

The Impact of the arrival of Europeans in the Americas on the Carbon Cycle

The Great Dying of the Indigenous Peoples of the Americas resulted in a human-driven global impact on the carbon cycle in the two centuries prior to the Industrial Revolution. The abandonment of 56 million ha of land in the 1500s following the deaths of 55 million people would have resulted in widespread vegetation succession coupled with a decrease in human driven fire activity. The carbon uptake by regenerating vegetation that is thought to have occurred following the arrival of epidemics in the Americas may have reduced atmospheric CO₂ levels which contributed to the coldest part of the Little Ice Age.

1) Roughly indicate the outline of these regions on the map below:

North America

Caribbean

Inca Territory: current Peru, Bolivia, Ecuador, southern Colombia, Chile and parts of north-western Argentina

Central America: current Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama

Mexico

Amazonia: The vast drainage basin of the Amazon and contiguous forested areas

Rest of the Americas: Venezuela, Uruguay, Paraguay and Argentina



Region	Arable land 1500 (million ha)	Arable land 1600 (million ha)	Land use change (million ha)	% land use change
North America	6.6	0.858		
Caribbean	0.5	0.005		
Central America	4.5	0.45		
Mexico	21	1.47		
Inca kingdom	20	1.4		
Amazonia	6	0.6		
Remainder of Americas	2.2	0.22		
TOTAL:				-----

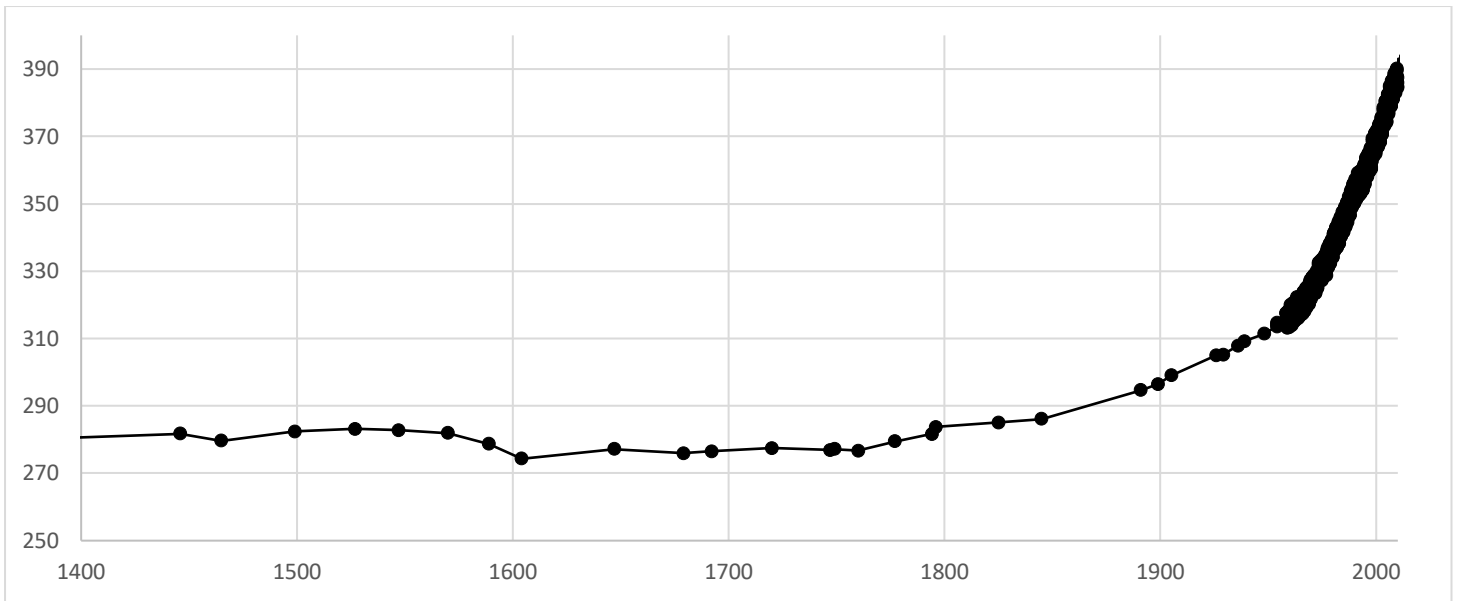
- 2) Complete the table by filling in the last two columns.
- 3) On the map, shade the regions to illustrate the % land use change
- 4) Calculate the mean, mode and median land use change:

Mean: _____ Mode: _____ Median: _____

- 5) What is the most useful average to look at in this situation? Why?

- 6) “The above ground biomass of tropical forest in Amazonia is 161 MgC ha^{-1} ; fourteen times greater than maize cropland.” Assuming that all the land use change involved maize cropland regenerating into tropical forest, how much carbon does this imply was taken up by the vegetation?

- 7) What changes to the other carbon stores in the climate system might you expect to see?



Atmospheric CO₂ (ppm) from 1400 – 2010

(data from Law Ice Dome <https://cdiac.ess-dive.lbl.gov/ftp/trends/co2/lawdome.combined.dat> and Mauna Loa <https://www.esrl.noaa.gov/gmd/ccgg/trends/data.html>)

- 8) With reference to the above graph, describe the impact of vegetation changes on the carbon stored in the atmosphere over time. Refer to both your existing knowledge of the carbon cycle and the information contained above.