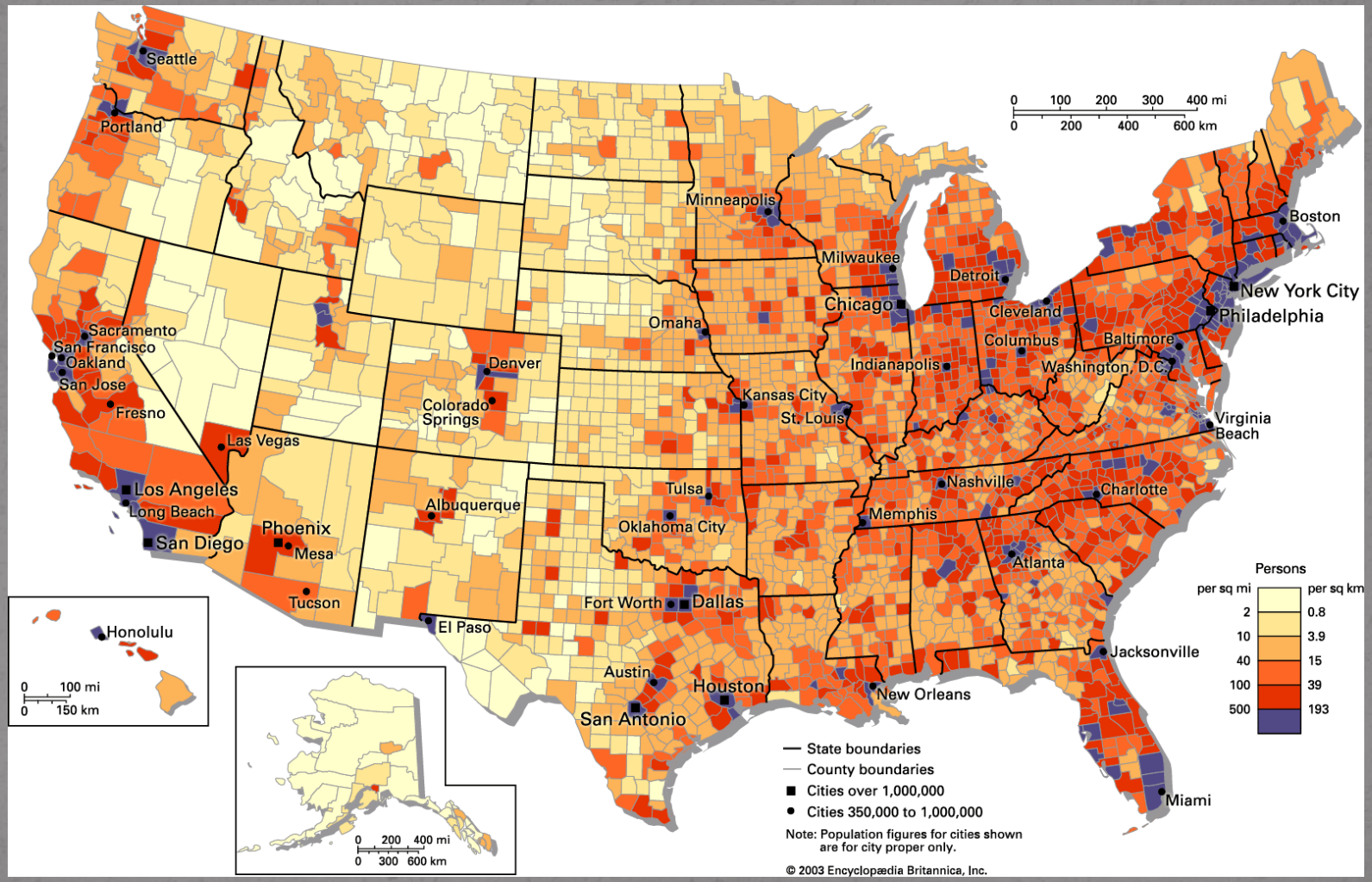


New York State Map
MILES
0 20 40 60 80
Albers equal area projection
CANADA
QUÉBEC
VERMONT
NEW HAMPSHIRE
MASSACHUSETTS
CONNECTICUT
NEW JERSEY
LONG ISLAND
ATLANTIC OCEAN
Lake Ontario
Lake Erie
Lake Champlain
Oneida Lake
Seneca Lake
Cayuga Lake
Lake George
Long Island Sound
Hudson R.
Delaware R.
Black R.
Susquehanna River
ADIRONDACK MTS
Catskill Mts
Slide Mtn+ 4180
+Mt Marcy 5344
Massena
Malone
Plattsburgh
Ogdensburg
Potsdam
Saranac Lake
Lake Placid
Tupper Lake
Watertown
Long Lake
Glens Falls
Saratoga Springs
Oswego
Fulton
Irondequoit
Rochester
Lockport
Niagara Falls
North Tonawanda
Cheektowaga
Buffalo
Newark
Seneca Falls
Geneva
Auburn
Oneida
Rome
Utica
Ilion
Gloversville
Johnstown
Amsterdam
Schenectady
Troy
Albany
Syracuse
Geneseo
Dansville
Cortland
Norwich
Oneonta
Ithaca
Hudson
Catskill
Kingston
Poughkeepsie
Monticello
Newburgh
Middletown
Peekskill
White Plains
Yonkers
Levittown
Hempstead
New York
Montauk
Dunkirk
Fredonia
Jamestown
Olean
Wellsville
Hornell
Bath
Corning
Elmira
Endicott
Binghamton
Sidney
TRANSPORTATION
Interstate; limited access highway
Other principal highway
Railroad
Ferry
POPULATED PLACES
1,000,000 and over
New York
100,000 – 499,999
Syracuse
25,000 – 99,999
Binghamton
24,999 and less
Saranac Lake
State capital
Albany
Urban areas
PHYSICAL FEATURES
Streams
Lakes
Highest elevation in state (feet) +5344
Other elevations (feet) +4180
The lowest elevation in New York is sea level (Atlantic Ocean).
washingtonstatesearch.com

Where is the following on the map:

- **Title ???**
- Scale
- Legend
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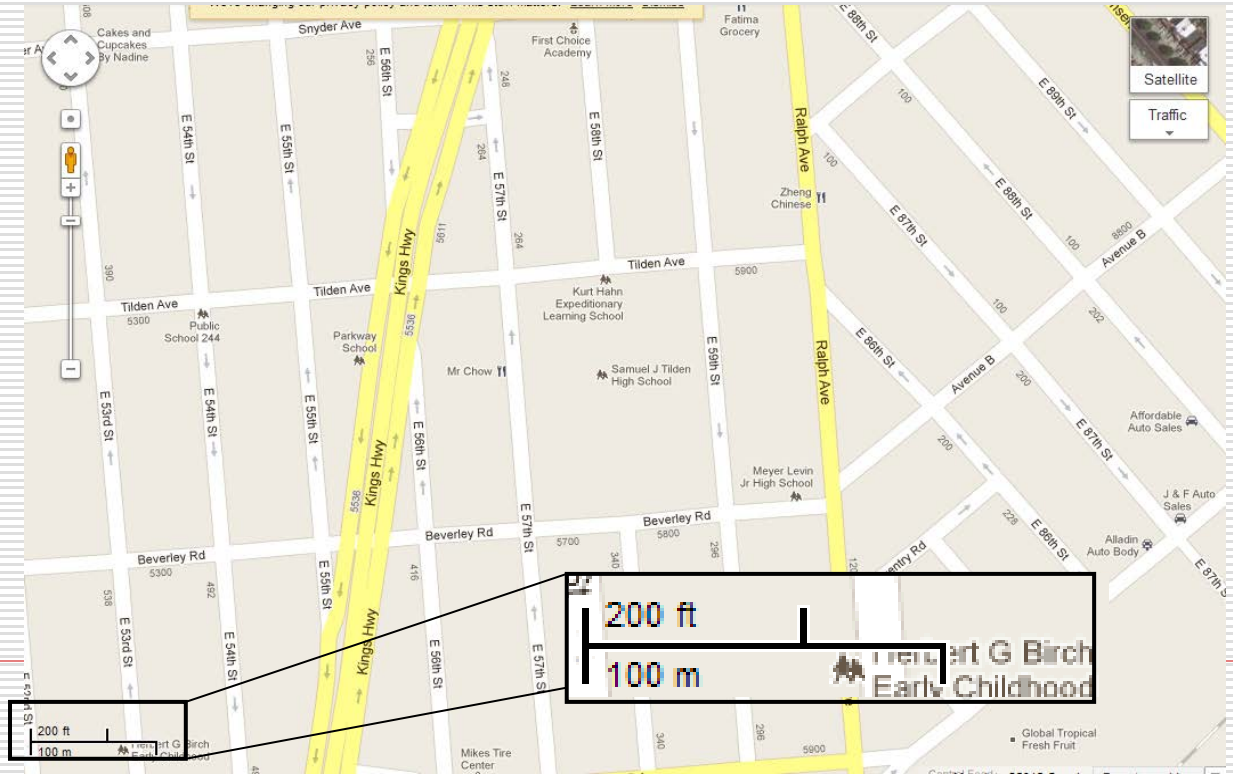
Mapping Worksheet

- Revisit the map you made for the do now, and them improve it based on what you learned in class today.
- What were the most important points on your map that were missing?
- Did you have the title, legend, scale and north arrow on your map?

Carbon Footprint Project Results

How do figure out how much CO2 is being emitted by the cars we counted up?

- First we find the Length of the Block we counted.



Convert Length to Miles

- 1 mile = 5280 ft
- So… 1000 ft = ? Miles?
- $\frac{5280}{1} = \frac{1000}{?} \rightarrow \frac{1000}{5280} = 0.1894 \text{miles}$

Figure out the Gas Mileage for each Car Type.

- Small Car = ~22mpg
- Large Car = ~18mpg
- Box Truck = ~11mpg
- Semi Truck = ~6mpg
- Bus = ~8mpg

How Many Gallons per block?

- For Each car type, measure the gallons of gasoline being used per block.

- $\frac{22m}{1gal} = \frac{0.1894}{?} \rightarrow \frac{0.1894}{22}$

- = 0.00859gallons per block for small cars

How many grams of CO_2 are being emitted per gallon of gasoline?

- 8920 grams of CO_2 per gallon of gasoline
- How is this possible if a gallon of gasoline weighs about 6lbs?

Now we can figure out how much CO2 is being emitted on the block per car.

- 8920 grams per gallon X 0.00859 gallons (for small cars)
- This equals:
  - 46.22182 grams of CO2 per small car for this block

So, what is the final result?

Car Counting Data

sm car

block l(ft)	block l(m)	gallons per block	grams CO2 per block
600	0.114	0.005182	46.22182
1000	0.189	0.008591	76.63091
1200	0.227	0.010318	92.03818

lg car

block l(ft)	block l(m)	gallons per block	grams CO2 per block
600	0.114	0.006333	56.49333
1000	0.189	0.0105	93.66
1200	0.227	0.012611	112.4911

Box Truck

block l(ft)	block l(m)	gallons per block	grams CO2 per block
600	0.114	0.010364	92.44364
1000	0.189	0.017182	153.2618
1200	0.227	0.020636	184.0764

Semi

block l(ft)	block l(m)	gallons per block	grams CO2 per block
600	0.114	0.019	169.48
1000	0.189	0.0315	280.98
1200	0.227	0.037833	337.4733

Bus

block l(ft)	block l(m)	gallons per block	grams CO2 per block
600	0.114	0.01425	127.11
1000	0.189	0.023625	210.735
1200	0.227	0.028375	253.105

Beverly Rd

1200ft long

2:00-2:15

car type	sm car	lg car	box truck	semi	bus		total
car count	111	19	3	1	17		151
g of CO2	10216.24	2137.331	552.2291	337.4733	4302.785		17546.06

Tilden Ave area

Tilden Ave

1000ft long

2:35-2:50

car type	sm car	lg car	box truck	semi	bus		total
car count	99	21	1	0	1		122
g of CO2	7586.46	1966.86	153.2618	0	210.735		9917.317

Ralph Ave

600ft

12:20-12:35

car type	sm car	lg car	box truck	semi	bus		total
car count	110	60	43	6	11		230
g of CO2	5084.4	3389.6	3975.076	1016.88	1398.21		14864.17

Kings Hwy

600ft

1:43-1:57

car type	sm car	lg car	box truck	semi	bus		total
car count	469	80	28	13	26		616
g of CO2	21678.03	4519.467	2588.422	2203.24	3304.86		34294.02

E56st, E57st, E59st

600ft

2:00-2:15

car type	sm car	lg car	box truck	semi	bus		total
car count	4	11	0	2	2		19
g of CO2	184.8873	621.4267	0	338.96	254.22		1399.494
						combined:	4198.482

total CO2 emissions in area over a 15 minutes time period

80820.04

in a day

7758724

Tree Data

- Carbon Sequestration

- Based on the weight of the tree, we can figure out how much CO2 it holds.
- A tree holds .246kg of CO2 for every .18 kg of the tree.

So…

- If we use this formula we can figure out how much CO2 each tree is holding.

- (Weight of tree/0.18kg) X .246kg

How do the trees compensate for humans?

- An average human exhale about .7kg of CO_2 in a day. Therefore, we can figure out how may people are being compensated for by each tree.

- $\frac{\text{Carbon footprint of tree}}{0.07\text{kg}} = \#$ of ppl compensated

Results

- Combined Tree data
  - Total CO_2 sequestered: 6483146.40kg
  - Total # of ppl compensated for: 9261638ppl

  - In the area we measured, there are about 255 people.
  - The trees can make up for the people's CO_2 emissions in the direct area for 36392 days or about 100 years! (not including cars)

How are we affected by excessive noise?

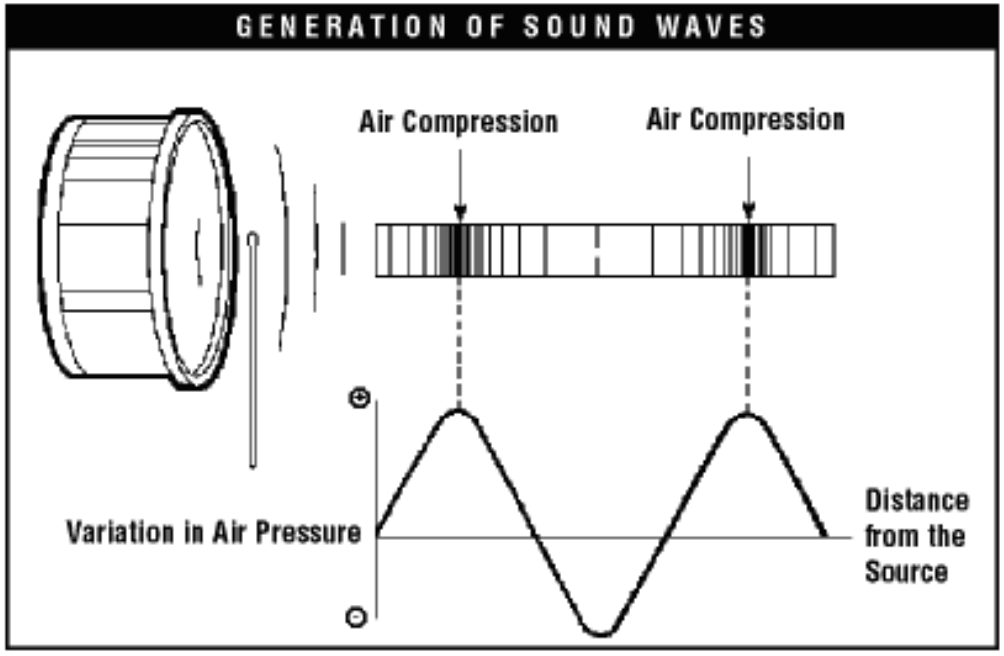
Do Now: What are the different types of pollution?

Noise Pollution

- Prolonged Exposure to high levels of noise can cause hearing loss
- Common sources include
  - o concerts
  - o car / bus / trains / planes
  - o construction / demolition

What Is Sound?

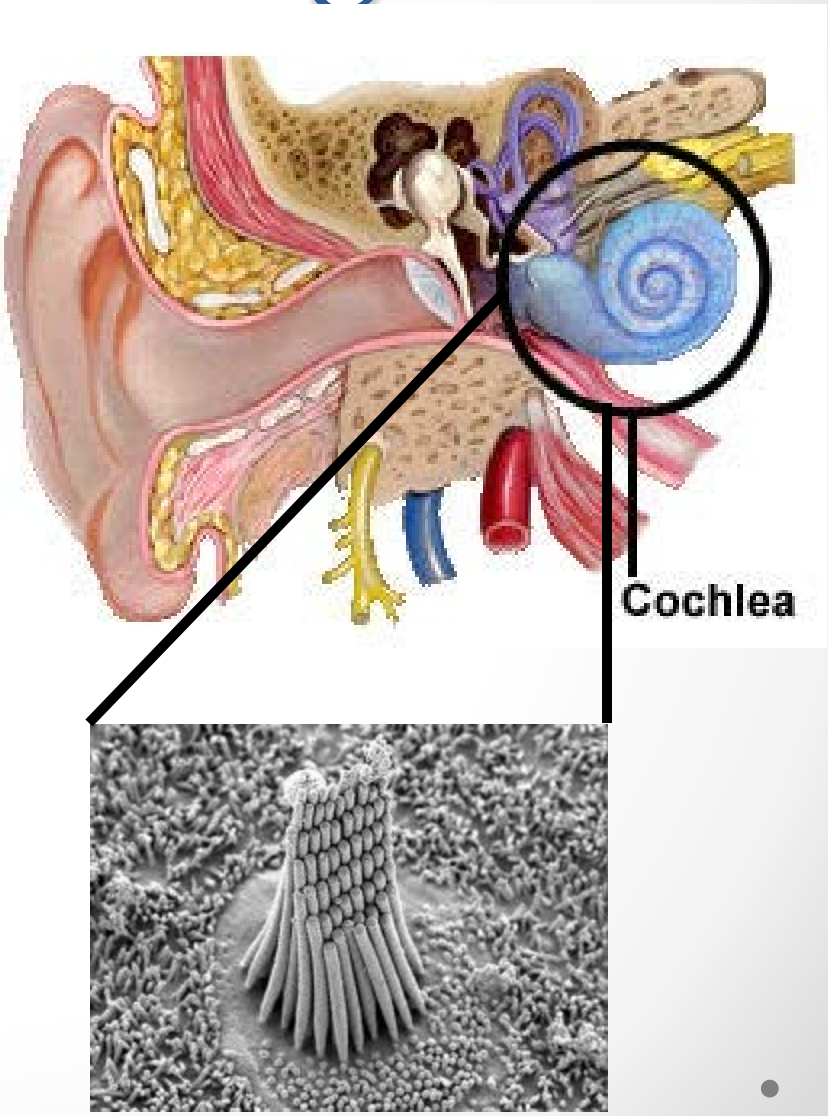
- Sound is defined as any pressure variation heard by the human ear.
- Sound is created by waves of pressure moving through gas, liquid or solid.



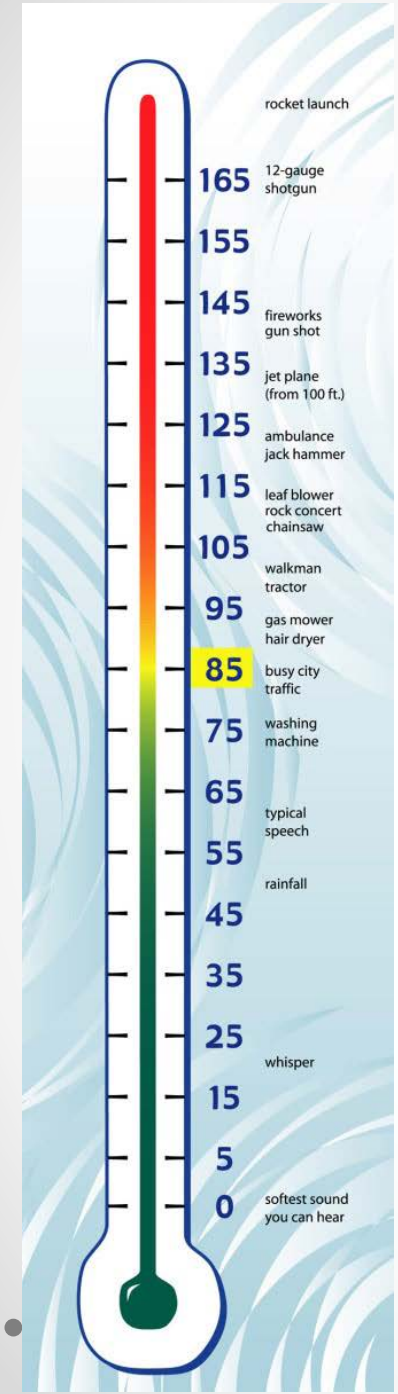
What causes hearing Loss?

- Sensitive structures called **hair cells** are small sensory cells that convert sound energy into electrical signals that travel to the brain.

- When you expose yourself to sounds that are too loud for too long, you will damage these Hair cells, causing permanent hearing loss.



How Loud Is Loud?

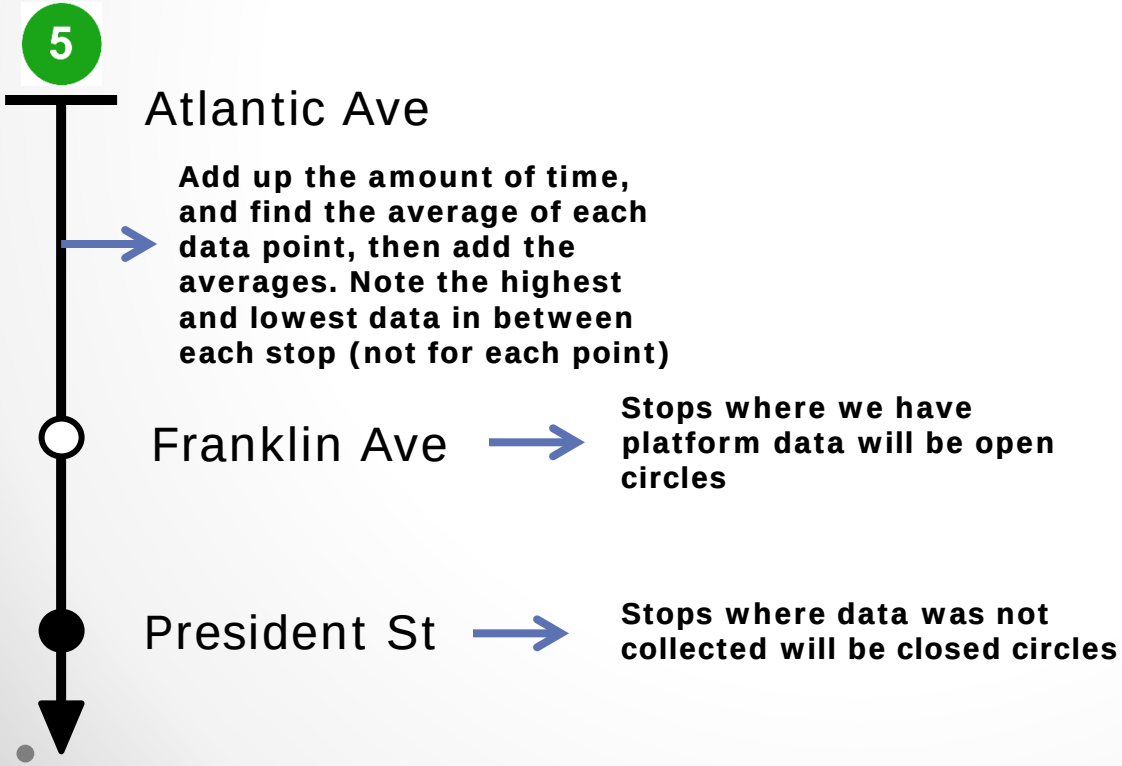


Continuous dB	Permissible Exposure Time
85 dB	8 Hours
88 dB	4 hours
91 dB	2 hours
94 dB	1 hour
97 dB	30 minutes
100 dB	15 minutes
103 dB	7.5 minutes
106 dB	3.75 minutes (< 4 min)
109 dB	1.875 minutes (< 2 min)
112 dB	.9375 min (~ 1 min)
115 dB	.46875 min (~ 30 sec)

Noise Level Subway Survey

Now that we have collected our data, we must organize it.

Format:



Example

Why Chemistry?

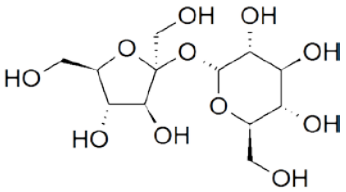
Malgorzata Frik

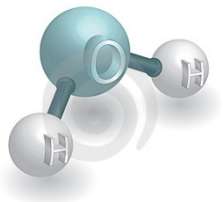
Brooklyn College

Graduate Center of the City University Of New York


PRODUCED BY THE FOUNDATION FOR EDUCATION, SCIENCE AND TECHNOLOGY FOR NATIONAL SET WEEK 2003
PERIODIC TABLE of the ELEMENTS
DEPARTMENT OF SCIENCE AND TECHNOLOGY
Proudly sponsored by the SHUTTLEWORTH FOUNDATION
DMITRI MENDELEYEV (1834 – 1907)
The Russian chemist, Dmitri Mendeleyev, was the first to observe that if elements were listed in order of atomic mass, they showed regular (periodicall) repeating properties. He formulated his discovery in a periodic table of elements, now regarded as the backbone of modern chemistry.
The crowning achievement of Mendeleyev's periodic table lay in his prophecy of then, undiscovered elements. In 1869, the year he published his periodic classification, the elements gallium, germanium and scandium were unknown. Mendeleyev left spaces for them in his table and even predicted their atomic masses and other chemical properties. Six years later, gallium was discovered and his predictions were found to be accurate. Other discoveries followed and their chemical behaviour matched that predicted by Mendeleyev.
This remarkable man, the youngest in a family of 17 children, has left the scientific community with a classification system so powerful that it became the cornerstone in chemistry teaching and the prediction of new elements ever since.
In 1955, element 101 was named after him: Md, Mendelevium.
ALKALI METALS
ALKALI EARTH METALS
TRANSITIONAL METALS
OTHER METALS
SEMI-METALLIC
HALOGENS
NOBLE GASSES
RARE EARTH METALS
At room temperature the element is:
Gas
Liquid
Natural solid
Man-made solid (synthetic)
Symbol
Element name
Atomic number
Atomic mass
Lanthanide Series
Actinide Series
FEST
Foundation for Education, Science & Technology

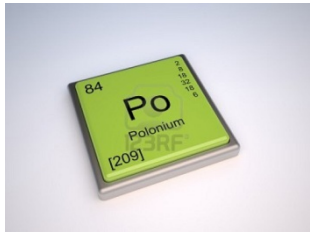
Why Chemistry?





Marie Skłodowska–Curie
(1867-1934)

- Was a Polish–French physics-chemist famous for her pioneering research on radioactivity.
- She was the first person honored with two Nobel Prizes, in physics and chemistry.
- She was the first female professor at the University of Paris.
- She discovered two elements, polonium and radium.
- Under her direction, the world's first studies were conducted into the treatment of neoplasms , using radioactive isotopes.
- She founded the Curie Institutes: the Curie Institute in Paris and the Curie Institute in Warsaw.



Application of gold compounds as anticancer agents

Goal

Our Group research's focuses on the area of inorganic chemistry and, more specifically in the chemistry of coordination and organometallic compounds of gold in different oxidation states.

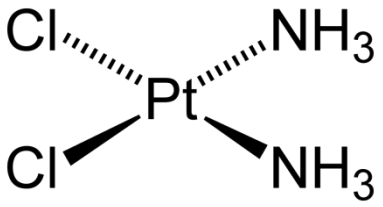
We thus have two main projects in the areas of homogenous catalysis and green chemistry and in the area of medicinal chemistry

Long Term Goal

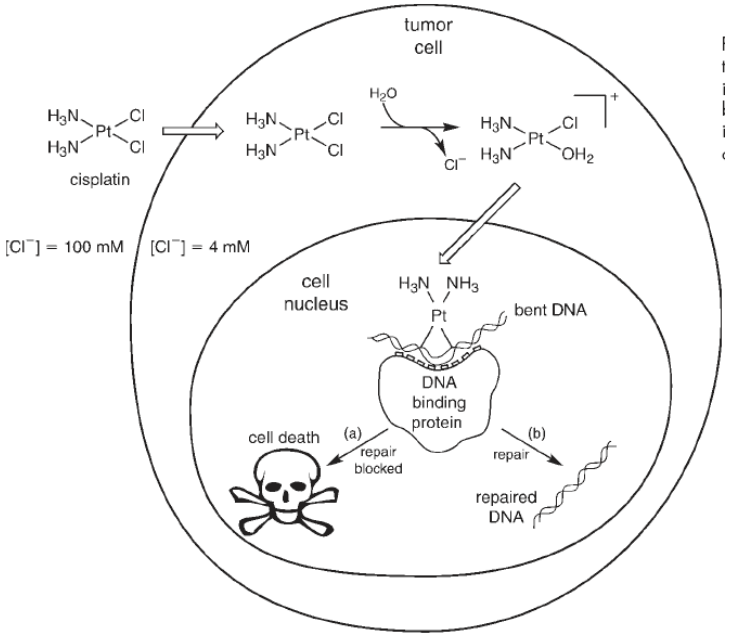
To design of gold-anticancer pharmaceuticals that overcome some of the existing clinical problems associated with the use of platinum drugs in cancer chemotherapy

To understand the mechanism of action of gold derived anticancer pharmaceuticals, and identify their final target.

Cisplatin



- Cisplatin discovered by Rosenberg in 1961
- Approved for human use by FDA in 1979
- One of the most successful drugs ever in cancer treatment, such as small cell lung cancers and ovarian cancer



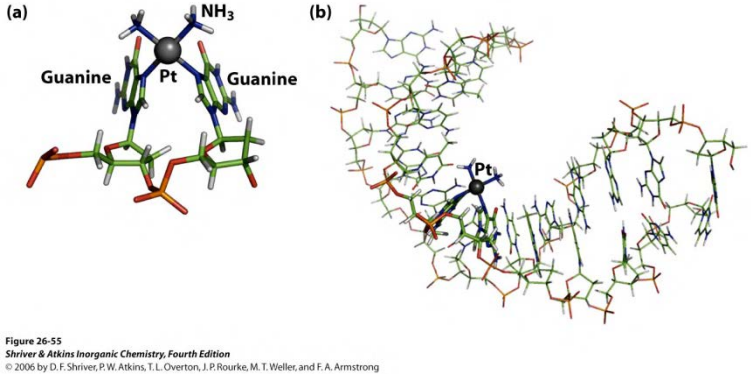


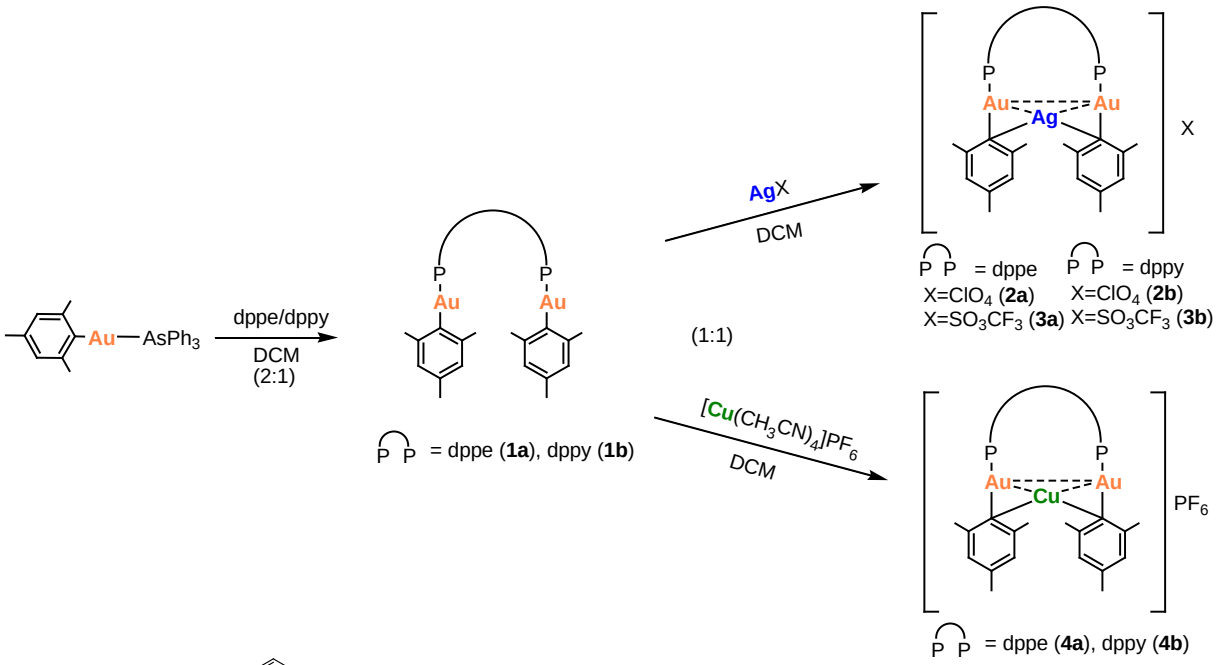
Figure 26-55
Shriver & Atkins Inorganic Chemistry, Fourth Edition
© 2006 by D. F. Shriver, P. W. Atkins, T. L. Overton, J. P. Rourke, M. T. Weller, and F. A. Armstrong

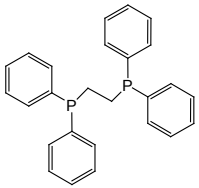
Introduction

- Gold and silver derivatives have been studied in the last few decades for their potential applications in medicine.
- While silver derivatives are used mainly as antibacterial agents, gold compounds have been used in the treatment of rheumatoid arthritis.
- More recently gold(I)-phosphine have been studied as potential antitumor and antimicrobial agents.
- Silver carbene derivatives have also displayed high activity against selected tumor cancer cells *in vitro* and Gram-positive and Gram-negative bacteria.

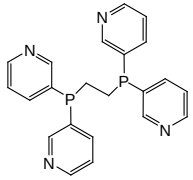
Project

- To develop luminescent gold compounds as antimicrobial agents.





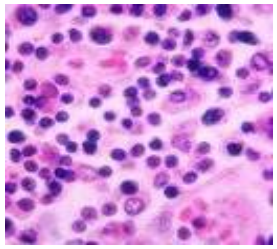
dppe = 1,2-Bis(diphenylphosphino)ethane



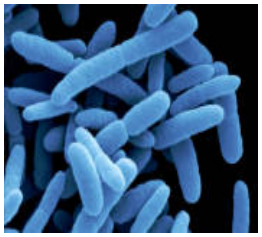
dppy = 1,2-Bis(di-3-pyridylphosphino)ethane

Antimicrobial Assay:

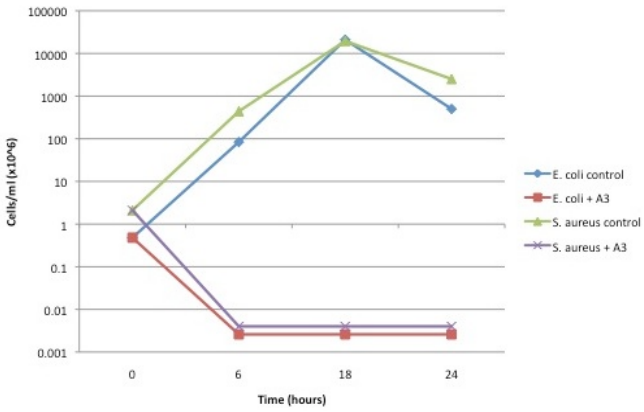
- The antimicrobial activity of the compounds were evaluated against:
- -gram-negative (*Escherichia coli and Salmonella tiphymurium*) bacteria,
- -gram-positive (*Bacillus cereus* and *Staphyloccocus aureus*) bacteria.
- -yeast (*S. cerevisiae*)

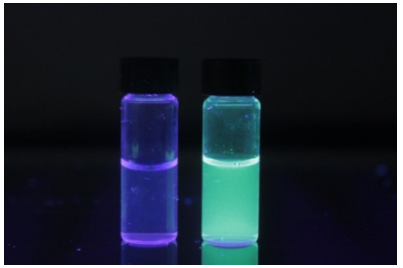


Salmonella Typhimurium

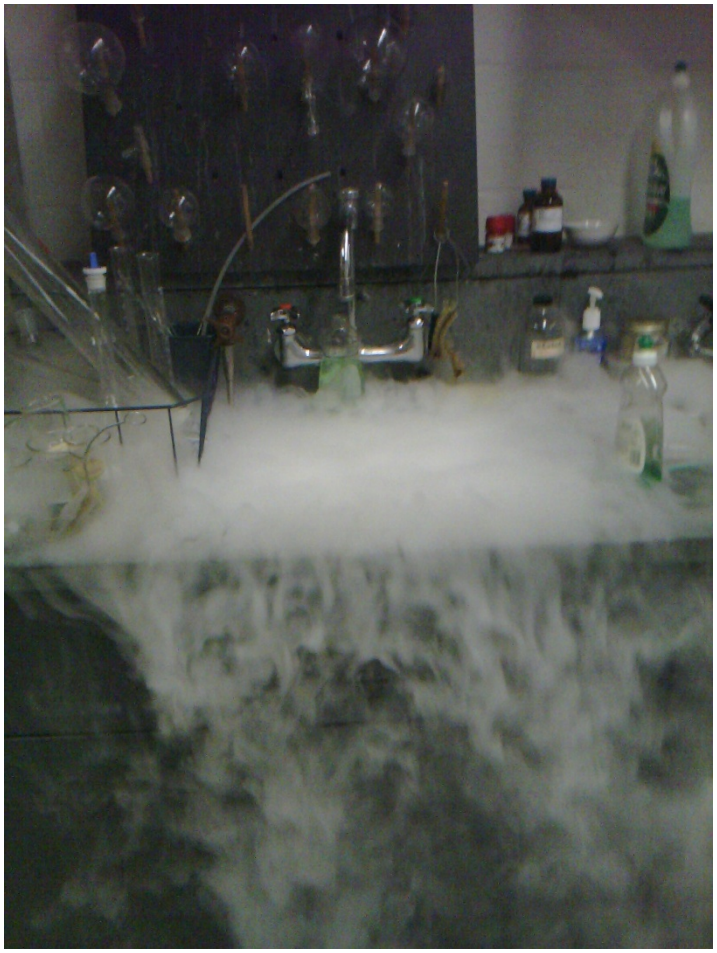


E. Coli



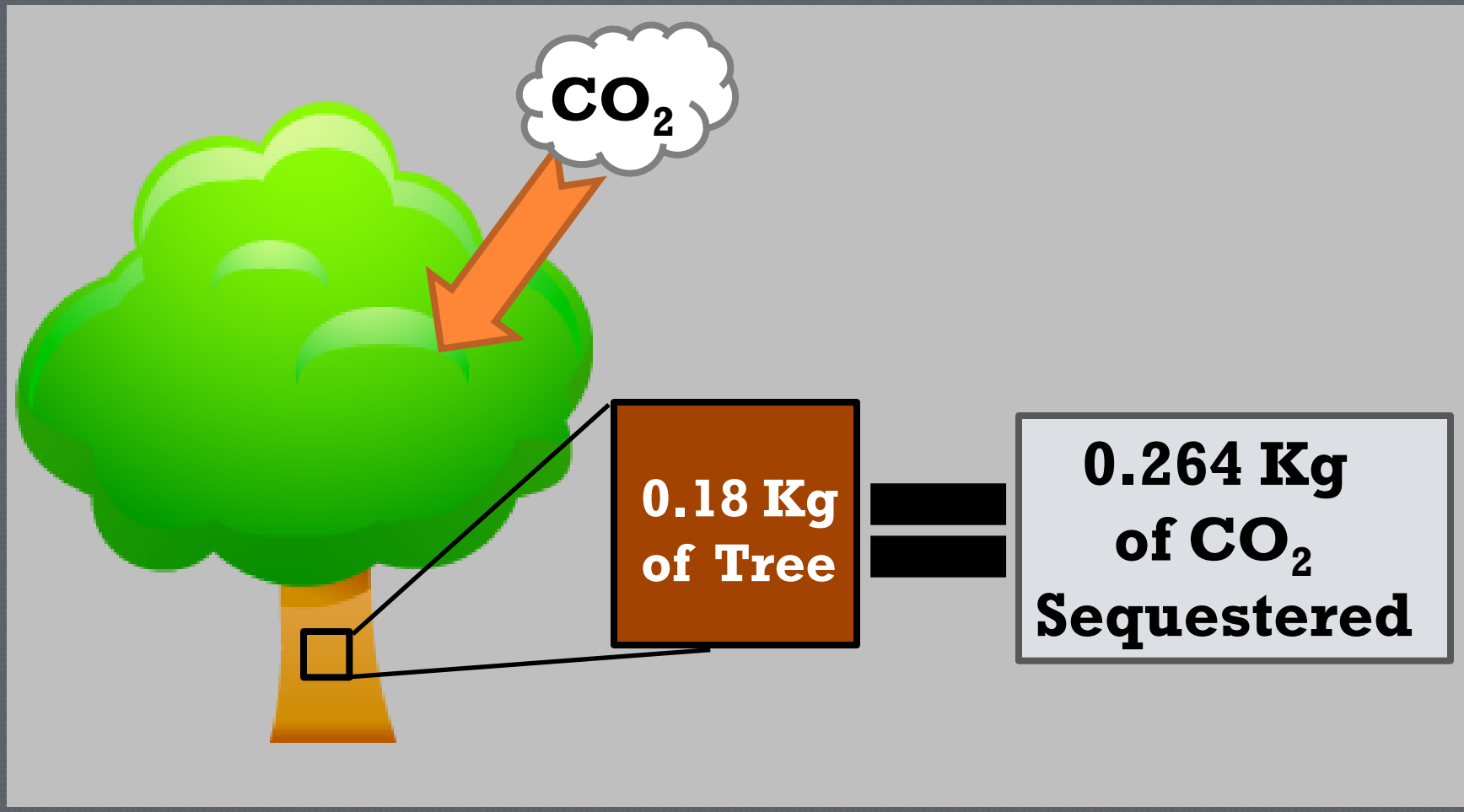


Chemistry is Fun

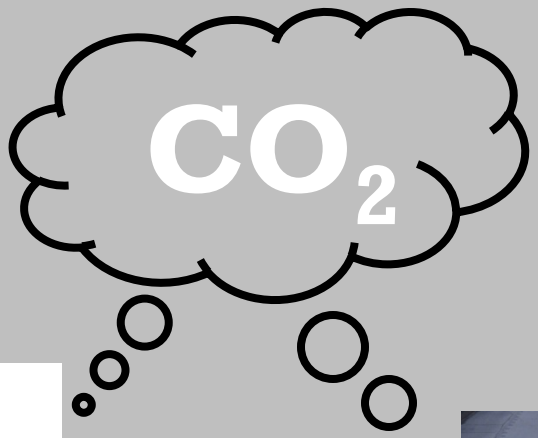


Final Results

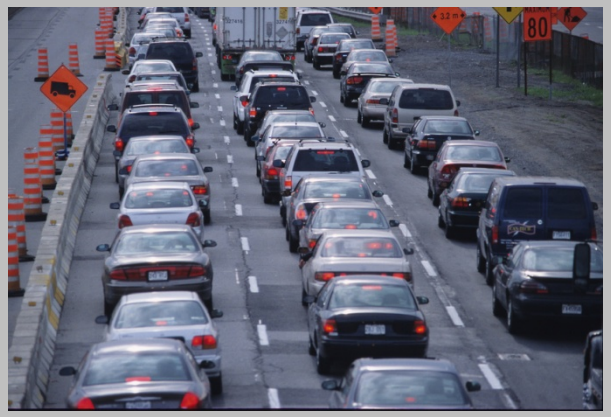
Review



Sources of CO_2 we measured

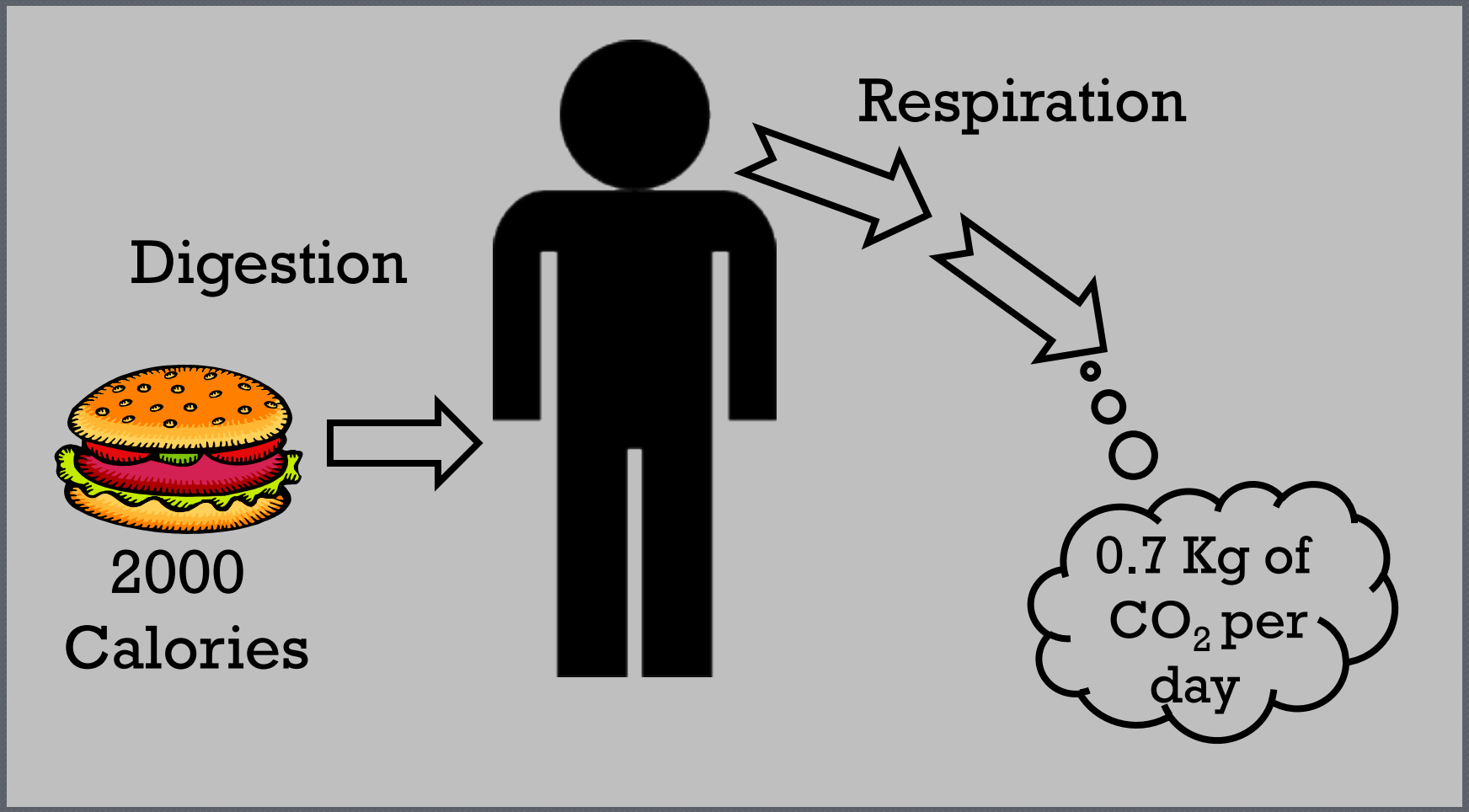


People

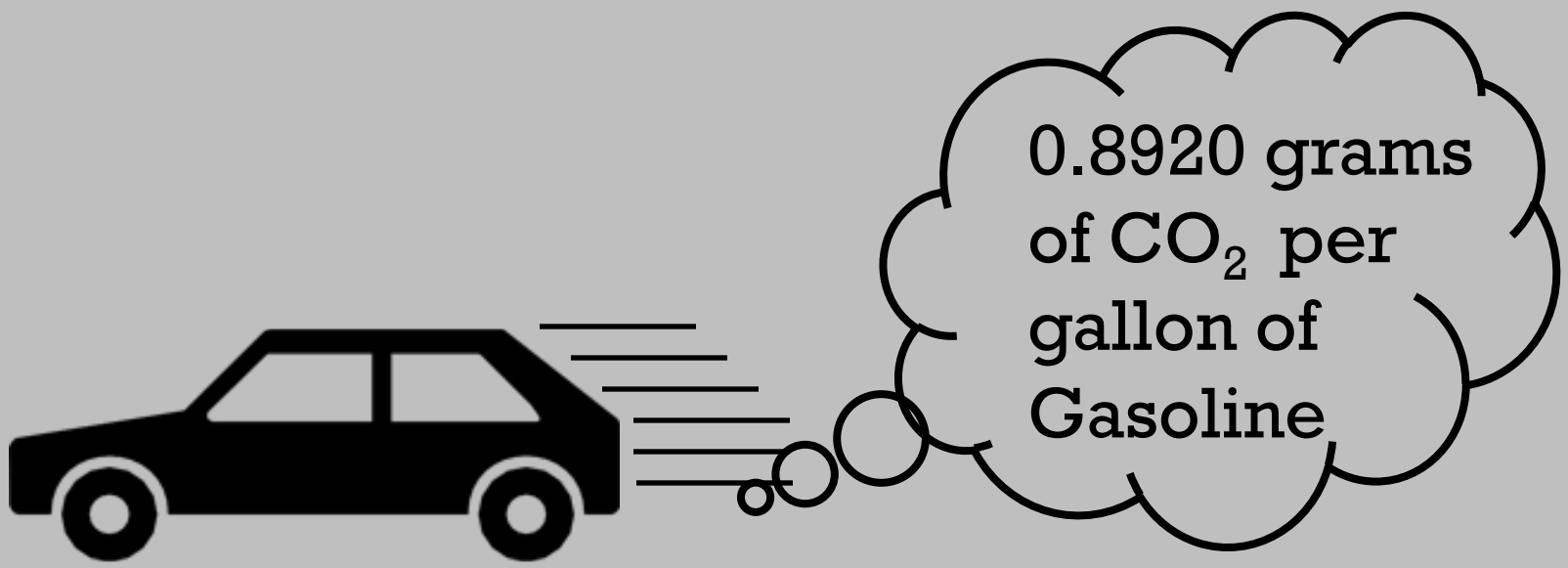


Cars

People

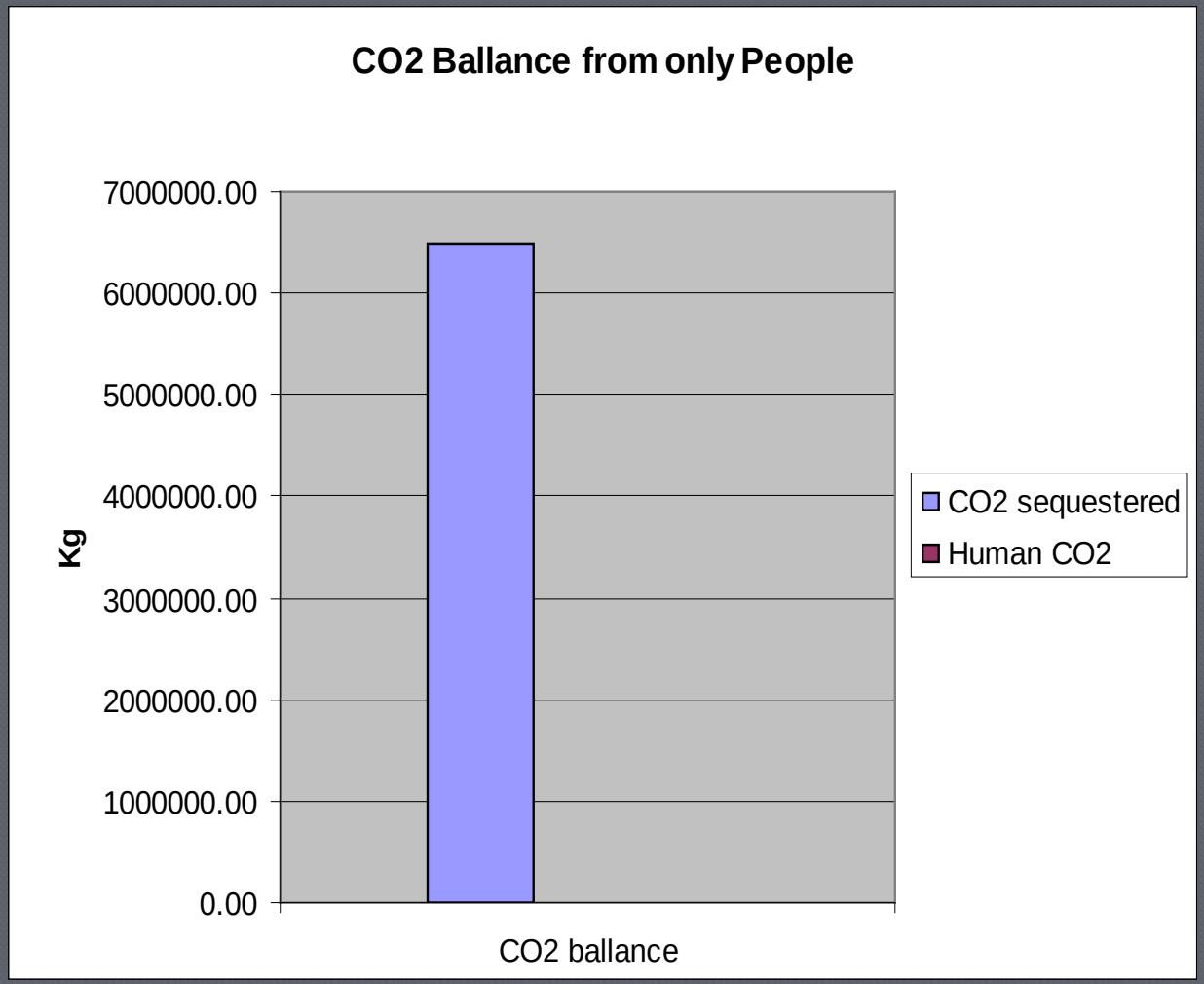


Cars

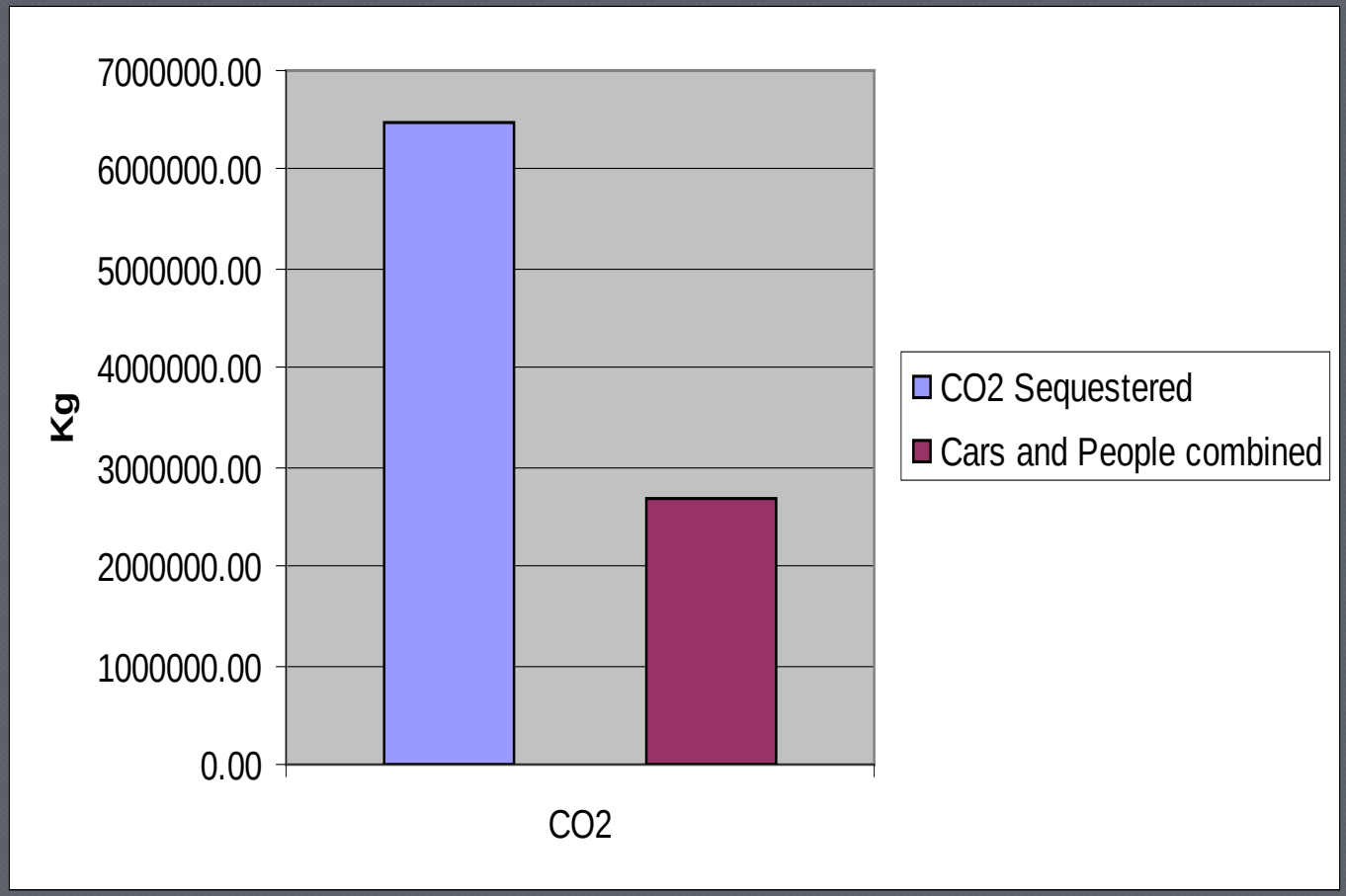


Are we producing more than what the trees can sequester?

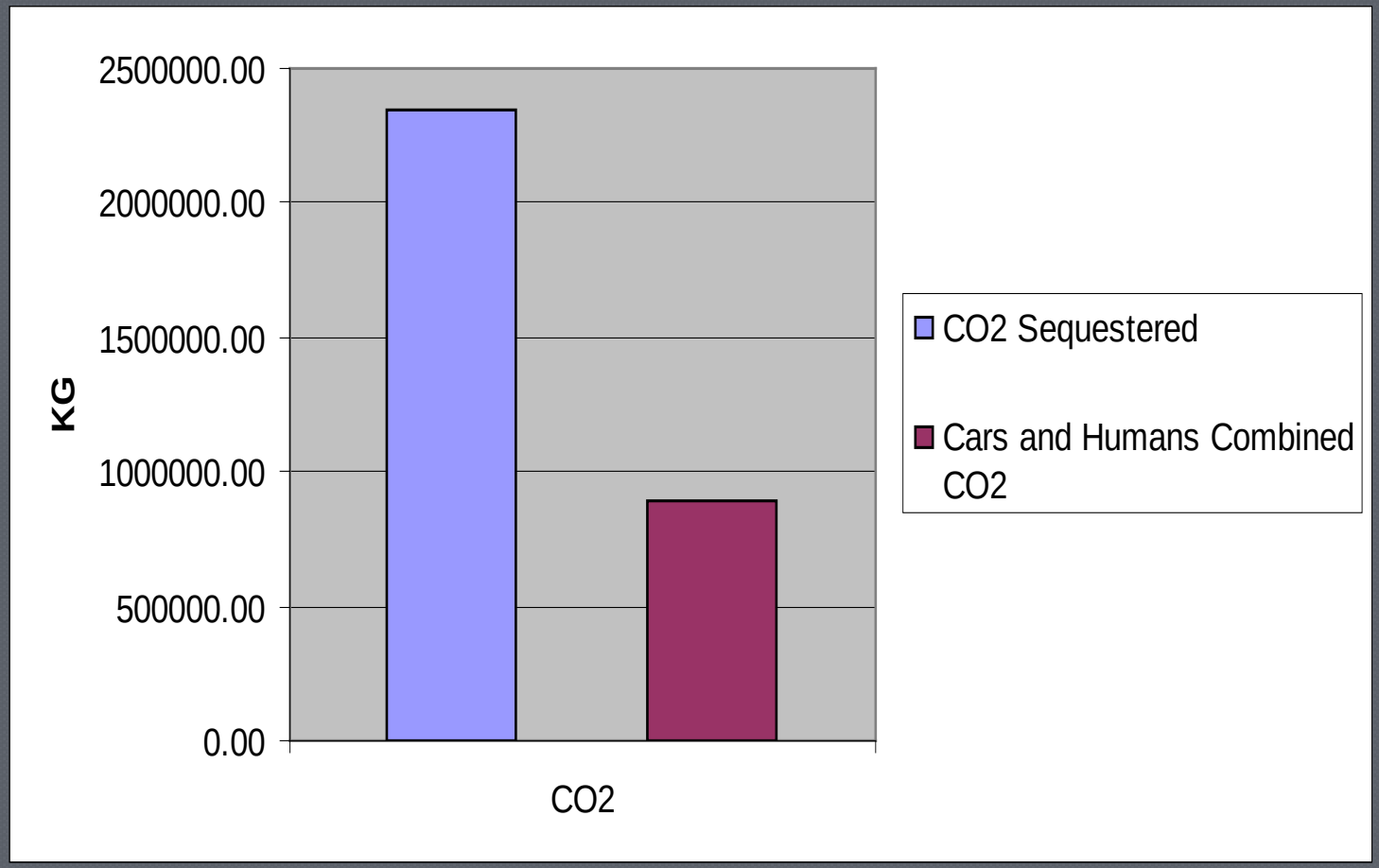
Tilden Area


CO2 Ballance from only People
7000000.00
6000000.00
5000000.00
4000000.00
3000000.00
2000000.00
1000000.00
0.00
Kg
CO2 ballance
CO2 sequestered
Human CO2

Cars and People



Church Ave area



What do you think?

- Is our data accurate?
- Is there anything else we should consider?
- What can we conclude with this data?
- Do changes need to be made?