Planetary boundaries

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Concept of boundaries

Concept of planetary boundaries was introduced by Stockholm Environmental Institute in 2009.

[Rockstrom J. et al., 2009. Planetary boundaries: exploring the safe operating space for humanity. Ecology and Society, 14(2):1-25 (item 32 online). URL:http://www.ecologyandsociety.org/vol14/iss2/art32/].

Nine boundaries

Authors have done a search for critical Earth System processes. They were able to identify nine such processes for which boundaries need to be established to minimize the risk of crossing critical threshold that may lead to undesirable outcomes. The nine planetary boundaries identified cover the global biogeochemical cycles of nitrogen, phosphorus, carbon, and water; biophysical features of Earth that contribute to the underlying resilience of its self-regulatory capacity (marine and terrestrial biodiversity, land systems); and two critical features associated with anthropogenic global change (aerosol loading and chemical pollution).

Evidence

There is ample evidence from local to regional-scale esosystems, such as lakes, forests, and coral reefs, that gradual changes in certain key control variables (e.g. biodiversity, harvesting, soil quality, freshwater flows, and nutrient cycles). The critical Earth Systems processes are:

Critical processes:

- rate of biodiversity loss;
- nitrogen cycle;
- climate change;
- stratospheric ozone depletion;
- ocean acidifation;
- phosphorus cycle;
- land system change (soil protection);
- global freshwater use;
- chemical pollution;
- aerosol loading.

Loss of biodiversity

Loss of biodiversity can increase the vulnerability of terrestrial and aquatic ecosystems to changes in climate and ocean acidity, thus reducing the safe boundary levels for these processes. Current global average extinction rate is > 100 E/MSY, what means >100 extinctions per million species and year (E/MSY). In the last 20 years about half of the recorded extinctions have occurred on continents (second half in oceans), primary due to land use change, species introductions, and increasingly climate change, indicating that biodiversity is now broadly at risk throughout the planet. A safe planetary boundary is proposed on the level of 10 E/MSY, but the actual situation is from 100 to 1000 E/MSY and it is indicating an urgent need to radically reduce biodiversity loss rates.

PLANETARY BOUNDARIES FOR HUMANITY