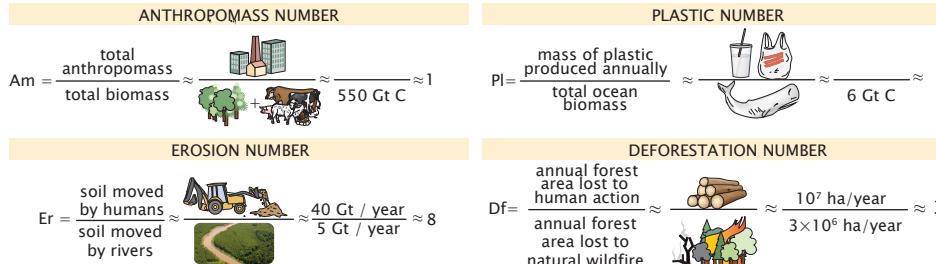


# HUMAN IMPACTS by the numbers

Griffin Chure<sup>1</sup>, Avi Flamholz<sup>2</sup>, Nicholas Sarai<sup>3</sup>, Tine Valencic<sup>1</sup>, and Rob Phillips<sup>2,4,\*</sup><sup>1</sup>Department of Applied Physics, California Institute of Technology, Pasadena, CA, 91125<sup>2</sup>Division of Biology and Biological Engineering, California Institute of Technology, Pasadena, CA, 91125<sup>3</sup>Division of Chemistry and Chemical Engineering, California Institute of Technology, Pasadena, CA, 91125<sup>4</sup>Department of Physics, California Institute of Technology, Pasadena, CA, 91125ALPHABETICAL ORDERING -- SUBJECT TO CHANGE  
CHECK AVITINE AFFILIATION

INCLUDE RON, YINON, HAMZA?

## THE ANTHROPOCENE BY THE NUMBERS



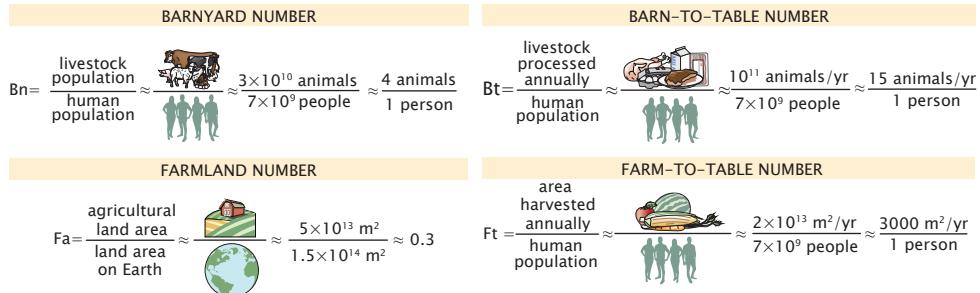
## SUMMARY

 Total anthropomass (non-biological mass of human origin) is approximately equal to the planetary biomass.

 Humans rival natural processes as the planets' most significant geomorphological agent, moving  $\approx 40 \text{ Gt}$  of soil annually.

 Annual forest loss due to human activity (including agriculture, logging, and forestry) is  $\approx 3$  times larger than that due to wildfires of natural origin.

## AGRICULTURE BY THE NUMBERS



## SUMMARY

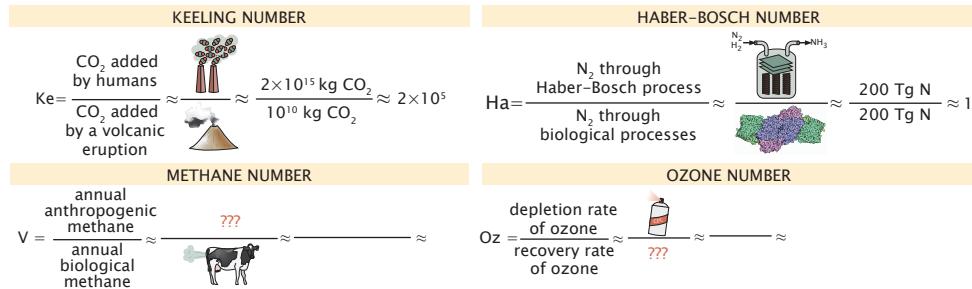
 At a population of  $\approx 30$  billion, agricultural animals outnumber the human population by a factor of 4. Chickens alone account for  $\approx 65\%$  of the livestock population.

 The generation of animal products requires  $\approx 15$  animals per person per year.

 Land used for agriculture, both in terms of harvest and animal husbandry, accounts for  $\approx 30\%$  of Earth's total land area.

 The plant-based diet of most humans requires  $\approx 3000 \text{ m}^2$  or  $\approx 1$  acre of land per year. Harvests of cereals, wheat, and corn account for  $\approx 50\%$  of harvested cropland.

## ATMOSPHERIC EMISSIONS BY THE NUMBERS



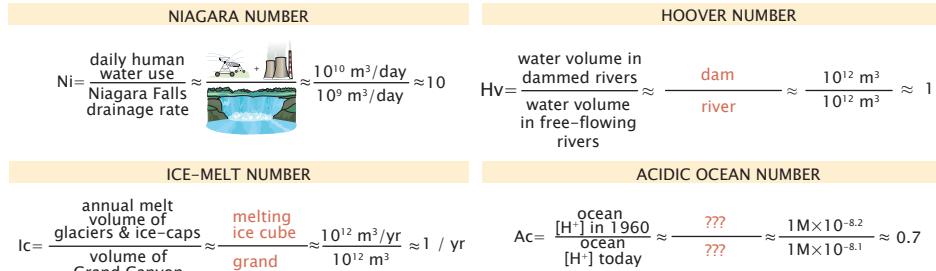
## SUMMARY

 Humans have released  $1500 \text{ Gt}$  of  $\text{CO}_2$ , equal to  $\approx 200,000$  large volcanic eruptions. Of this, 40% is absorbed by the ocean, leading to a net increase of  $\approx 1000 \text{ Gt}$  of atmospheric  $\text{CO}_2$ .

 XX methane number description

 ozone number description. Comment on ability to respond

## WATER BY THE NUMBERS



## SUMMARY

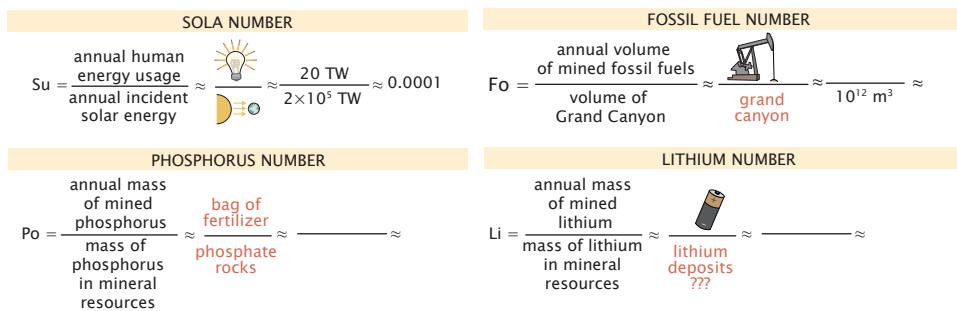
 Daily human fresh water usage is equivalent to the daily discharge of 10 Niagara Falls or 1 Amazon river.

 Around half of the world river volume is used in the generation of hydroelectric power. The Amazon alone accounts for  $\approx 25\%$  of the global free-flowing (undammed) river volume.

 Increasing global temperature leads to a volume of  $\approx 1000 \text{ km}^3$  of water released per year from glaciers, permafrost, and ice caps, a volume comparable to that of the Grand Canyon.

 Over the past sixty years, increased  $\text{CO}_2$  in the atmosphere has decreased the pH of the ocean by  $\approx 0.1 \text{ pH units}$ , corresponding to a  $\approx 30\%$  increase in  $\text{H}^+$  concentration.

## RESOURCE EXTRACTION BY THE NUMBERS



## SUMMARY

 Total human energy usage is  $\approx 0.01\%$  of the solar energy incident on the planet.

 Fossil fuels (crude oil and natural gas) is responsible for XX% of the global energy usage. Mining produces XX  $\text{m}^3$  per year, comparable to XX the volume of the Grand Canyon.

 xx phosphorus number description

 xx lithium number description