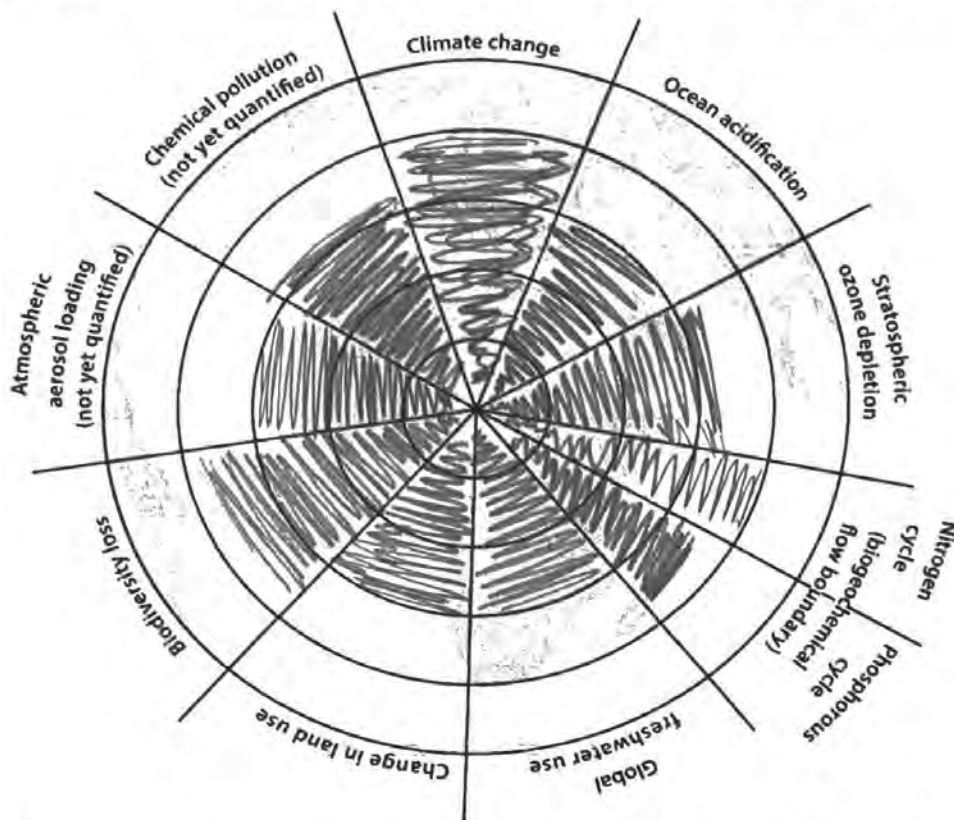


Directions

Each of the terms along the outside of the figure below represents a "planetary boundary" that the authors of our upcoming paper argue must not be transgressed to prevent human activities from causing unacceptable environmental change. These boundaries thus define the safe operating space for humanity with respect to the Earth system and are associated with the planet's biophysical processes.

1. Draw the average predication among your group members for each of the planetary boundaries



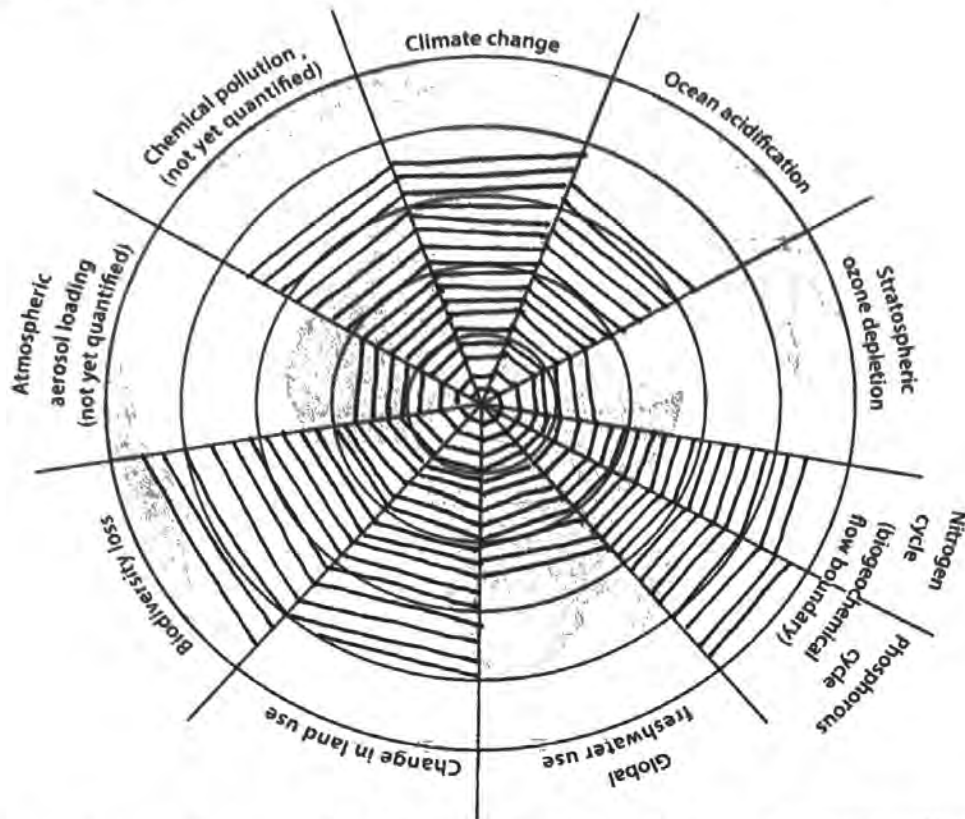
2. Identify the three largest discrepancies between your predictions and that presented by the authors. What processes or patterns were used to explain the current position of where we are along these three boundaries?

Planetary Boundary	Current Position according to Rockstrom et al. (%)	Explanation Presented in the Paper
Phosphorous cycle	relatively low (~50%) (still high)	have not reached the threshold, but ~8x the natural amount is flowing into the oceans each year
biodiversity loss	very high, out of the threshold	many of the other boundaries affect biodiversity, such as land use on terrestrial organisms & pollution on aquatic organisms
Nitrogen cycle	very high, surpassed the threshold	creation of fixed N via the Haber-Bosch process, we use & input a ridiculous amount of nitrogen

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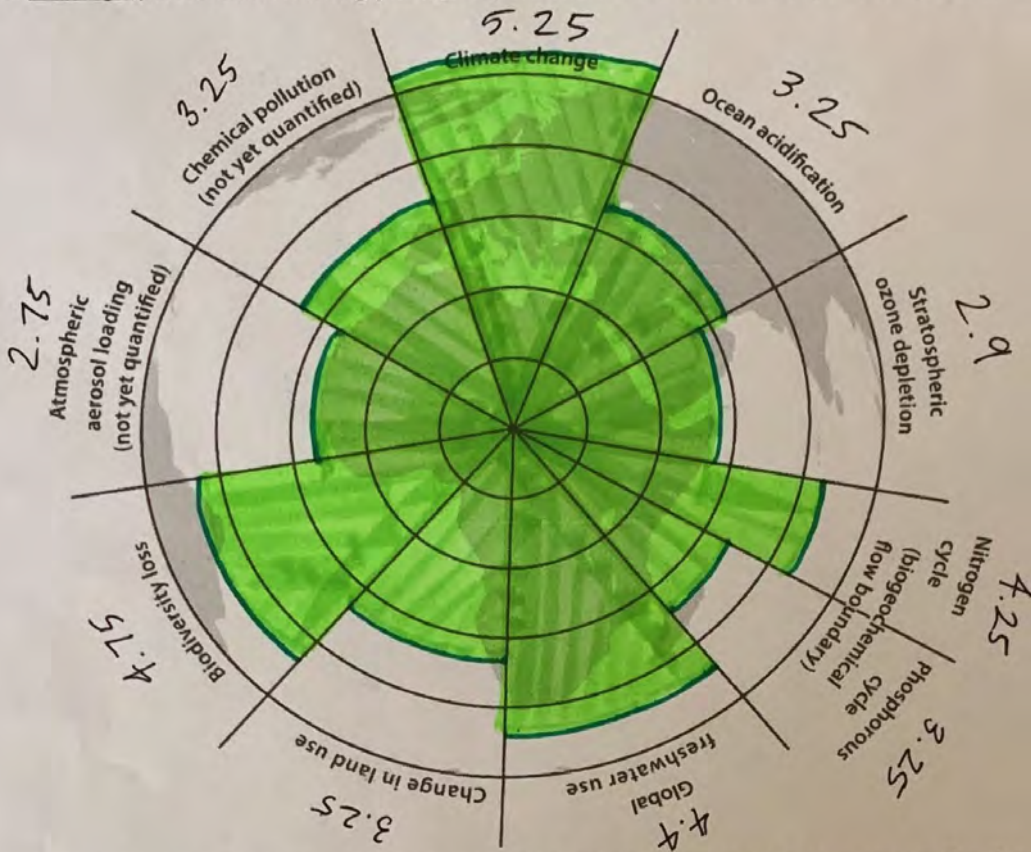
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Planetary Boundary	Current Position according to Rockstrom et al. (%)	Explanation Presented in the Paper
Phosphorus Cycle	18%	The amount of phosphorus brought into flux by humans is still within the bounds of being reversible.
Change in land use	22%	Change in land use does not exceed the reversible limit.
Ocean acidification	30%	The global mean saturation rate of aragonite and surface seawater give acidification rates within reversible bounds.

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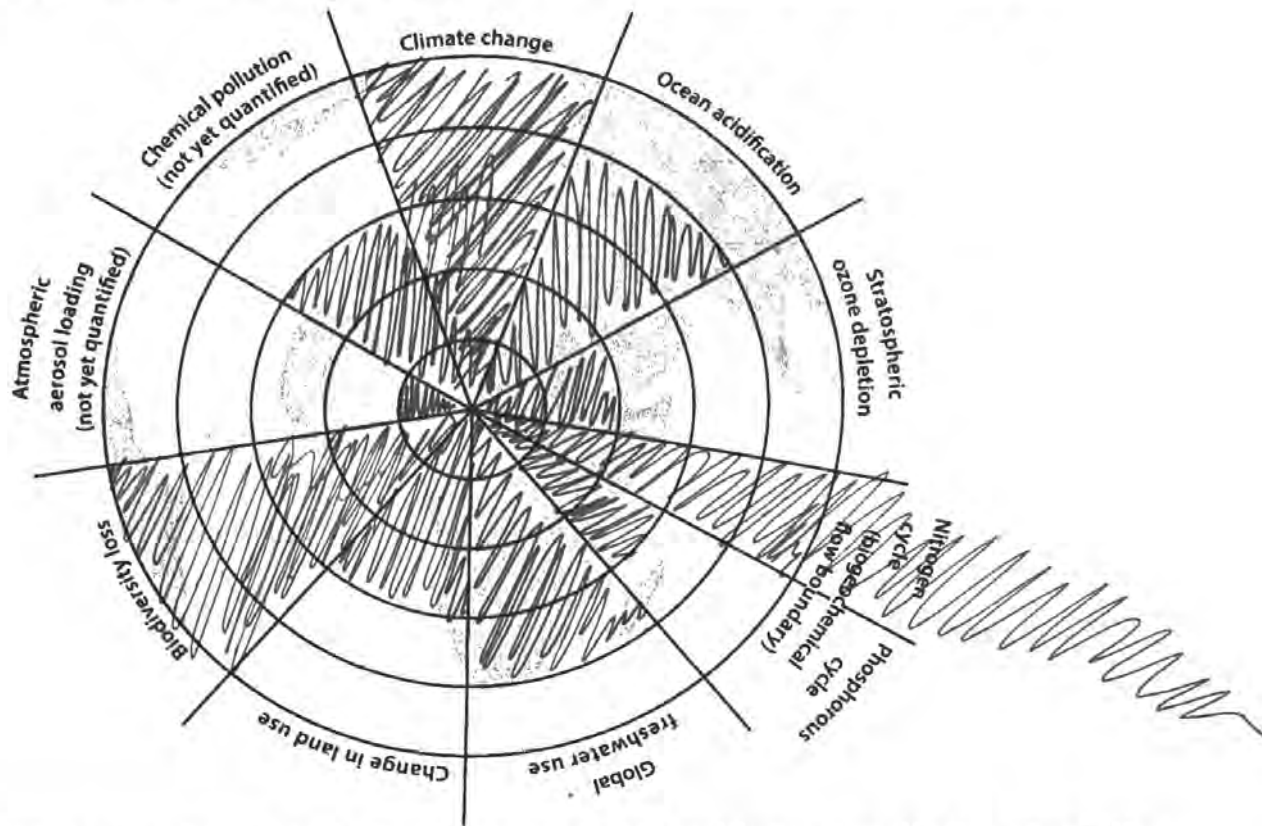
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Planetary Boundary	Current Position according to Rockstrom et al. (%)	Explanation Presented in the Paper
Nitrogen	current 121 proposed boundary 35	Humans fixing Nitrogen faster than global scale can handle. Fixing N for fertilizer (feeding growing pop.)
Biodiversity	over 100 / 100	Biodiversity loss due to habitat degradation, duration/freq. in wildfires, + invasive species.
Fresh water use	2,600 / 4,000	- loss of soil moisture bc land degradation/deforest. - use and shift in runoff volumes/patterns - climate regulation due to decline in moisture feedback of vapor flows affecting local and regional precip. patterns

Directions

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1. Draw the average predication among your group members for each of the planetary boundaries



2. Identify the three largest discrepancies between your predictions and that presented by the authors. What processes or patterns were used to explain the current position of where we are along these three boundaries?

Planetary Boundary	Current Position according to Rockstrom et al. (%)	Explanation Presented in the Paper
Global Freshwater use	65%	It was not discussed in the paper, but we overestimated it because we believed the increase in population size has greatly decreased freshwater availability.
Ocean Acidification	105.5%	It wasn't discussed in the paper, but we believed ocean acidification was higher because there has been a large increase in CO ₂ levels. The buffer system may be why it has not reached its threshold yet.
Biodiversity	>1000%	Normally 0.1-1 for man and 0.2-0.5 for mammals - now estimated is 100-1000 times more than natural