



Novel entities

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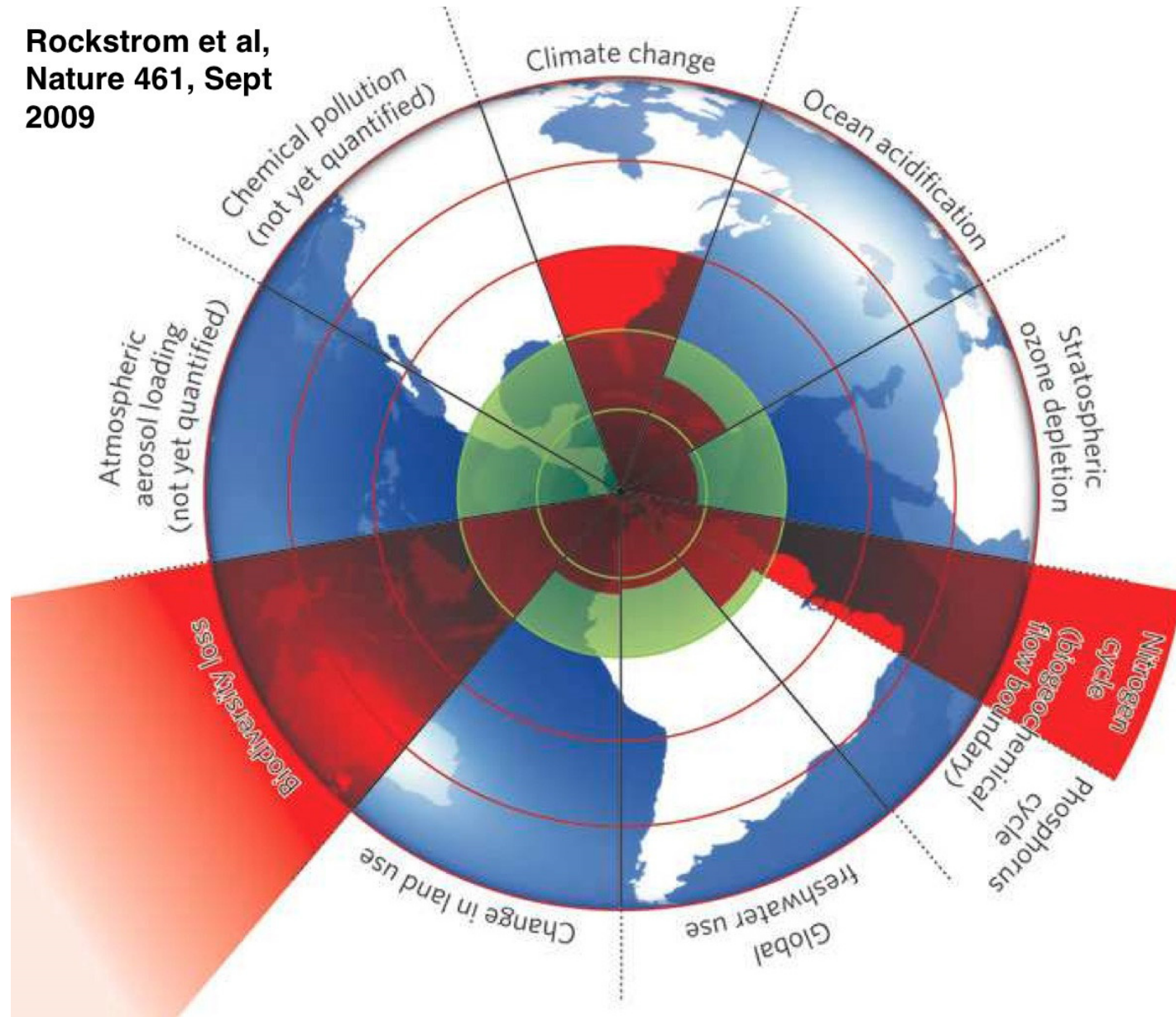
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The “novel entities” planetary boundary is
a placeholder for pollution-related
planetary boundary problems that we are
currently ignorant about.

Making the Planetary Boundaries Concept Work, Berlin, 24 April 2017

Novel entities (chemical pollution)

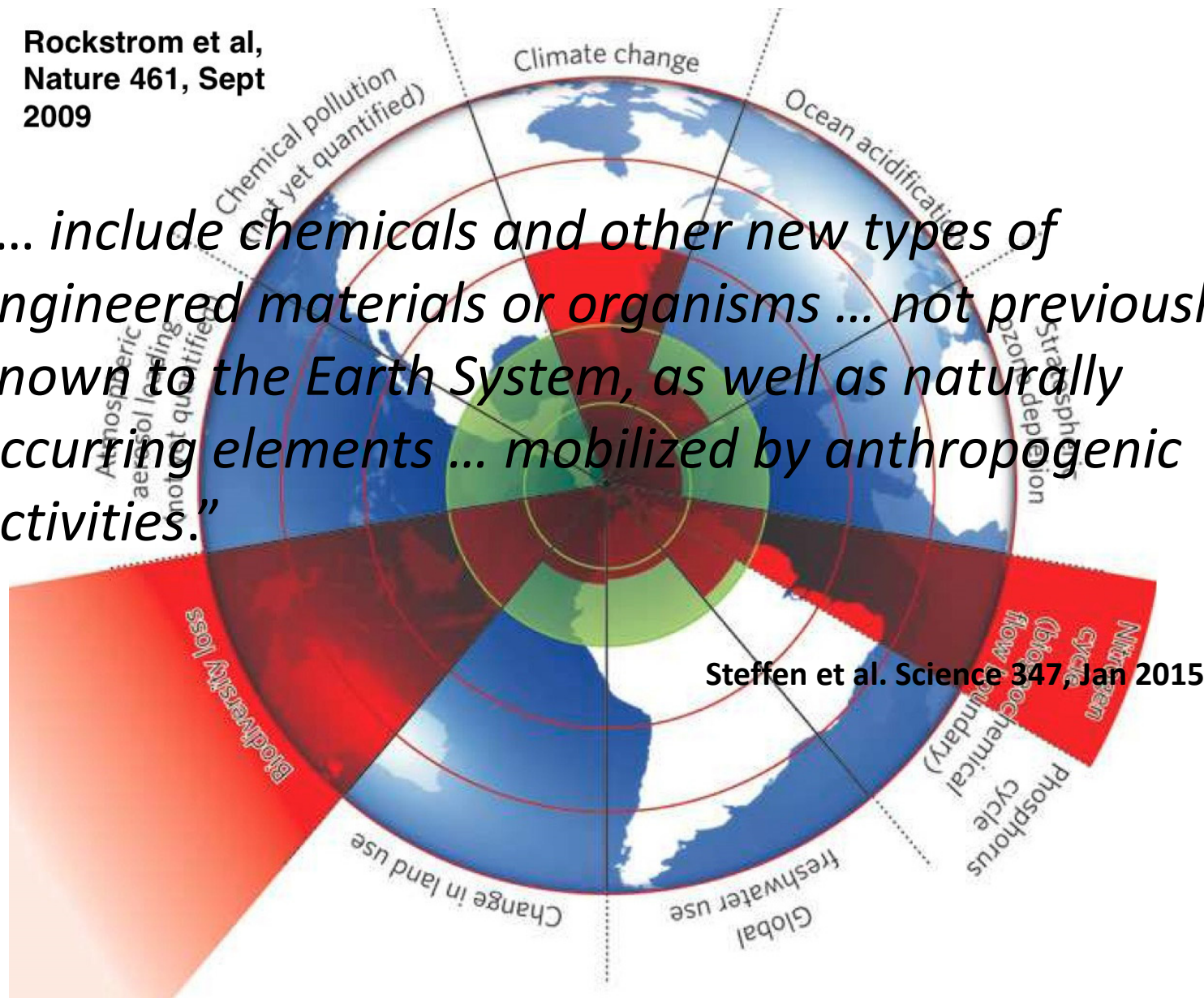
Rockstrom et al,
Nature 461, Sept
2009



Novel entities (chemical pollution)

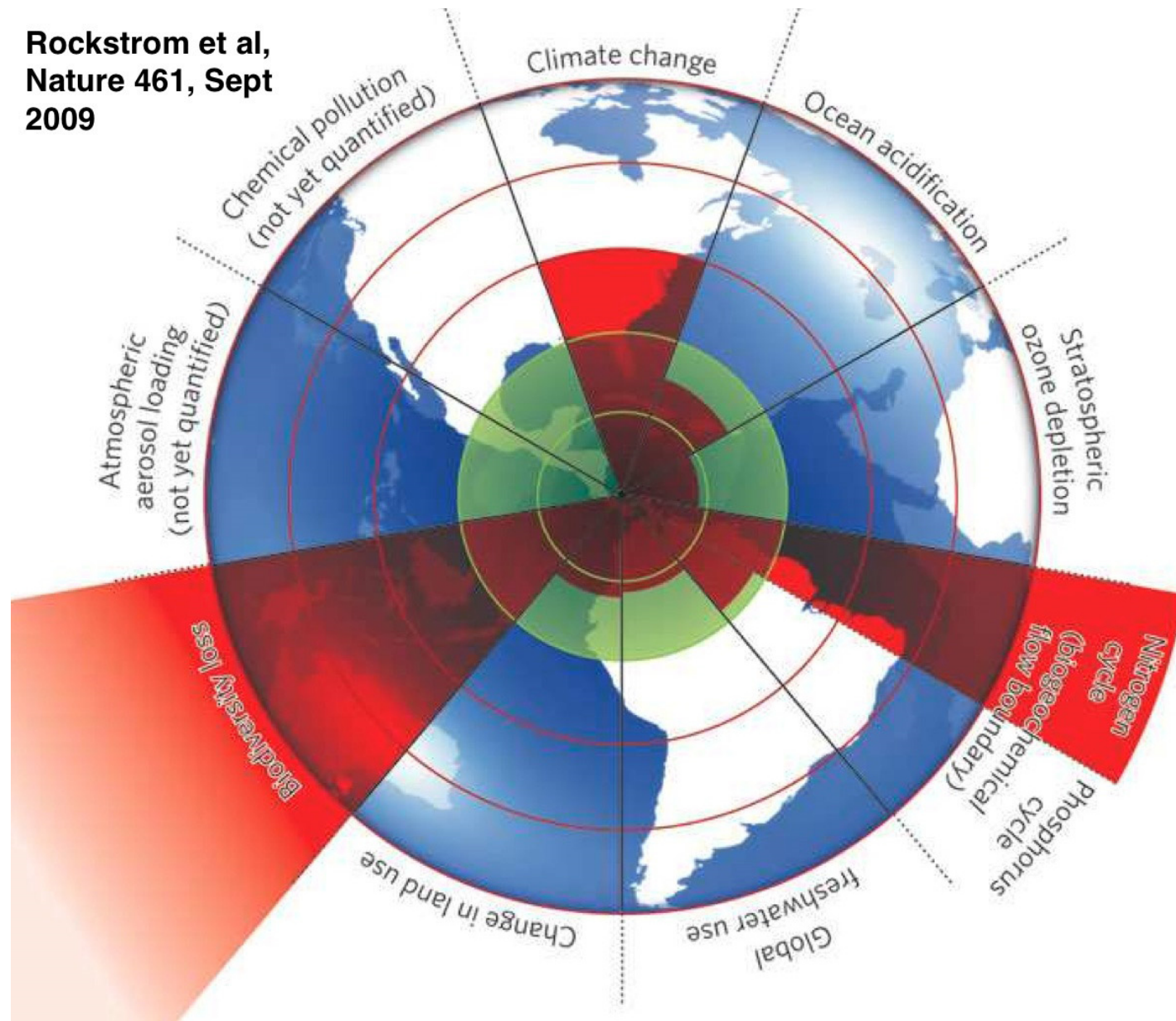
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- “... include chemicals and other new types of engineered materials or organisms ... not previously known to the Earth System, as well as naturally occurring elements ... mobilized by anthropogenic activities.”



Existing novel entity PBs

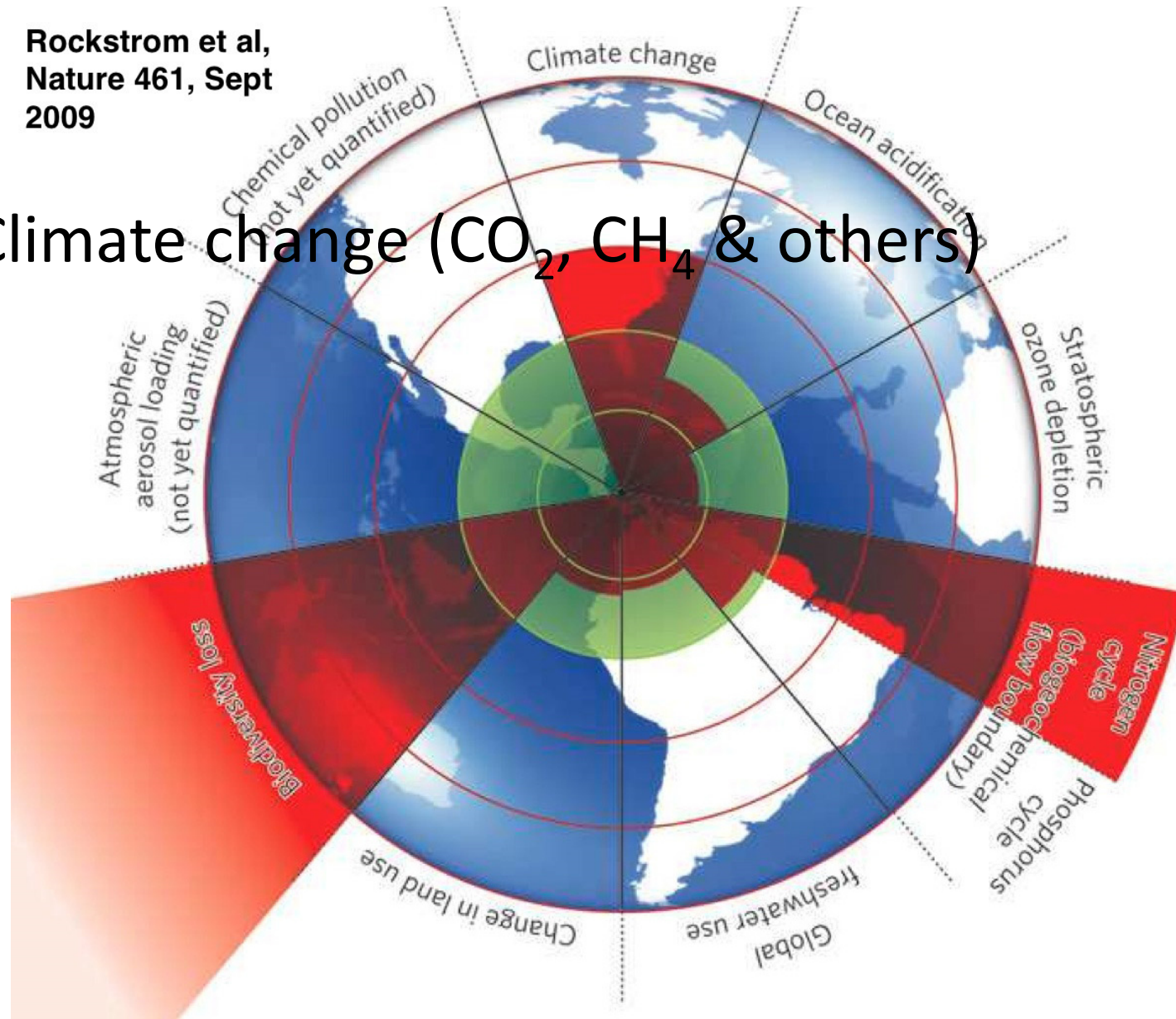
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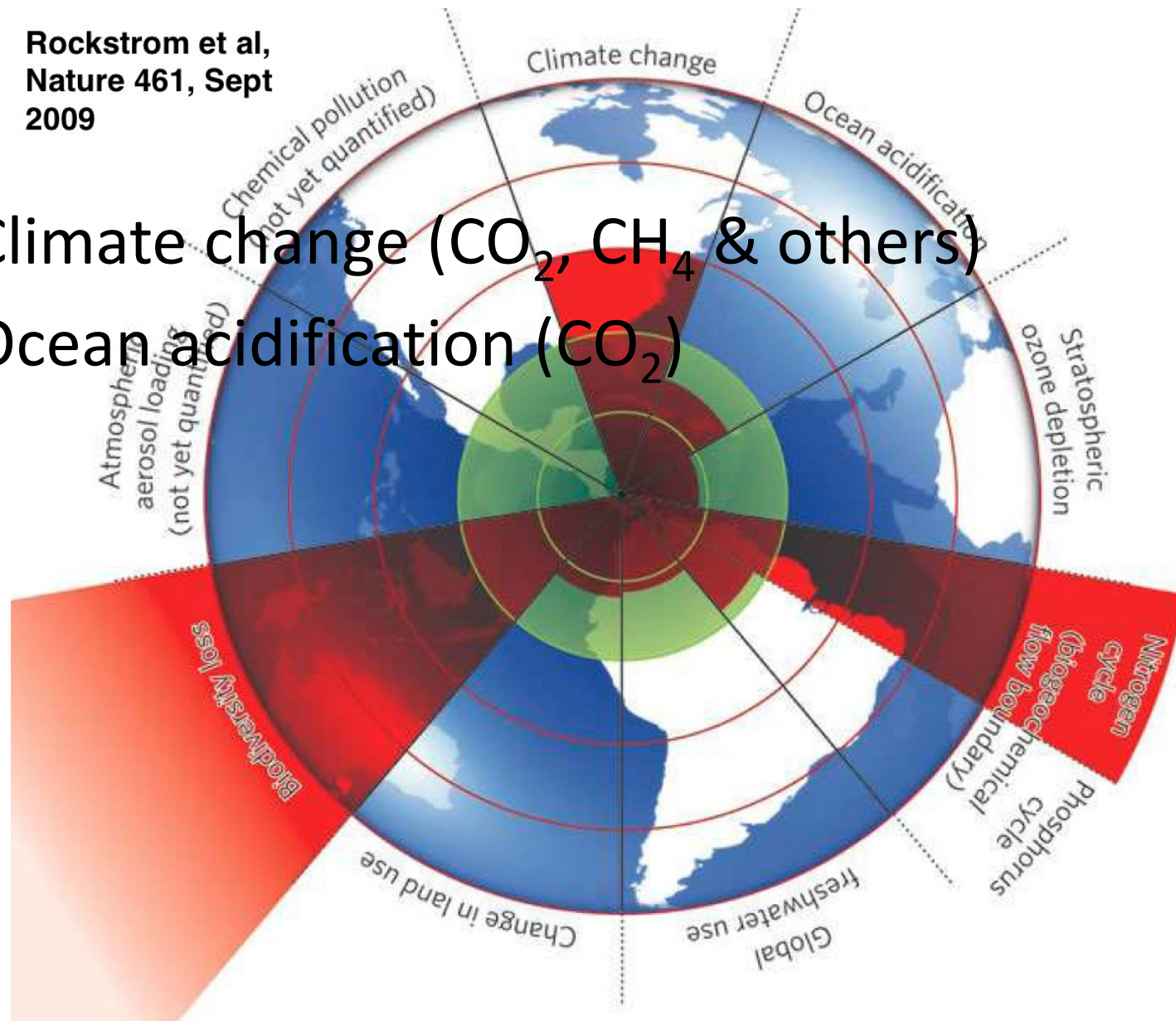
- Climate change (CO₂, CH₄ & others)



Existing novel entity PBs

Rockstrom et al,
Nature 461, Sept
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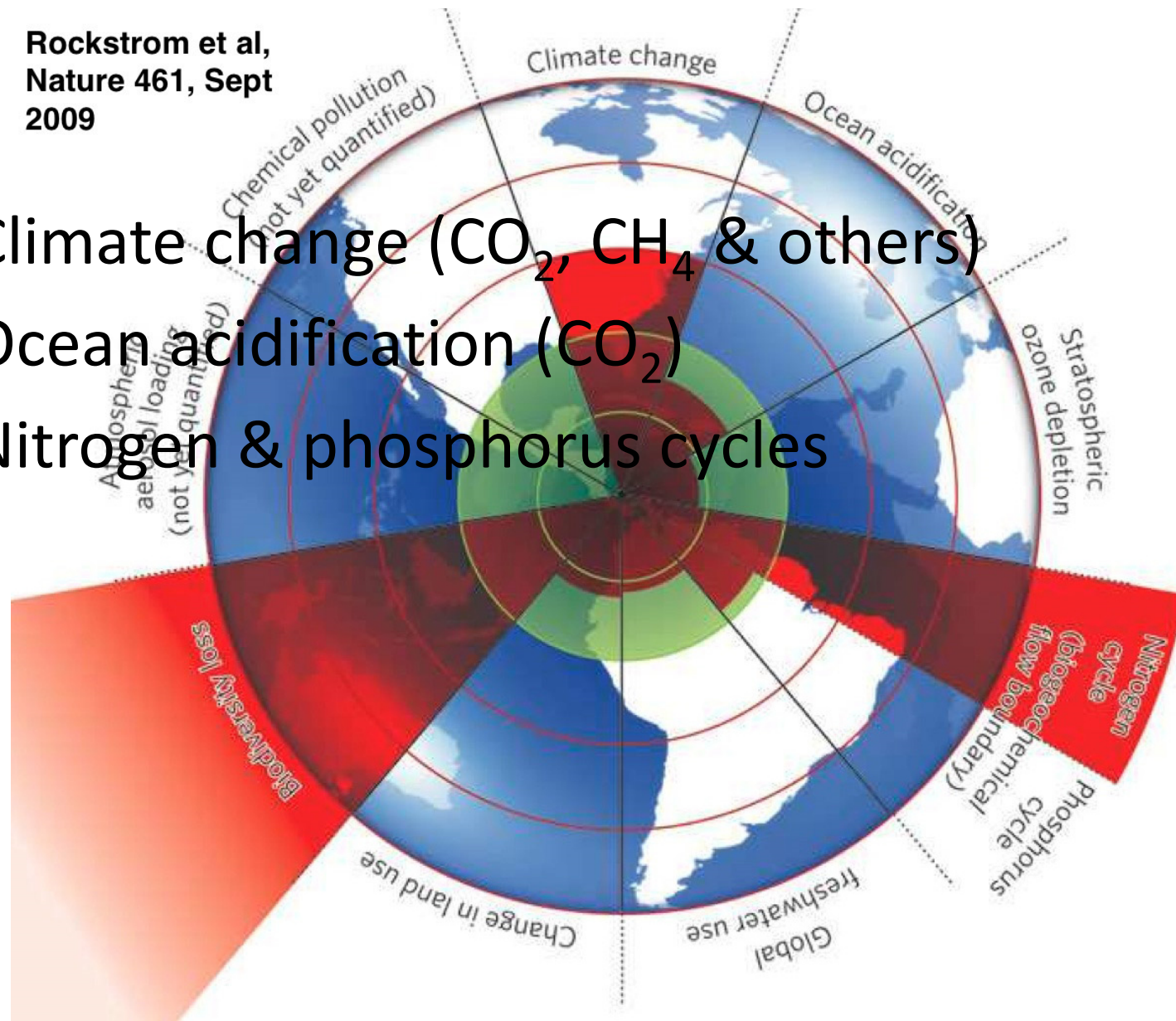
- Climate change (CO₂, CH₄ & others)
- Ocean acidification (CO₂)



Existing novel entity PBs

Rockstrom et al,
Nature 461, Sept
2009

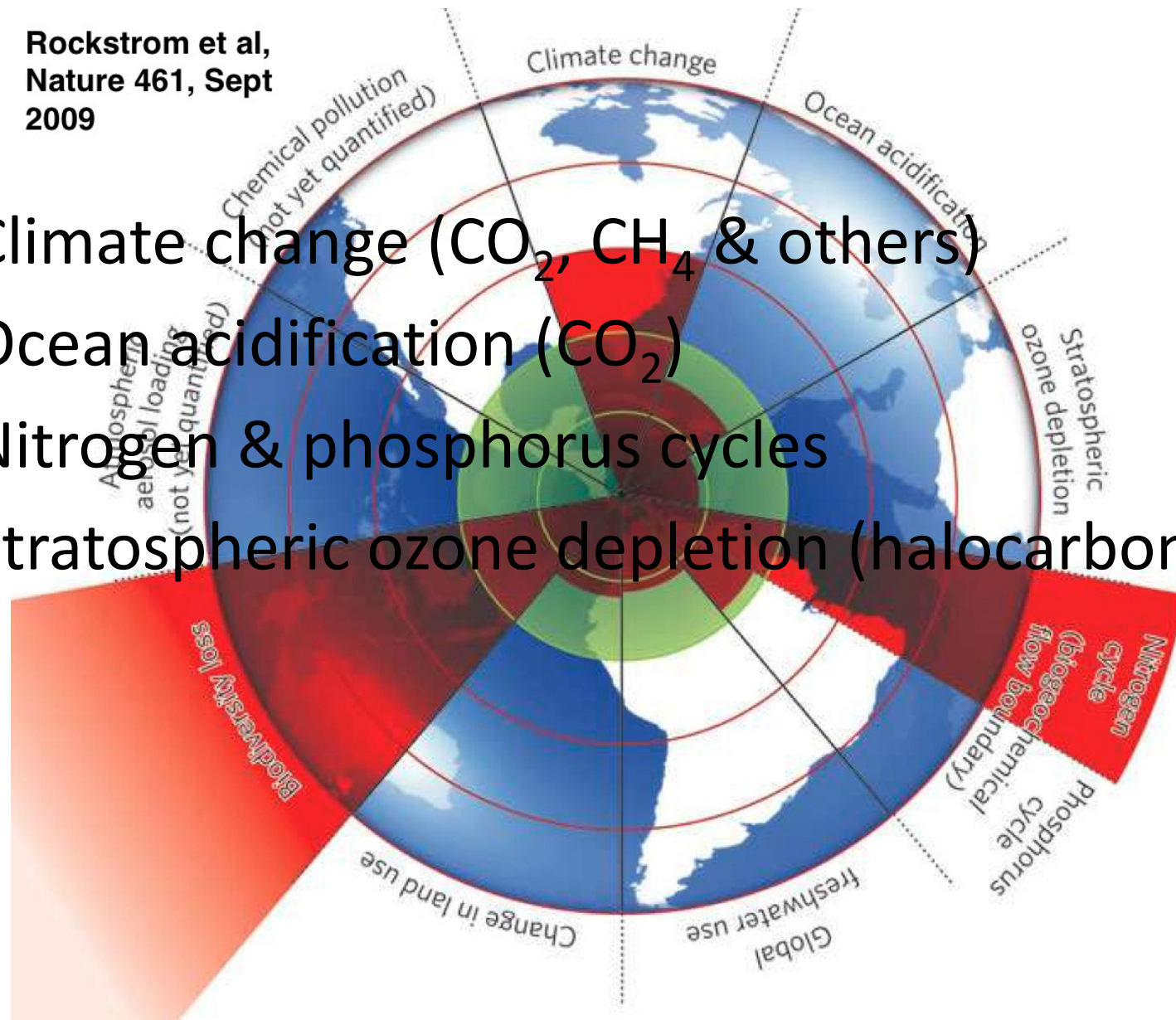
- Climate change (CO₂, CH₄ & others)
- Ocean acidification (CO₂)
- Nitrogen & phosphorus cycles



Existing novel entity PBs

Rockstrom et al,
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- Climate change (CO₂, CH₄ & others)
- Ocean acidification (CO₂)
- Nitrogen & phosphorus cycles
- Stratospheric ozone depletion (halocarbons)





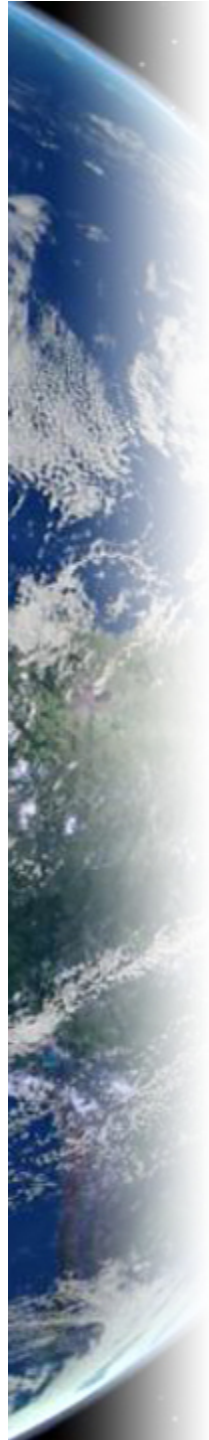
Why an extra PB for novel entities?

- Past experience and intuition tell us that there will be more pb problems that we are unaware of.
- If we aren't aware of them, we can't quantify them.
- Our challenge is to confront our ignorance.
- Prioritize pb issues that can seriously threaten the planet – **planetary boundary threats**.



Planetary boundary threats

- We assume that society will react to manage known planetary boundary concerns.
- A planetary boundary threat exists when:
 - We are ignorant of the existence of a boundary;
 - We cannot easily “un-cross” the boundary.



The Three Conditions

for novel entities to pose a planetary boundary threat

1. The novel entity has a disruptive effect on a vital earth system process.
2. The disruptive effect is not discovered until it is, or inevitably will become, a problem at a planetary scale.
3. The effect of the novel entity cannot be readily reversed.



Scenarios and chemical profiles for Condition 3

Condition	Scenario	Chemical Profile
C3 Disruptive effect is poorly reversible	C3-1 Poor reversibility of exposure	C3-1 Emissions from a technology that society is highly dependent on or from multiple sources that are costly to eliminate, or the chemical is persistent in the exposure environment.



How to confront our ignorance?

- Pro-active identification and management of planetary boundary threats.
- Monitoring & study of vital earth system processes are important complements.
- In addition to dealing with known PB concerns, society must work to avoid creating new PB problems!