

## ***Webinar Highlights***

### **Pollution and the Planet: Perspectives on Being Outside the 'Safe Operating Space'**

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An international group of scientists with expertise in chemical pollution and environmental health have been conducting research on the planetary boundary for novel entities. Novel entities include manufactured substances not previously found in nature. Pollution from plastic is of particular concern as a novel entity. Defining a quantitative boundary for novel entities presents challenges, but the scientists suggested some ways to approach the problem. Regardless of how it is ultimately defined, strong evidence suggests that we are already beyond the boundary. In this webinar, Dr. Sarah Cornell discussed novel entities and the planetary boundary framework.

**The international group of scientists** found that ***"the balance of evidence is that today's use, misuse and production trends for synthetic chemicals are changing Earth system processes in unprecedented ways and are currently outstripping societies' capacities to monitor and mitigate the problems and emerging risks."***

**Featured Speaker: Dr. Sarah Cornell**, Associate Professor at Stockholm University, speaking June 29, 2022.

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## **The Problem**

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The planetary boundary concept establishes guidelines for "a safe operating space for humanity." When environmental impacts extend beyond those boundaries, we are at risk of triggering catastrophic, irreversible environmental changes. Most work on novel entities such as chemical pollution has focused on much smaller scales – the effects on individual organisms, human health, and local ecosystems. Applying the planetary boundary framework to novel entities helps to bring the planetary and the person-scale perspectives together.

**Novel Entities.** “Novel Entities” include substances and modified life forms that humans have introduced into the environment. The following characteristics make them especially harmful:

- They persist in the environment.
- They move across the environment, which allows them to both disperse widely and accumulate in organisms and ecosystems.
- They bring with them significant potential negative impacts on Earth system processes.

**Control Variables.** The planetary boundary framework establishes “control variables” that impact Earth system behavior. For example, CO<sub>2</sub> concentration is a control variable, which affects the Earth’s temperature. Defining planetary boundary control variables for novel entities is difficult because they are without precedent. You cannot look to the past to gauge their future impacts. Also, novel entities have diverse properties. They can have different categories of impacts that affect Earth systems in unexpected ways.

**Potential Control Variables for Novel Entities.** Scientists proposed several control variables for the planetary boundary of novel entities. Environmental effects and risks rise as these indicators increase globally:

- Production of Novel Entities. The following are different ways to consider the production of novel entities as a control variable:
  - The trend in total production volume of chemicals.  
**“Global production increased 50-fold since 1950, and is projected to triple again by 2050 compared to 2010.”**
  - The trend in production volume of plastics.  
**“Worldwide use of plastics has increased steadily since the 1950’s, with global production increasing by 79% from 2000 to 2015. Cumulative global production is projected to triple by 2050 to reach 33 billion tonnes.”**
  - The share of chemicals with safety data or regulatory assessments.
- Trend in Release of Novel Entities. The following are different ways to consider trends in release of novel entities as a control variable:
  - The trend in emissions quantities of hazardous chemicals.  
Despite recent attempts to control emissions and waste management, emissions of chemicals are projected to continue to increase.

- The trend in release quantities (pollution) of plastics into the environment. Plastic pollution has been shown to influence biophysical thresholds and change Earth systems through various pathways and mechanisms.
- Unwanted Impacts of Novel Entities on Earth System Processes.

## Recommendations and Conclusions

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- To inform action and gauge progress, operational control variables for novel entities need to be established.
- An important part of defining the boundary is choosing control variables that are feasible, relevant, and comprehensive. Because no single control variable has been found that meets all these criteria, *several control variables should be used jointly to help define the planetary boundary.*
- Even if we stabilize or reduce production and release, we are still under threat as a result of the persistence of novel entities.  
**“The safe operating space of the planetary boundary of novel entities is exceeded since annual production and releases are increasing at a pace that outstrips the global capacity for assessment and monitoring.”**
- While more work needs to be done to define the planetary boundary, we cannot wait. We need urgent action now. We must reduce the release and emissions of novel entities, including with the following actions:
  - Design more circularity into materials and products.
  - Switch to safe and sustainable chemicals.
  - Address inequitable resource distribution.
  - Place caps on the production of plastics and all novel entities.
  - Overall, when it comes to the use of novel entities, take a preventive and precautionary hazard-based approach.

## To Find Out More

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- Watch the June 29, 2022 webinar: [Pollution and the Planet: Perspectives on being outside the 'Safe Operating Space'](#)
- Read the paper: [Outside the Safe Operating Space of the Planetary Boundary for Novel Entities](#)
- Watch a related webinar: [Outside the Safe Operating Space of a PFAS Planetary Boundary](#)

## About the Speaker

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**Dr. Sarah Cornell** is a global environmental change scientist. She is an associate professor at Stockholm University, working as a principal researcher at the Stockholm Resilience Centre. In this role, she leads a research group that seeks to integrate planet-scale perspectives into social-ecological systems approaches for dealing with risks, resource use, and responses to today's environmental challenges.

Sarah has over 20 years of interdisciplinary research experience working on human dimensions of global change, first at the University of East Anglia's Centre for Social and Economic Research on the Global Environment, then the Tyndall Centre for Climate Change. Before moving to Sweden in 2011, she was the science coordinator for QUEST, the UK Natural Environment Research Council's national programme for Earth system science. She has been involved in international strategic networks for global change research that connects social and biophysical sciences, including [Future Earth](#) and UNESCO's new [BRIDGES Sustainability Science Coalition](#). She is an Associate Editor for the journal *Environmental Science and Policy*.