*EES004 – Science of Environmental issues*

*Homework for Complexity*

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**INSTRUCTIONS**

**(1) Listen to the TED talk by Johan Rockström on the 9 planet boundaries.**

You can stream it online or download it to your computer here: <http://www.ted.com/talks/johan_rockstrom_let_the_environment_guide_our_development.html>

This talk is very rich in important content. The beauty of talks you stream online or download to your computer is that, contrary to listening to a live lecture, you can PAUSE it, REWIND it, and LISTEN TWICE (or more!) to it. Take advantage of these advantages; I know I did.

The speaker will be referring to a scientific article that was published in Nature in 2009 and that describes the 9 planet boundaries. I’ve added the article to Course Site (Rockstrom\_2009\_Nature\_planetary\_boundaries\_human\_activity.pdf); reading it should help you understand the content of the talk. It is very well written and the concepts are well explained.

There is also a Wikipedia page on the 9 planet boundaries; you can familiarize yourself with the topic there: <http://en.wikipedia.org/wiki/Planetary_boundaries>

**(2) Read the Science article by Steven Running on the 10th planet boundary.**

You can download it from Course Site (Running\_2012\_Science 10th planetary boundary for biosphere.pdf).

**(3) Choose 1 of the 4 following planet boundaries (circle your choice):**

. #1 Climate change (increasing atmospheric CO2 concentration)

. #2 Biodiversity loss

. #4 Ocean acidification

. #10 Earth’s carrying capacity (maximum net primary production, or NPP)

**(4) If/Once we reach the planet boundary you chose, what happens to our planet and/or to human societies? Present 5 consequences, and be ready to discuss them in class.** 5 points

1. Loss of major ice sheets

2. Accelerated sea-level rise

3. Abrupt shifts in forest and agricultural systems

4. Increase in global temperatures

5. Threatened ecological systems which leads to loss of biodiversity

**(5) Give an example of a positive feedback that accelerates the rate at which we might reach the planet boundary you chose.** 2.5 points

An example of how climate change increases globally is that as the atmospheric temperature rises, evaporation increases. This causes increased atmospheric water vapor concentration, which leads to an increase in global temperatures. The cycle then repeats. Each time the temperature increases, atmospheric carbon dioxide concentrations increases as well. As a result, the cycle amplifies climate change in a positive feedback loop.

**(6) Give an example of a negative feedback that reduces the rate at which we might reach the planet boundary you chose.** 2.5 points

An example of a negative feedback relating to climate change has to do with vegetation. As temperatures increase, the trees can grow larger. This will thus allow the trees to absorb more CO2. Once the trees die, there will be less CO2 absorbed and the temperature will increase again since more CO2 can go into the atmosphere. This can possibly stabilize climate change.

**(7) What do you think is the best way to ensure humans do not reach these planetary boundaries? Think about the following: Clean energy, Food and water security, Healthy ecosystems, Population growth. Be ready to discuss your thoughts in class.** 1 bonus point

The best way to ensure humans do not reach these planetary boundaries is through making clean energy and other environmental solutions cheaper to implement. Many of these problems still exist because businessmen and normal consumers would rather use the inexpensive option for themselves and have others worry about “being green”. If there were cheaper solutions instead of fossil fuels, everyone would switch to the alternatives that are better for the environment.