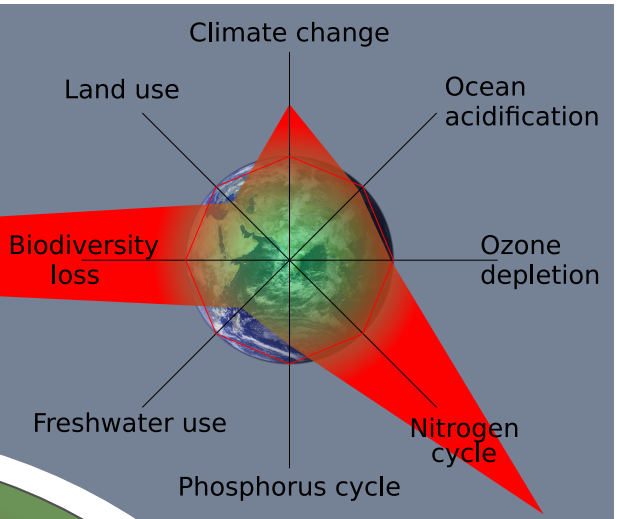
A planetary boundary is, 'a specific point related to a global-scale environmental process is [meant] beyond which humanity should not go', because this could hamper human development profoundly (Steffen et al. 2011: 2).

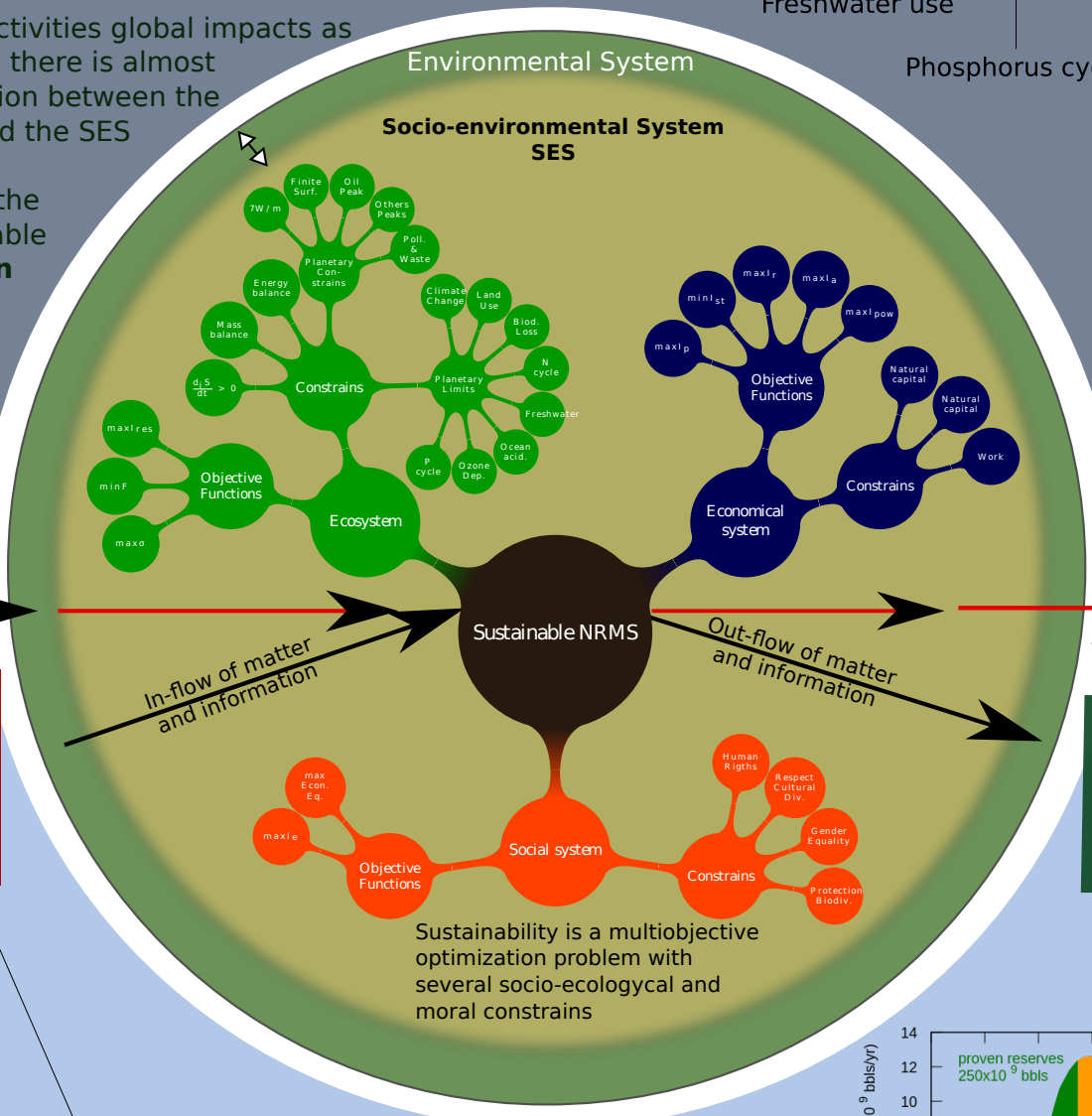


Climate Change impose a Planetary Boundary over the total amout of CO_2 ppm in the atmosphere. To avoid catastrophic effects the **CO2 must be <350ppm**

Due to human activities global impacts as Climate Change, there is almost no more distinction between the Environmental ad the SES

The CO2 is also the biophysical variable triggering **Ocean Acidification**

Sun light is a Planetary Constrain. It is the ultimate sustainable energy source.



Sustainability is ultimately a moral concept, a set of rules that allow people to live together in reasonable harmony between them and the other entities of the SES

Sunligth

$\langle\lambda\rangle \approx 500nm,\ S\downarrow,\ F\uparrow$

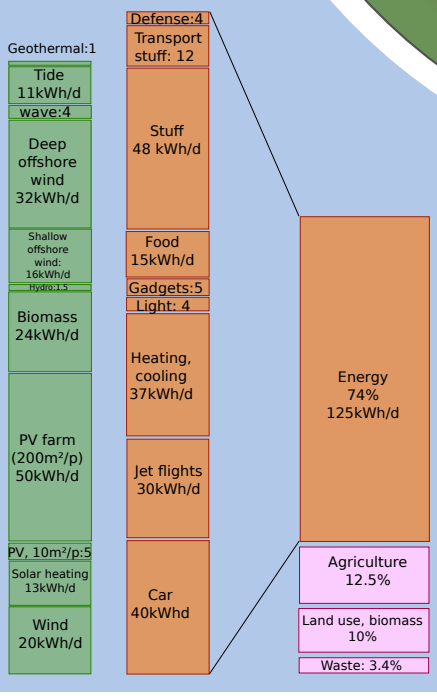
Earthligth

$\langle\lambda\rangle \approx 700nm,\ S\uparrow,\ F\downarrow$

Higher atmosphere 1366W/m2. Lower atmosphere ~ 1000W/m2

Maximum useful work is less than 7W/m²

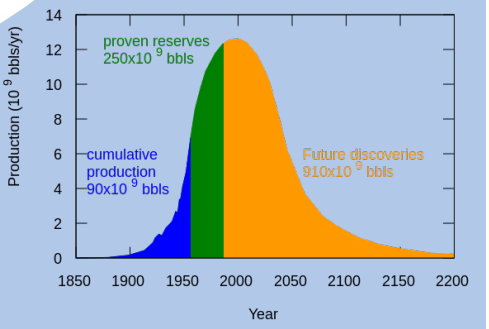
Sustainability involves solving wicked problems of deep complexity



A Planetary constrain is biophisical process that do not present a global scale threshold but it does impose limits to the global dynamics

Energy is a Planetary Constraint

The most significative contribution to Climate Change comes from the energy sector, which has several physycal limitations to be obtain from sustainable sources. Ultimatly maximum useful work is less than 7W/m²
Rith now we have a negative balance meaning energetic sustainability is not posible under the current lifestyle



Peak of materials as oil or metals impose some Planetary Constrains

The era of cheap high energetic oil is over. Oil energy return rate has gone from 100:1 in 1930 to 18-12:1 in 2007