

# Sink or swim: A foundation course in sustainability for all by all

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**THE COLBERT REPORT**

## **THE WORD - SINK OR SWIM**

Clip • 6/4/2012

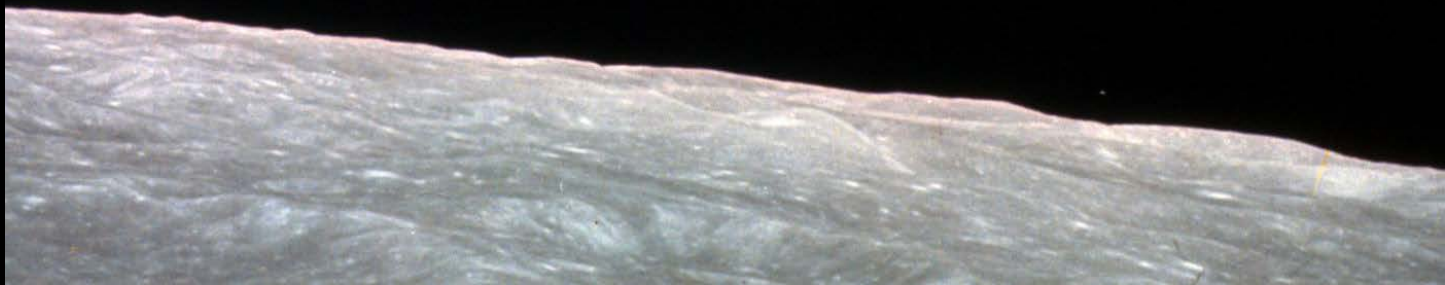
Scientists predict an economy-destroying, 39-inch sea level rise, but North Carolina drafts a law to make it eight inches.

*“the most influential environmental photograph ever taken”* –Galen Rowell

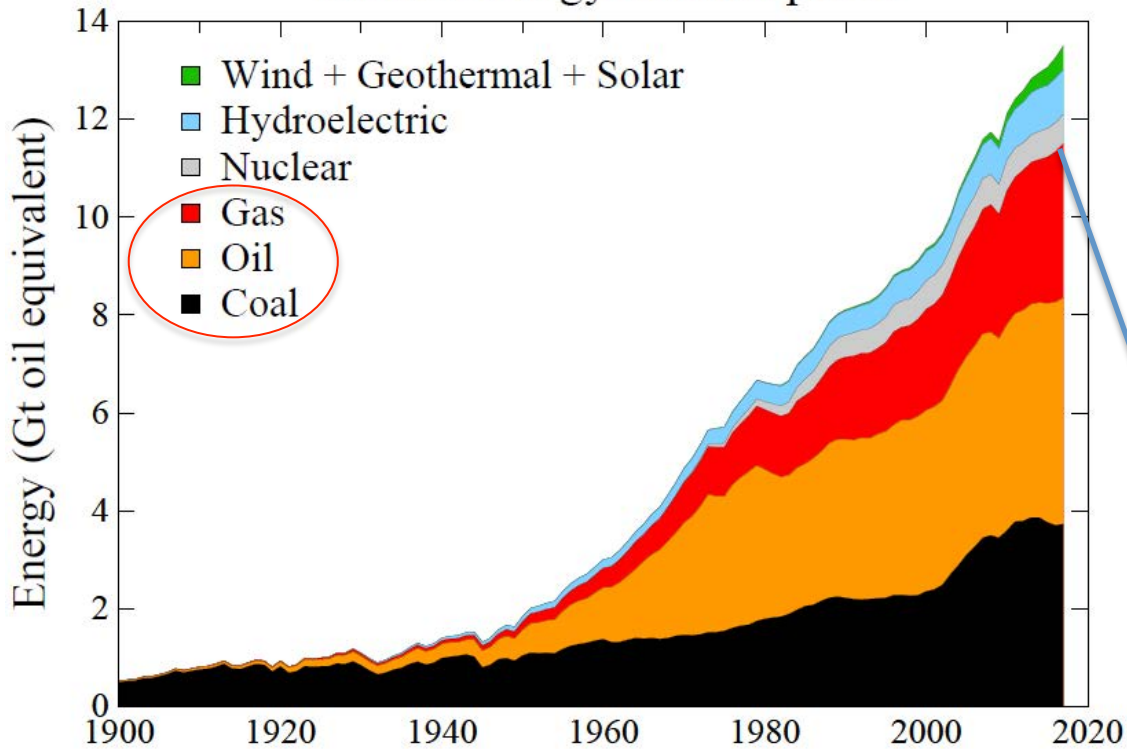
Planet A  
(photo taken  
1968/12/24)



	humans $\times 10^9$	emissions Gt C	CO <sub>2</sub> ppm	T <sub>s</sub> 1880-1920
1968	3.5	4	323	+0.25
2019	7.7	10	410	+1.1
2030	?	5?	?	+1.5?



## Global Energy Consumption



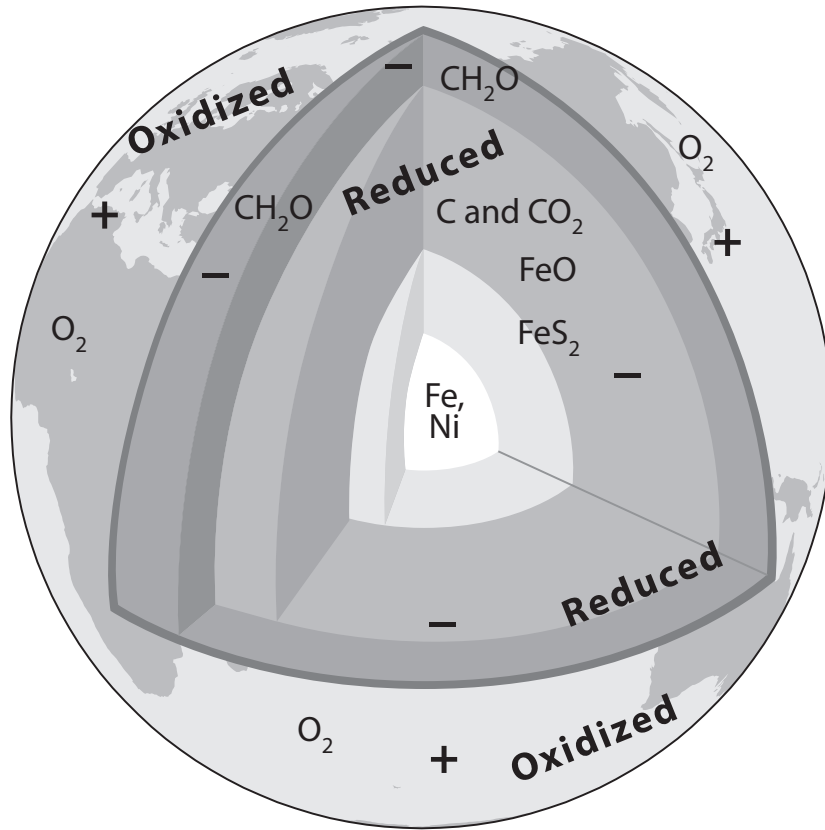
biodiversity

# humans

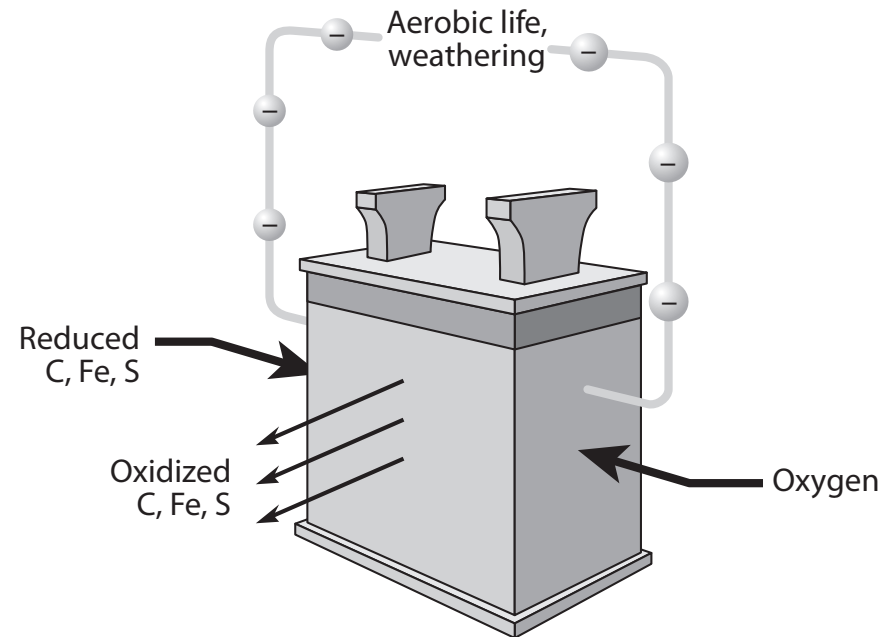
Clear definition of “problem” elusive

# We have short-circuited the planetary fuel cell

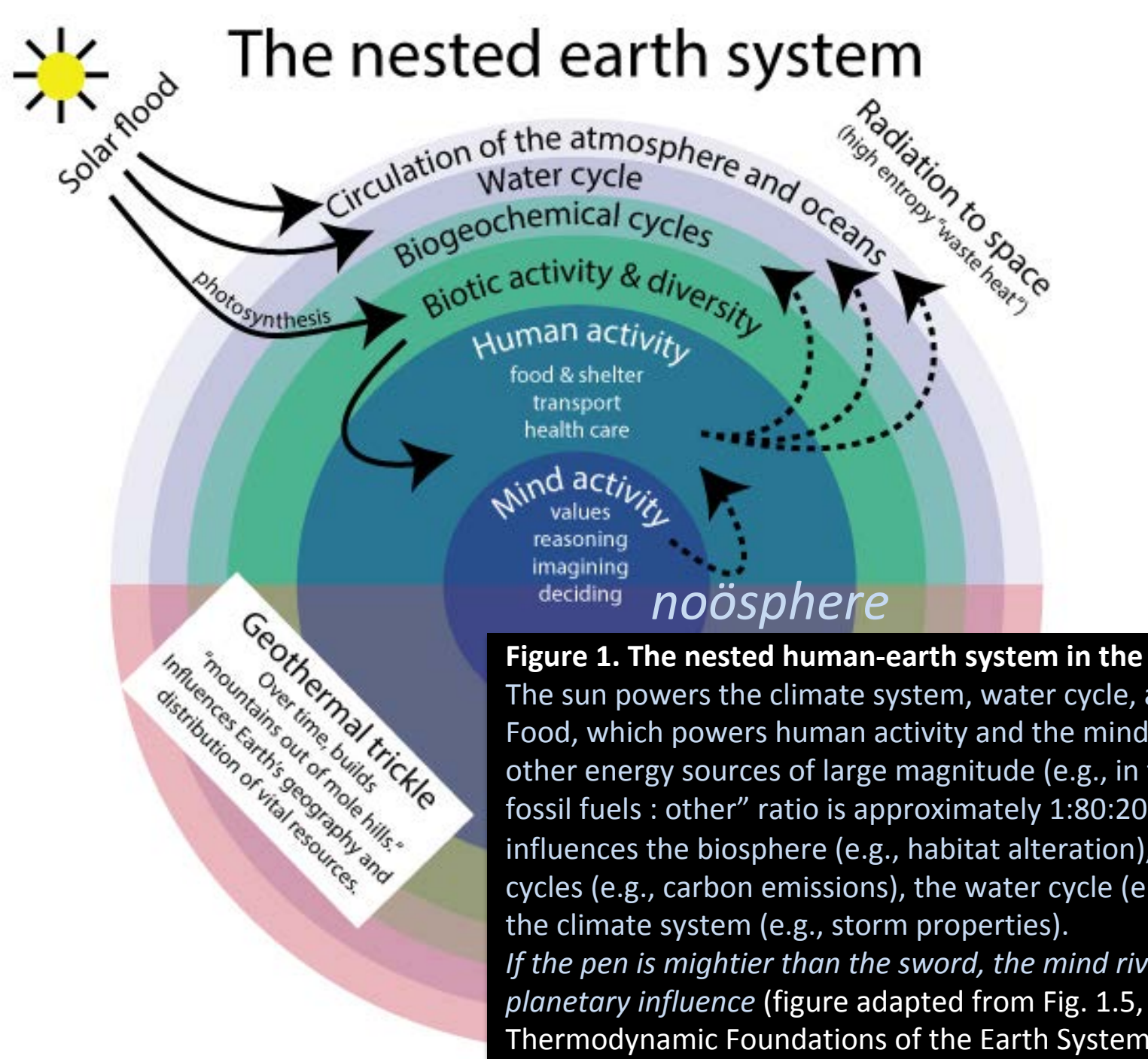
a) The planetary fuel cell



b) Modern Earth's fuel cell



(Langmuir & Broecker 2012)



As of 2019:  
7.7 billion  
people  
convert energy  
at >18 TW

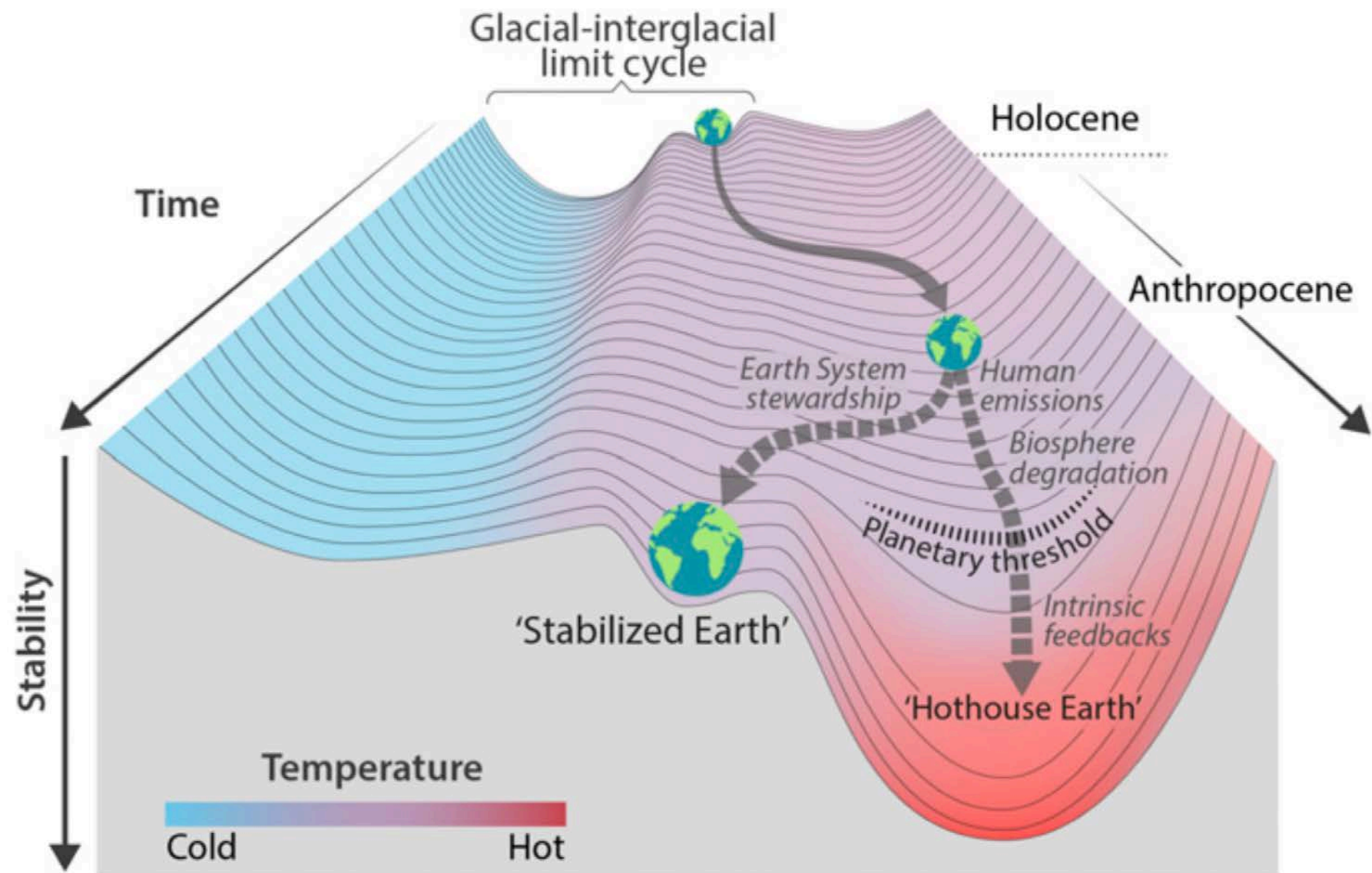
(What are the  
units of will  
power???)

**Figure 1. The nested human-earth system in the Anthropocene.**

The sun powers the climate system, water cycle, and photosynthesis. Food, which powers human activity and the mind, is supplemented by other energy sources of large magnitude (e.g., in the U.S., the "food : fossil fuels : other" ratio is approximately 1:80:20). Human activity influences the biosphere (e.g., habitat alteration), biogeochemical cycles (e.g., carbon emissions), the water cycle (e.g., irrigation), and the climate system (e.g., storm properties).

*If the pen is mightier than the sword, the mind rivals the sun in planetary influence* (figure adapted from Fig. 1.5, Kleidon, 2016, Thermodynamic Foundations of the Earth System).

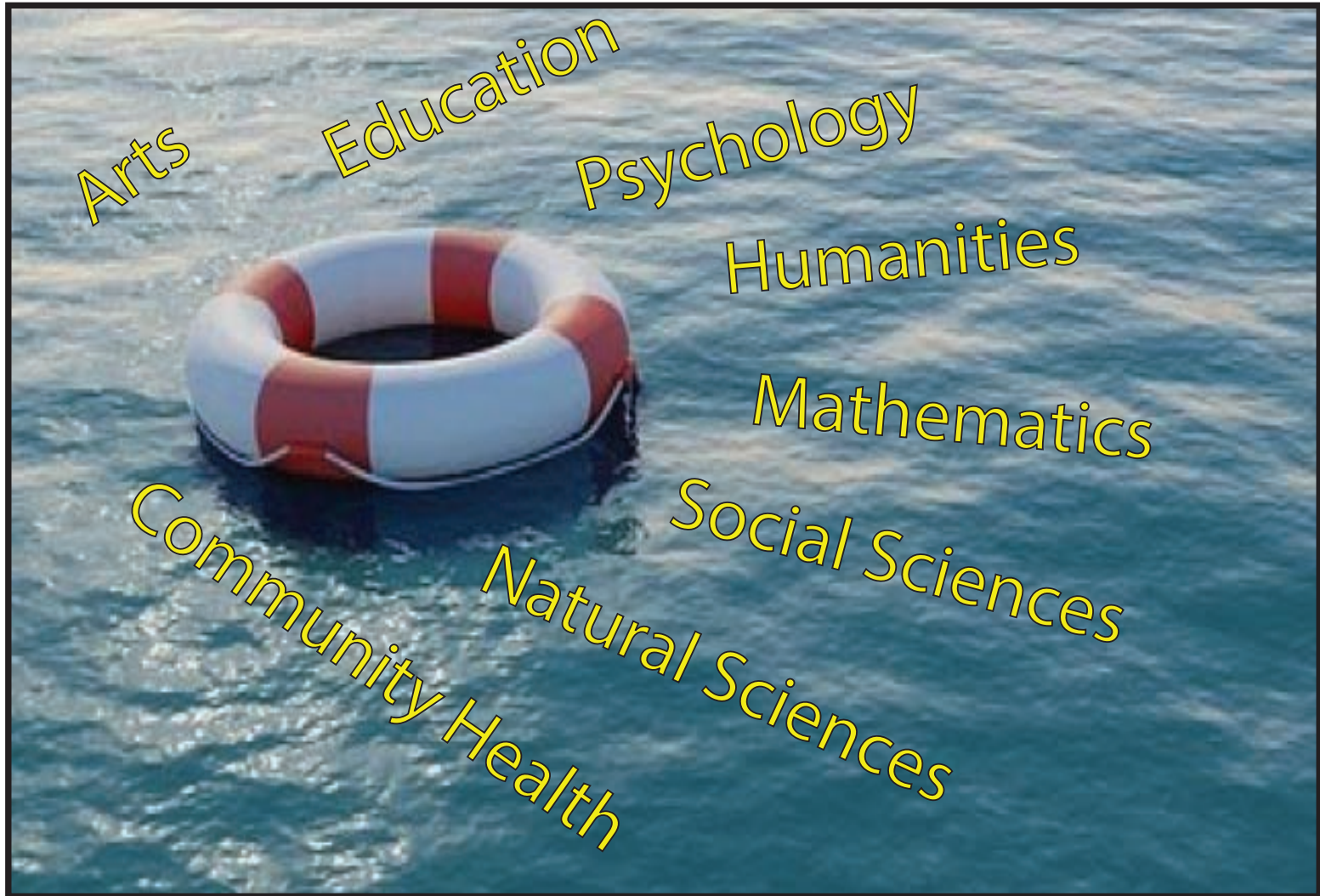




# Harness the noösphere?

- How can universities, ripe with faculty expertise and student energy, contribute?
- What if the vast majority of early college students, about to make critical life choices, were to acquire both a deep understanding of the problem and the resolve to enact solutions?

# All corners of campus “Lincoln’s cabinet”





# The “advisory council”



# On communicating (a model to emulate)

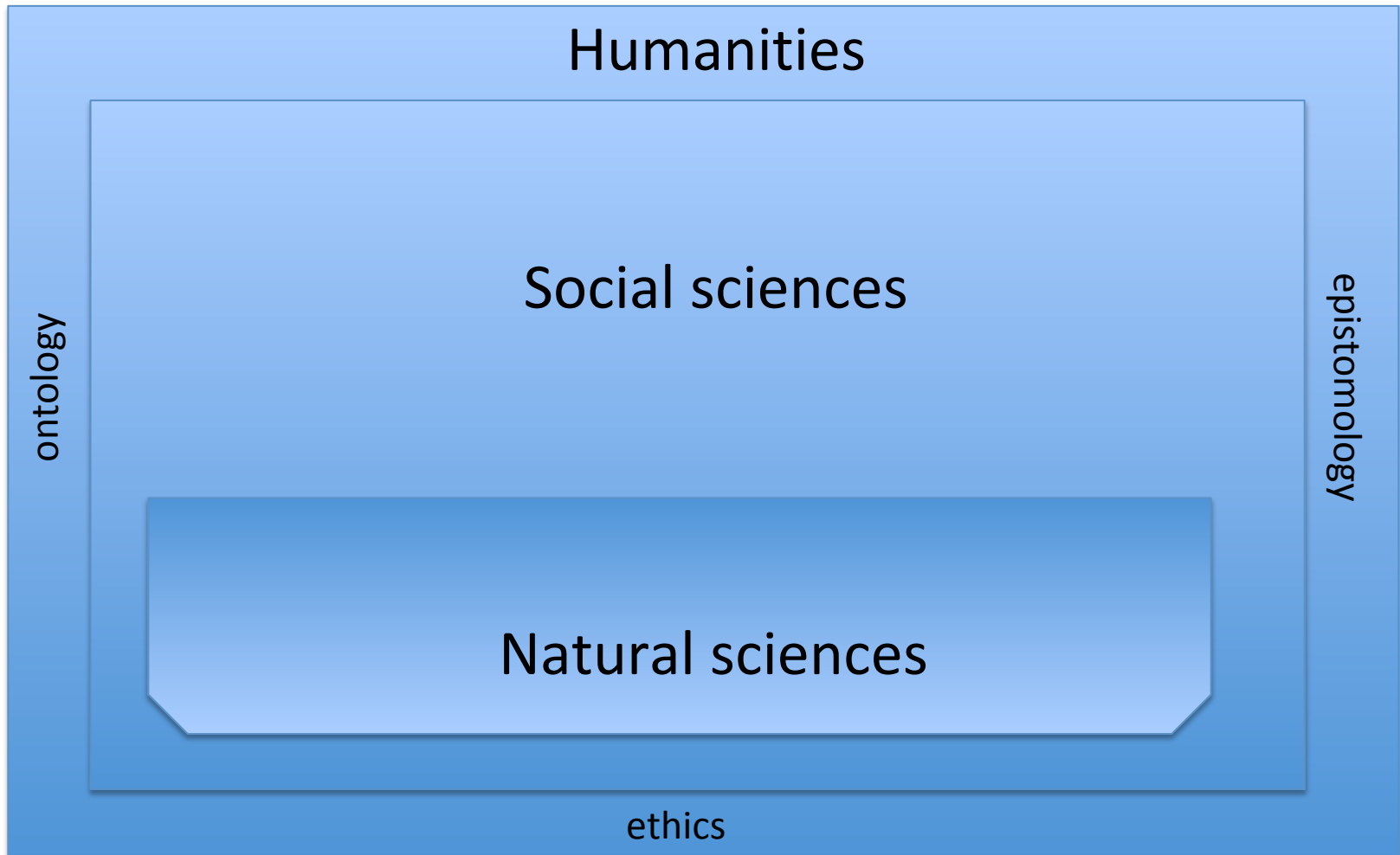
- The best part of the plate business is that it has made us all start communicating. People who squeeze rocks and people who identify deep ocean nannofossils and people who map faults in Montana suddenly all care about each others' work. I think I spend half my time just talking and listening to people from many fields, searching together for how it might all fit together. And when something does fall into place, there is that mental explosion and the wondrous excitement. I think the human brain must love order.

• Tanya Atwater

# On communicating (a model to emulate)

- The best part of the **sustainability crisis** is that it has made us all start communicating. People who squeeze rocks and people who identify deep ocean nannofossils and people who map faults in Montana suddenly all care about each others' work. I think I spend half my time just talking and listening to people from many fields, searching together for how it might all fit together. And when something does fall into place, there is that mental explosion and the wondrous excitement. I think the human brain must love order.
  - Tanya Atwater

# The structure





# 14-week semester

- Humanities
- Archeologist
- Energy
- Carbon cycle
- Ecologist 1
- Ecologist 2
- Quantifying
- Carbon pricing
- Project Drawdown
- Sustainable food
- Sustainable campus
- “Behavior”
- The artist
- Nature-based ed

# PEDAGOGY

“People affect people.”  
-Peter J. Coney



“The only rational way of educating is to be an example —of what to avoid if one can’t be the other sort.”

“Setting an example is not the main means of influencing others, it is the only means.”  
-A. Einstein

What can I do?

- \*exemplary footprint

- \*vote

- \*write letters/persuade

- \***educate (this effort)**

- \*research

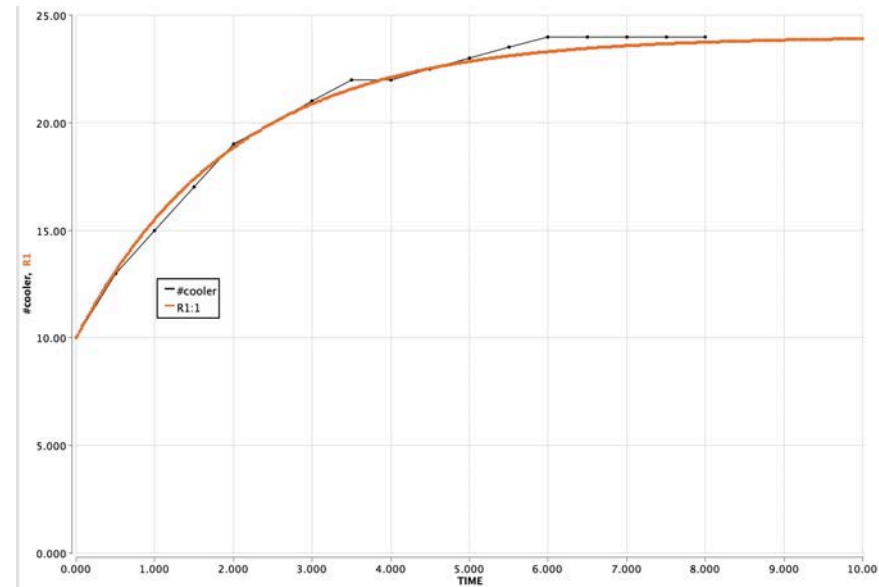
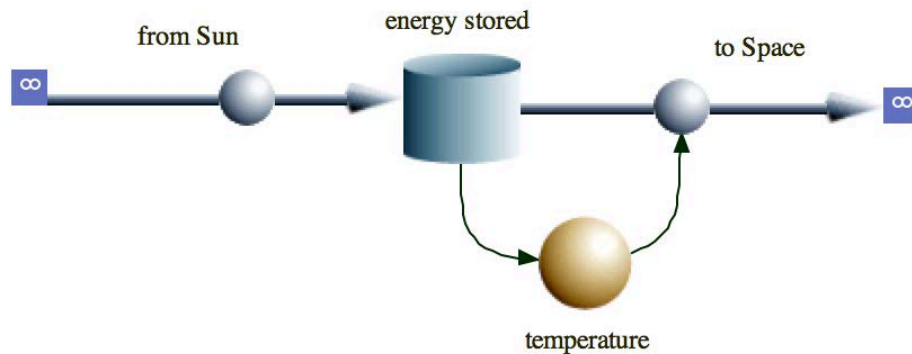
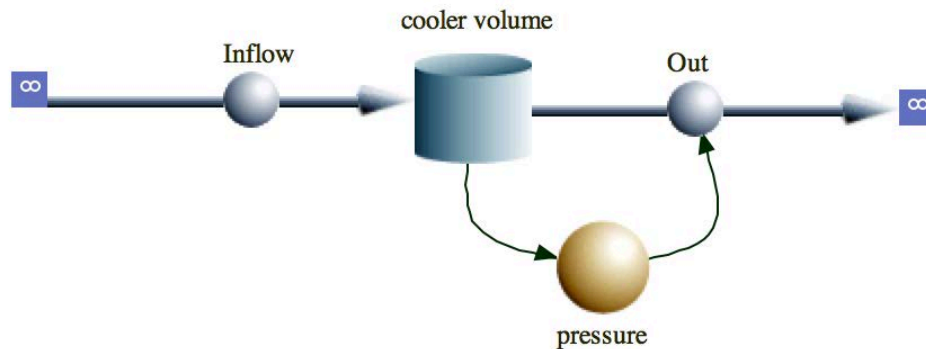
(e.g., Staten Island Project)



ZOOM

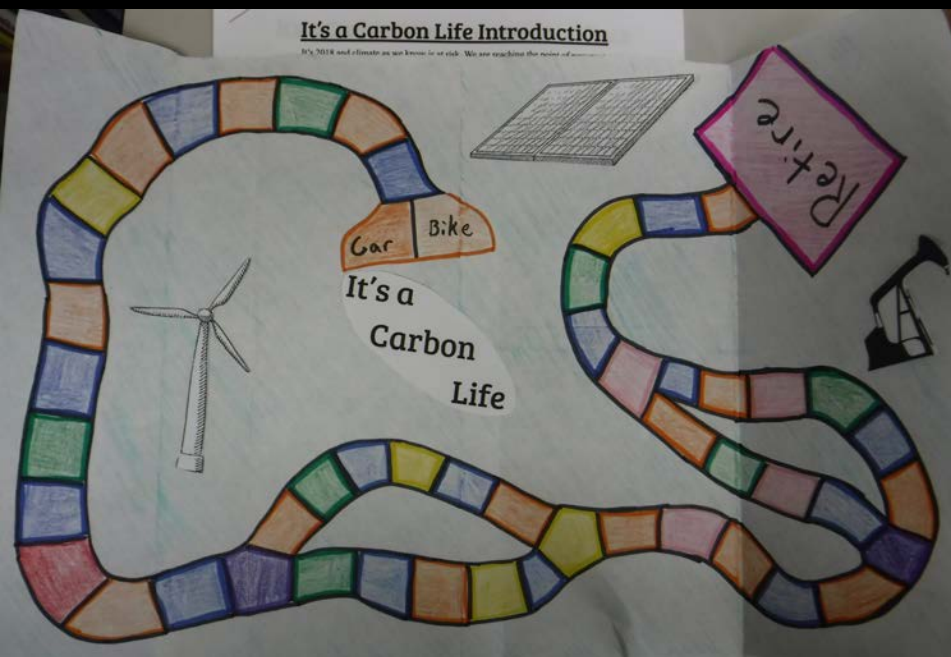
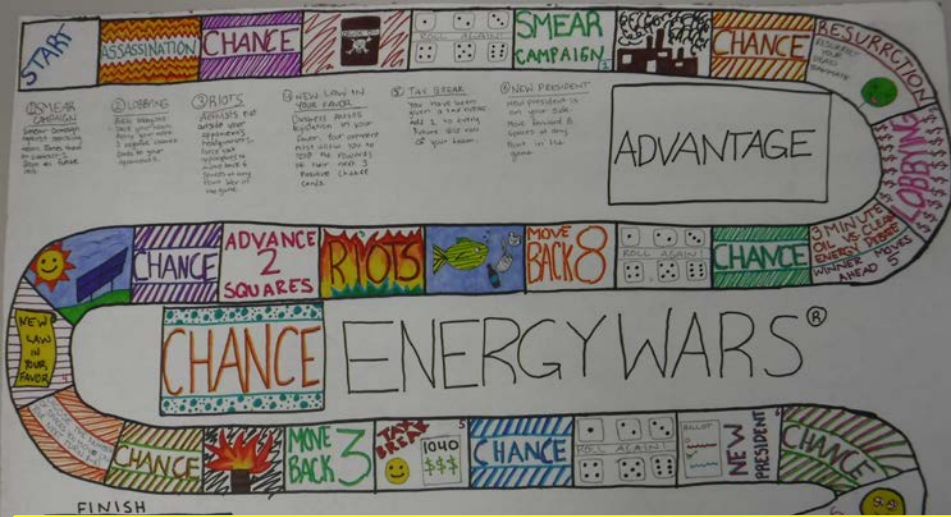
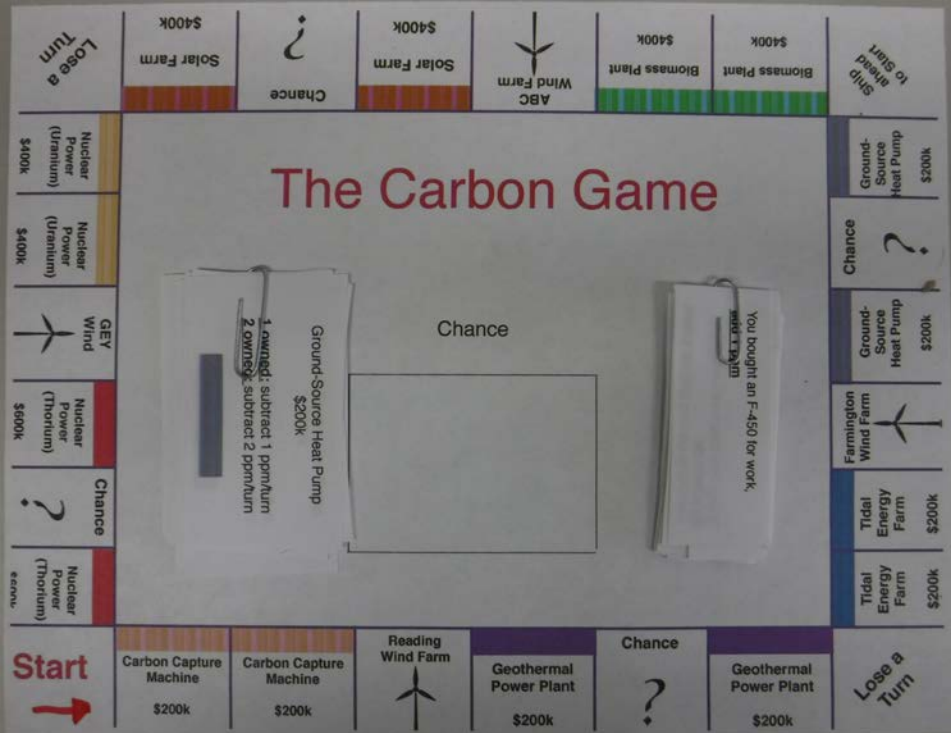
Before class, setting up for remote presentation by Karl Kreutz (Orono campus of UMS) on his ice core research and carbon cycle fundamentals. "It was like he was in the classroom!"

# Dynamical systems modeling



(Moore & Derry 1995, JGE)









# Student research



Solar (above), CMP “hydro” hearings (below)

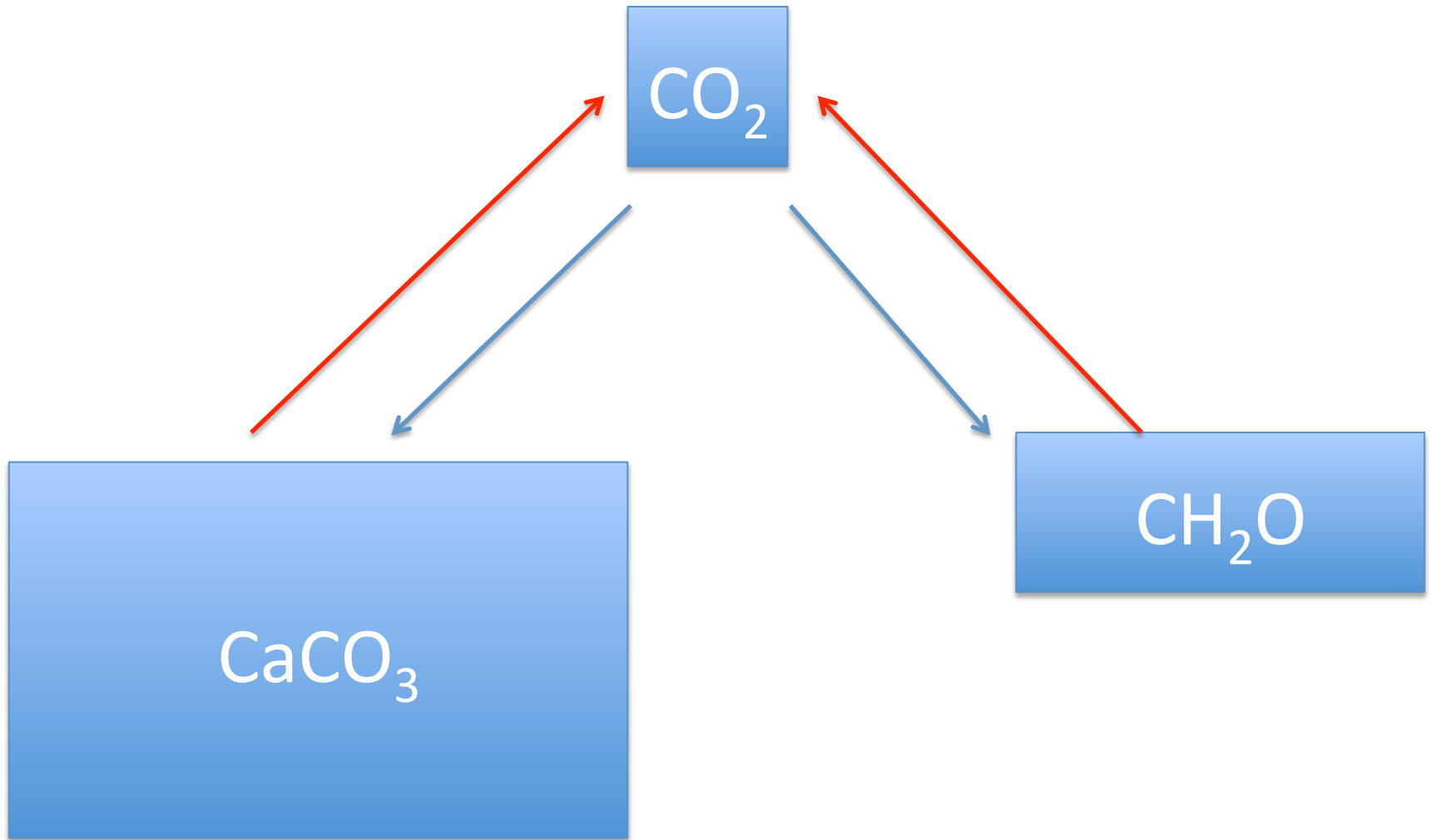
Wind (above), biomass (below)



# An ambitious goal

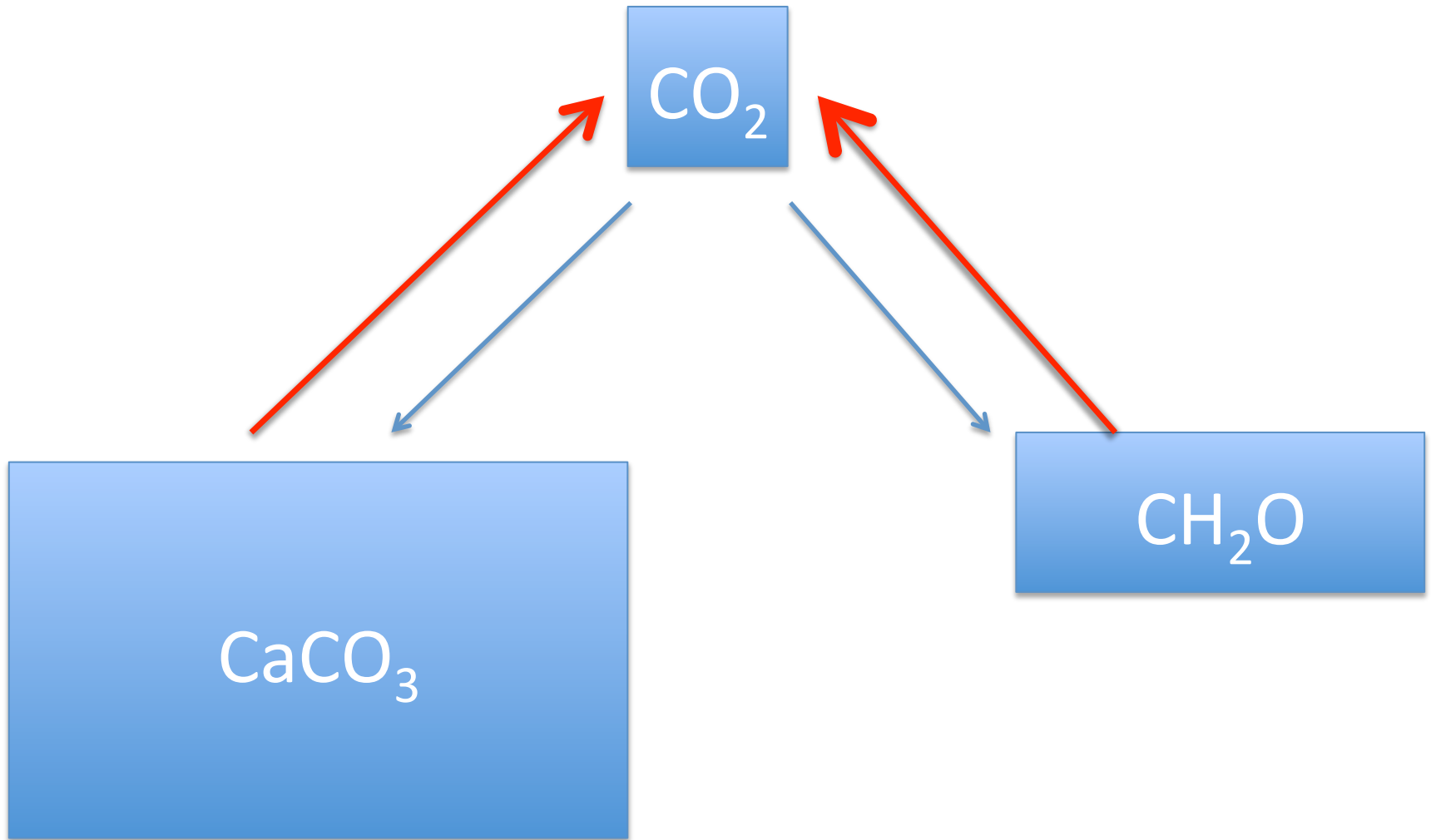
- The ultimate vision is a template that works when scaled up and exported to nourish a widespread culture of sustainability and earth stewardship.
- A first-year experience for every student?

## Long-term carbon cycles- BALANCED

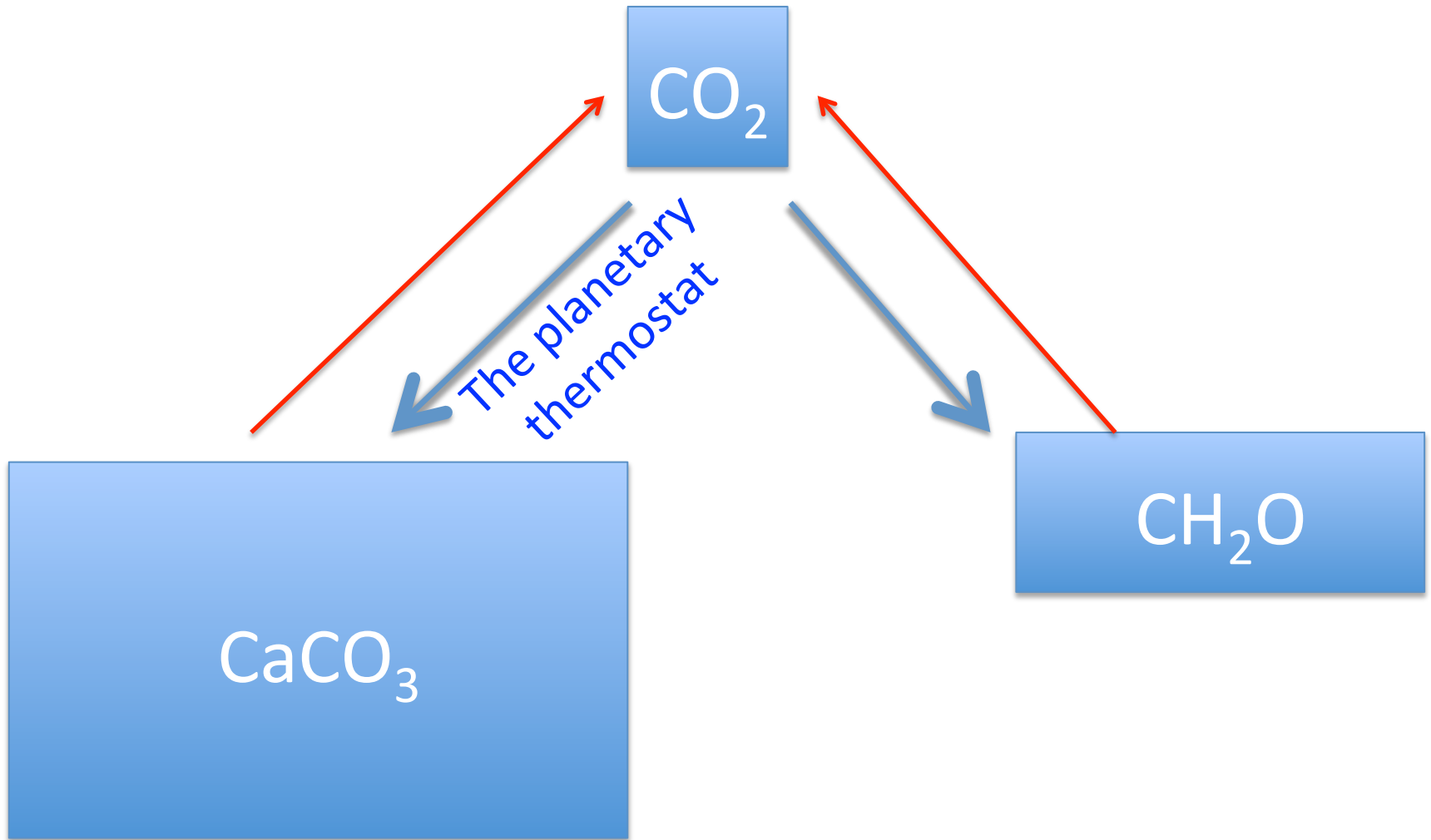




## Long-term carbon cycles- OUT OF BALANCE



Long-term carbon cycles- Turn down the sources, and increase the sinks.



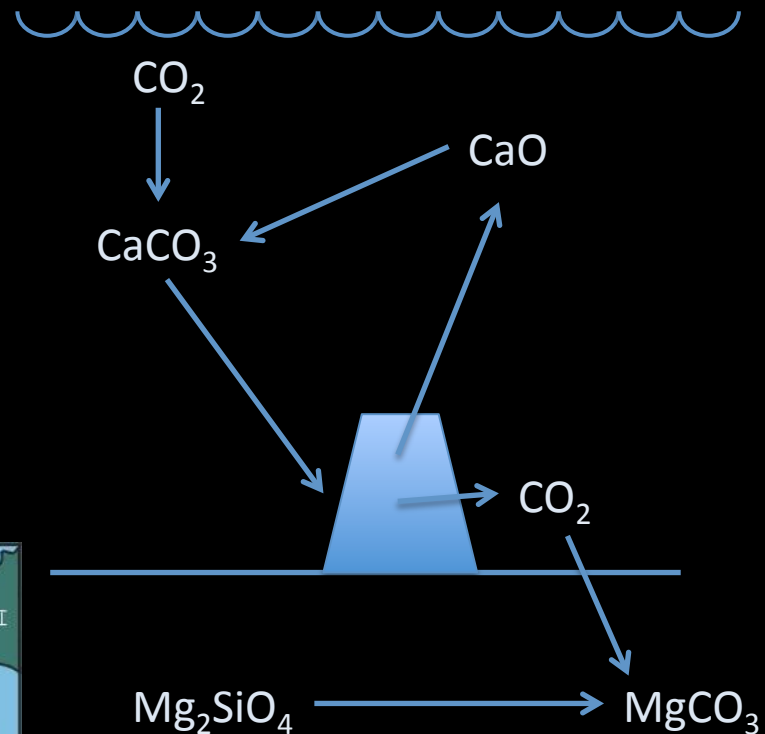
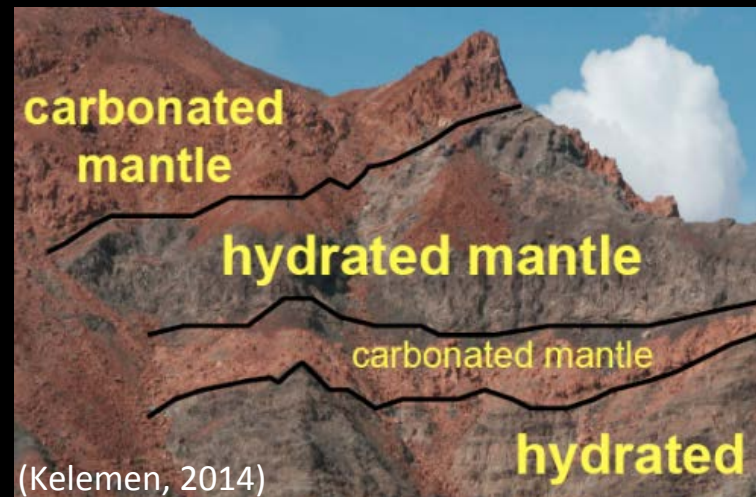
# STATEN ISLAND PROJECT

Remove  $\text{CO}_2$  from the atmosphere and store in carbonate minerals produced by reaction with ultrabasic silicates in the seafloor.

Lime produced in a submarine kiln collects dissolved carbon, and pure  $\text{CO}_2$  pumped into the seafloor drives the exothermic reaction, aided by self-cracking feedback, to completion.

Lost City carbonate chimney

Deb Kelley



# The Case for a Gaian Bottleneck: The Biology of Habitability (Chopra & Lineweaver 2016)

Could we be first in the universe to achieve planetary self control?

