



University of  
Zurich <sup>UZH</sup>

# Student's and Scientist's conceptions about the drivers and consequences of global environmental change

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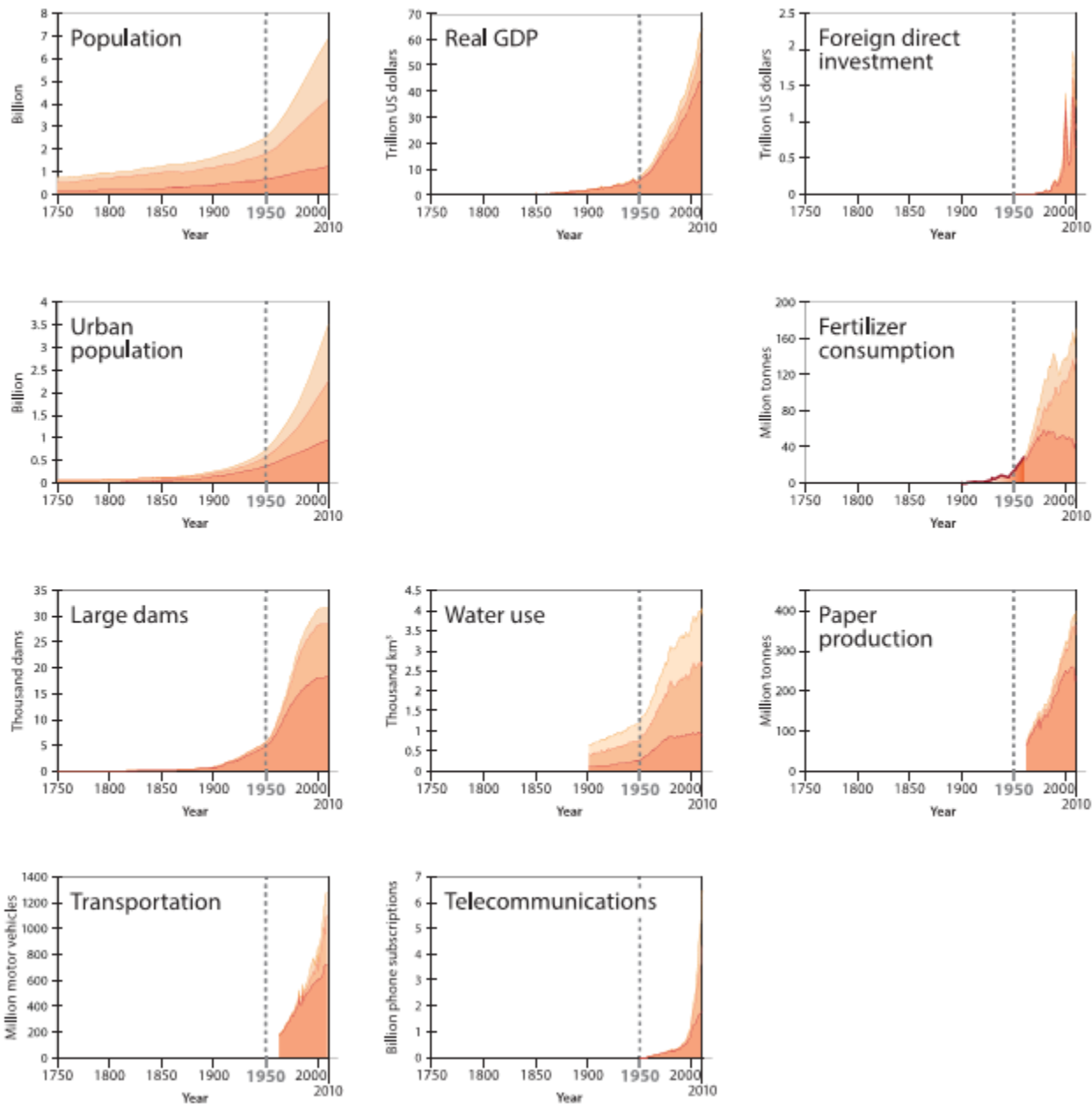
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Chair of Science and Sustainability Education



## Socio-economic trends

OECD BRICS Others



## Earth system trends

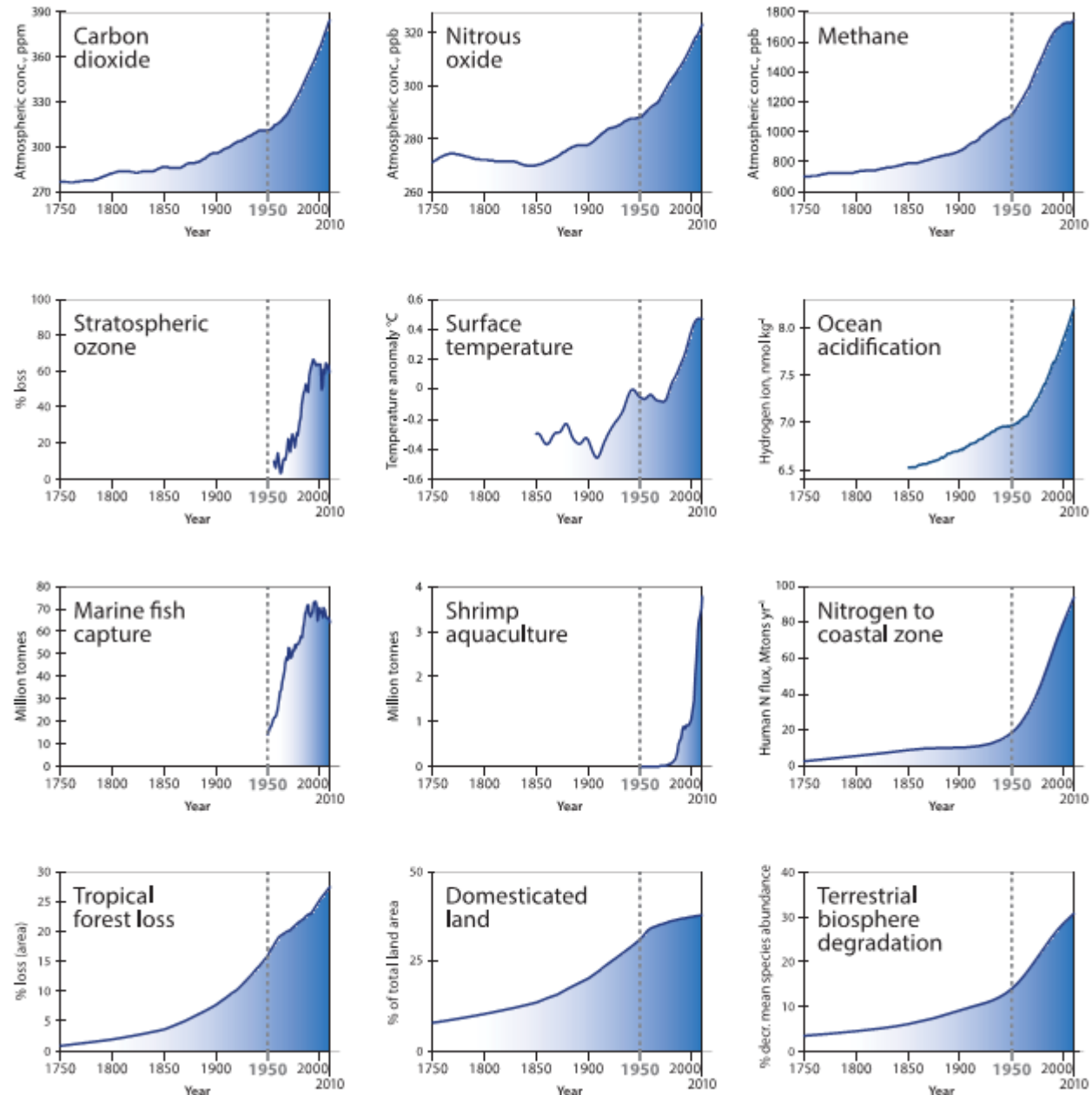
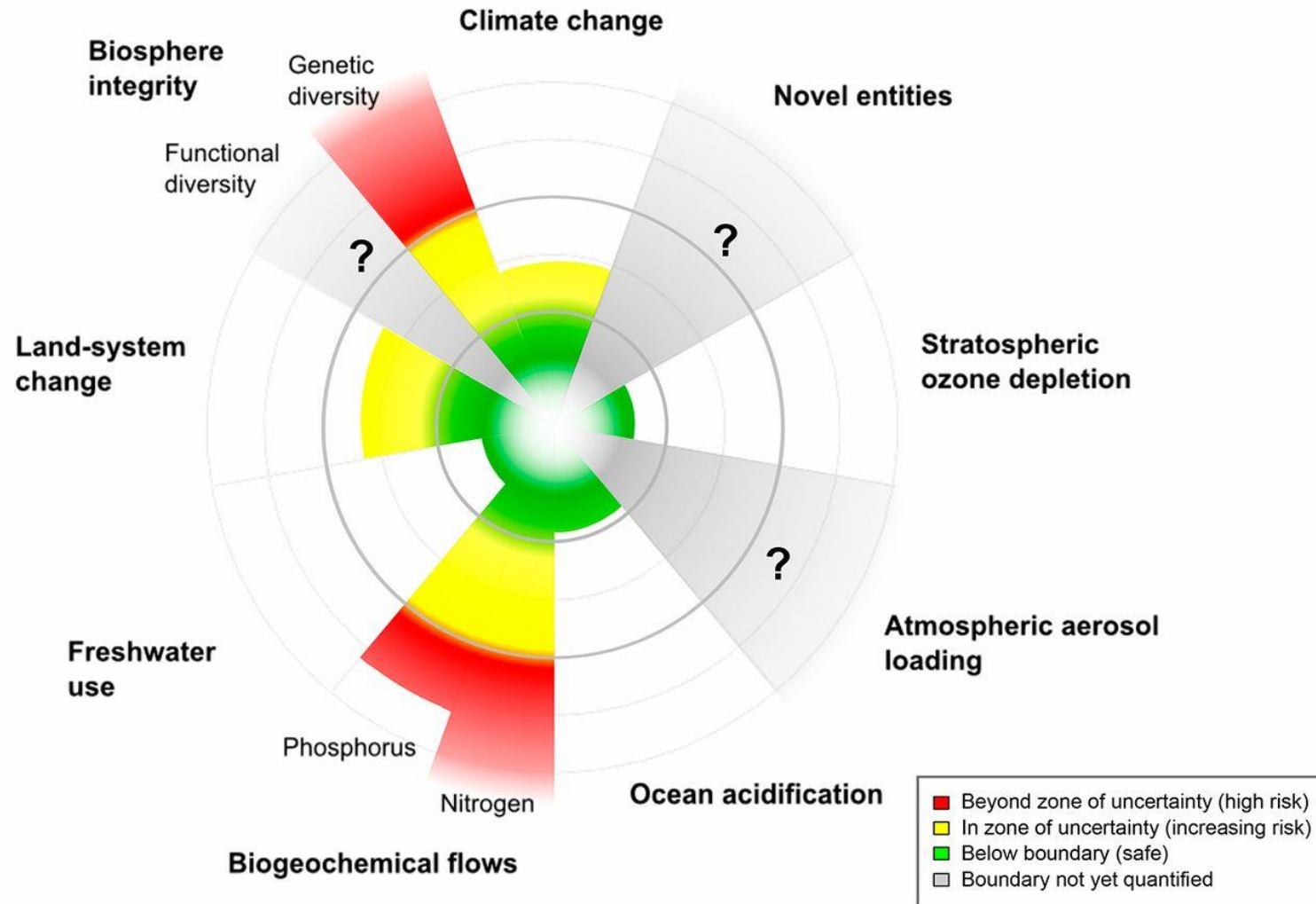


Fig. 3 The current status of the control variables for seven of the nine planetary boundaries.



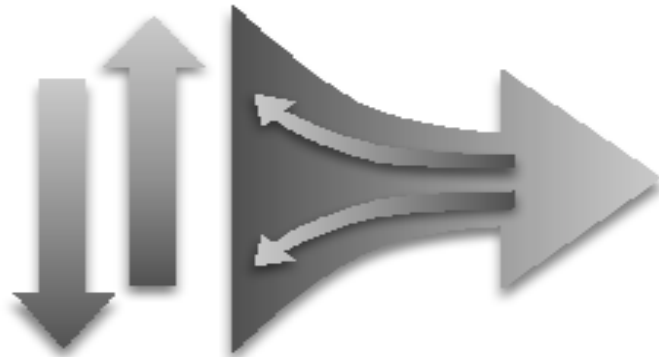
Will Steffen et al. Science 2015;347:1259855

# Educational Reconstruction of the Planetary Boundaries

*Which conceptions do students and scientists have about the drivers and consequences of global environmental change in the context of socioeconomic growth and the planetary boundaries?*

## Analysis of student concepts

- Students 7th – 12th grade, n=42
- Two interview studies – secondary I & II
- Guideline-based partner interviews



## Design of teaching and learning guidelines

## Clarification & Analysis of science concepts

- 7 Publications
- Steffen et al., 2015 & Rockström et al., 2009

Duit, R., Gropengießer, H., Kattmann, U., Komorek, M., & Parchmann, I. (2012). The Model of Educational Reconstruction—a Framework for Improving Teaching and Learning Science<sup>1</sup>. In *Science education research and practice in Europe* (pp. 13-37) (verändert)





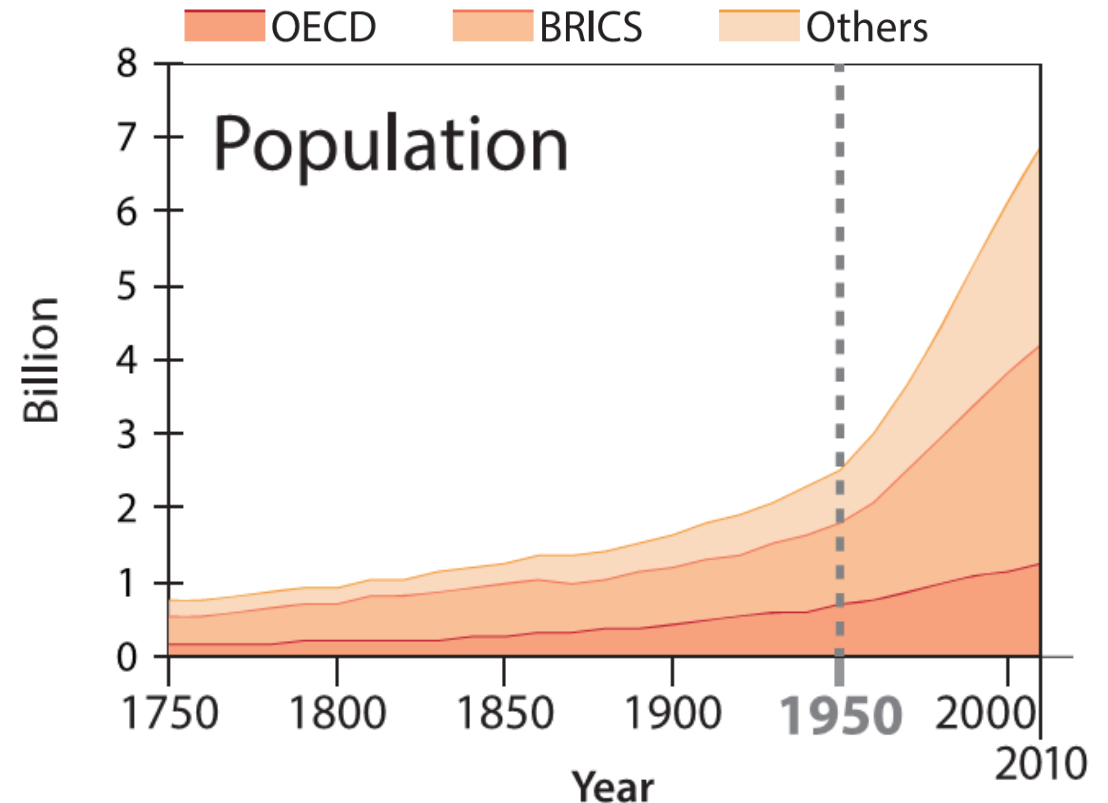
## STUDENT CONCEPTIONS

EXPONENTIAL POPULATION GROWTH IS FUTURE  
GREAT ACCELERATION THROUGH WORLD POPULATION GROWTH

„Because each human consumes and uses resources. Just when you think about the cars, how much CO2 they emit. And with more people all of that will increase. More people need more resources.“ (Ute)

„A larger population is multiplying faster and human beings are getting older and older, so the growth of everything increases.“ (Urs)

“So, population growth will continue to increase exponentially.” (Konstantin)

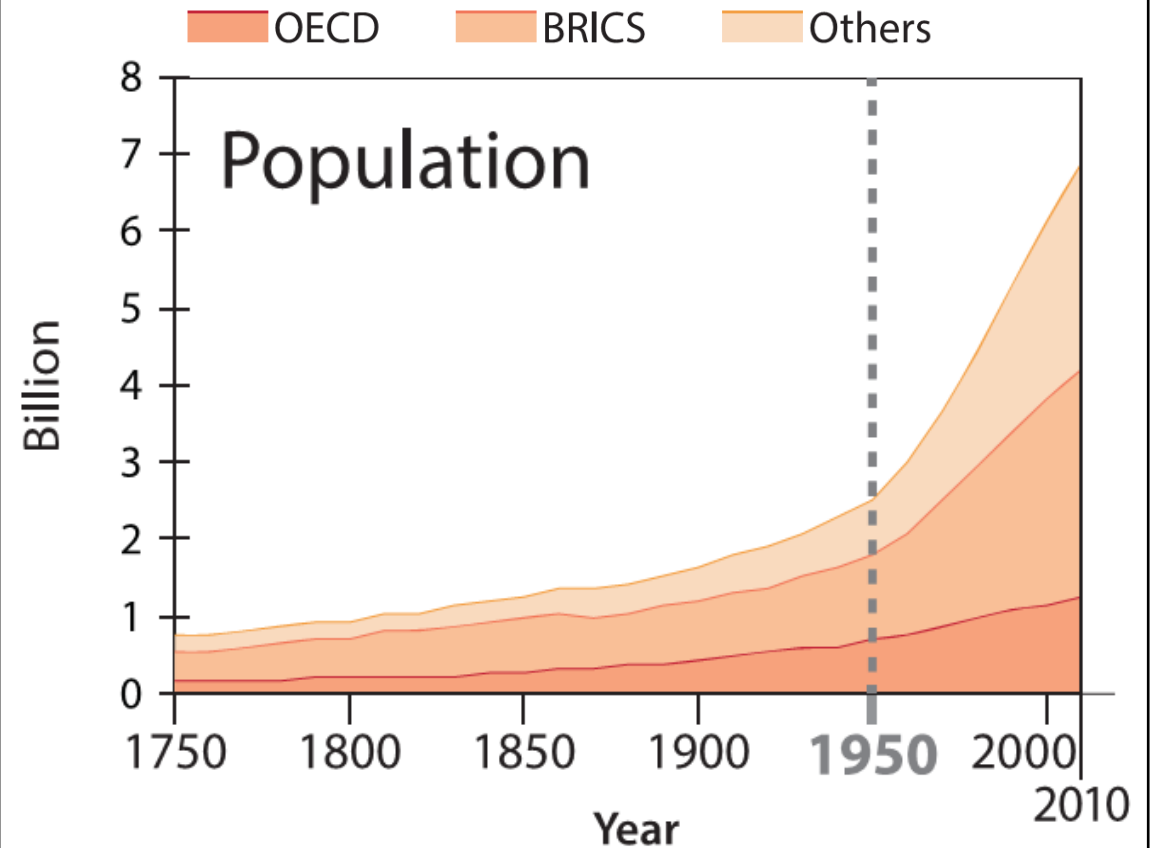




## SCIENTISTS CONCEPTIONS

### END OF EXPONENTIAL POPULATION GROWTH IS FUTURE

*“Population continued to grow strongly through the 2001–2010 period with little sign of slowing. However, changes in fertility rates foreshadow that exponential population growth will soon be over. Humanity has passed ‘peak child’ and population is expected to reach between 10 and 11 billion people later this century” (Steffen et al., 2015)*

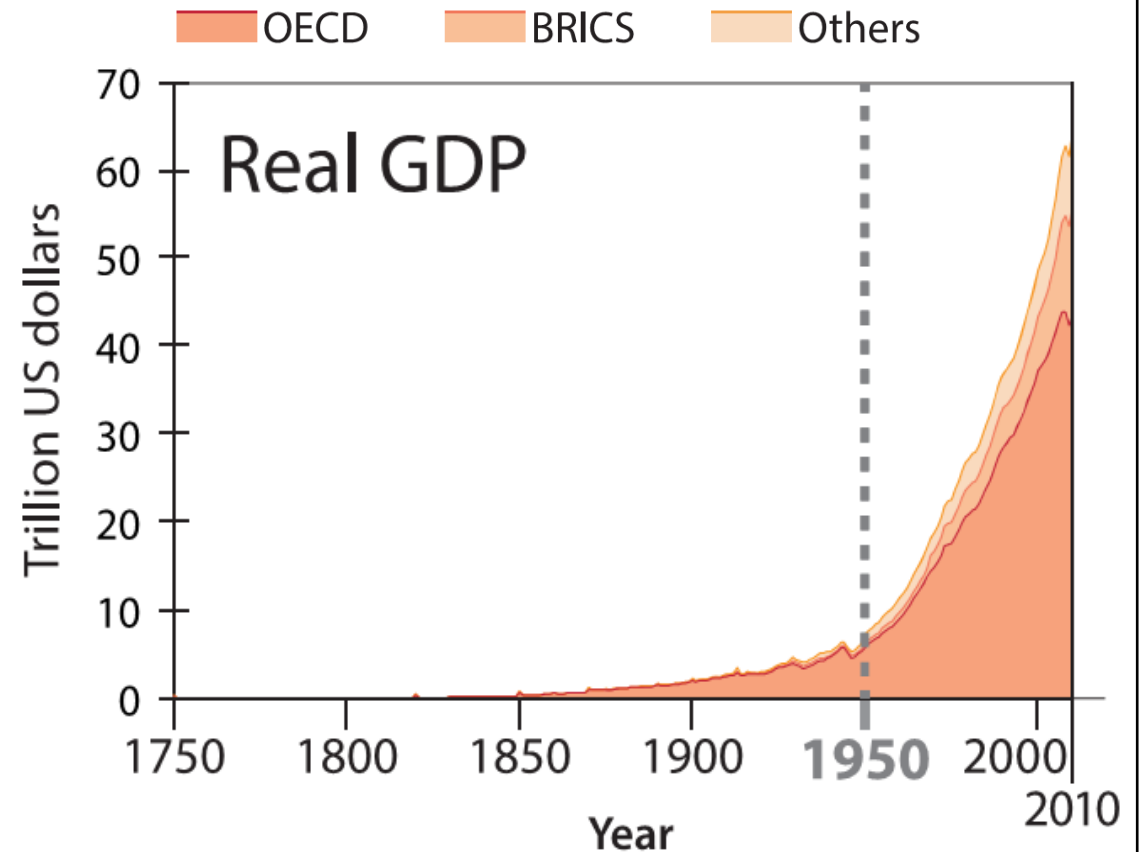




## SCIENTISTS CONCEPTIONS

### GREAT ACCELERATION THROUGH SOCIO ECONOMIC ACTIVITIES OF THE OECD AND BRICS COUNTRIES

*“Despite the shift of global production, traditionally based within OECD countries, towards the BRICS nations, the bulk of economic activity, and with it, the lion’s share of consumption, remain largely within the OECD countries. In 2010 the OECD countries accounted for 74% of global GDP but only 18% of the global population.” (Steffen et al., 2015)*

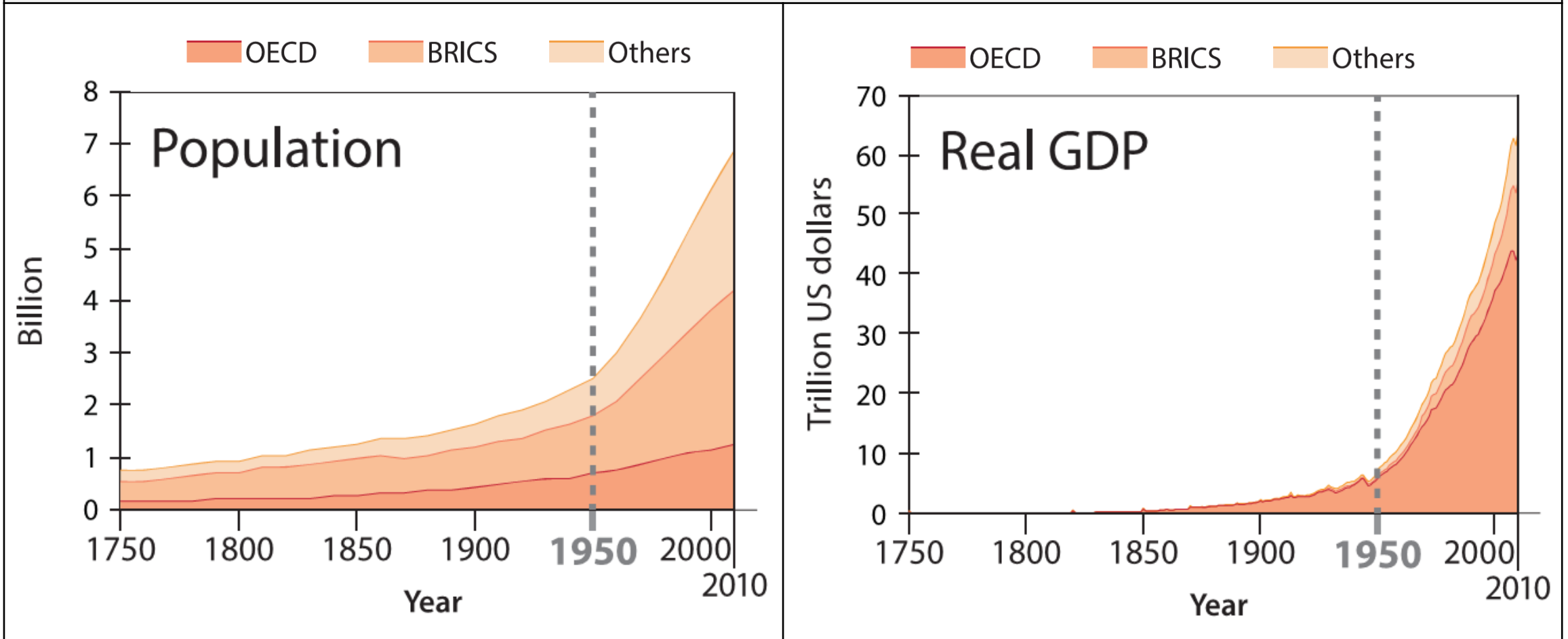






## SCIENTISTS CONCEPTIONS

GREAT ACCELERATION THROUGH SOCIO ECONOMIC ACTIVITIES OF THE OECD AND BRICS COUNTRIES



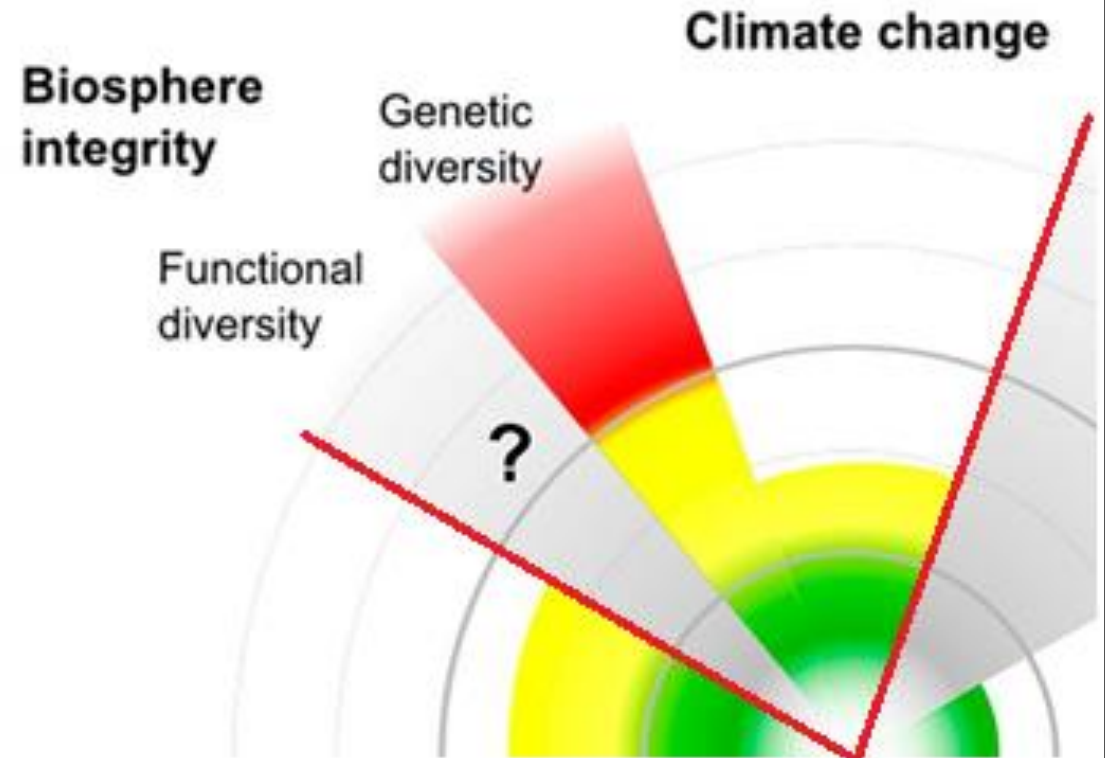


## STUDENT CONCEPTIONS

### BIODIVERSITY LOSS AND CLIMATE CHANGE THROUGH POPULATION GROWTH

*«Due to the increased population, people take up more space. So growth has brought climate change and species extinction» (Ivan)*

*“So the large population growth has led to the crossing of the boundaries, for example through the emission of CO<sub>2</sub>. And that's just problematic, because of that the earth is warming and that could lead to big problems in the future and make the earth more and more unstable.”(Damian)*

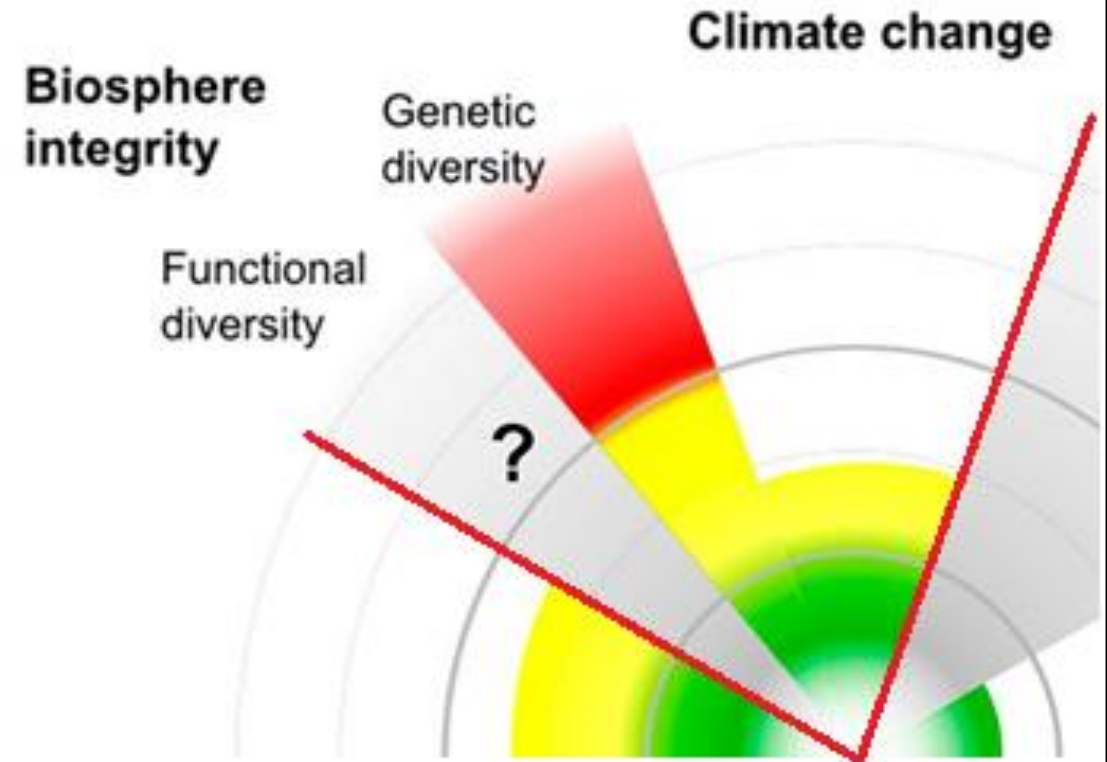




## SCIENTISTS CONCEPTIONS

BIODIVERSITY LOSS AND CLIMATE CHANGE THROUGH GLOBAL ECONOMIC ACTIVITIES OF THE OECD COUNTRIES

*“Insofar as the imprint on the Earth System scales with consumption, most of the human imprint on the Earth System is coming from the OECD world.”*  
(Steffen et al., 2015)





*“In the early 21st century, the poorest 45% of the human population accounted for 7% of emissions, while the richest 7% produced 50%; a single average US citizen emitted as much as upwards of 500 citizens of Ethiopia, Chad, Afghanistan, Mali, Cambodia or Burundi» (Malm and Hornborg, 2014)*



## Student Conception

GLOBAL ENVIRONMENTAL CHANGE  
THROUGH GROWTH OF THE  
WORLD POPULATIONS



## Scientist`s Conception

GLOBAL ENVIRONMENTAL CHANGE  
THROUGH UNSUSTAINABLE SOCIO  
ECONOMIC GROWTH

## Guideline

The students should critically reflect the growth of the world population as the cause for global environmental change and recognize the socioeconomic activities of the OECD and BRICS countries as the cause for the transgression of the planetary boundaries.

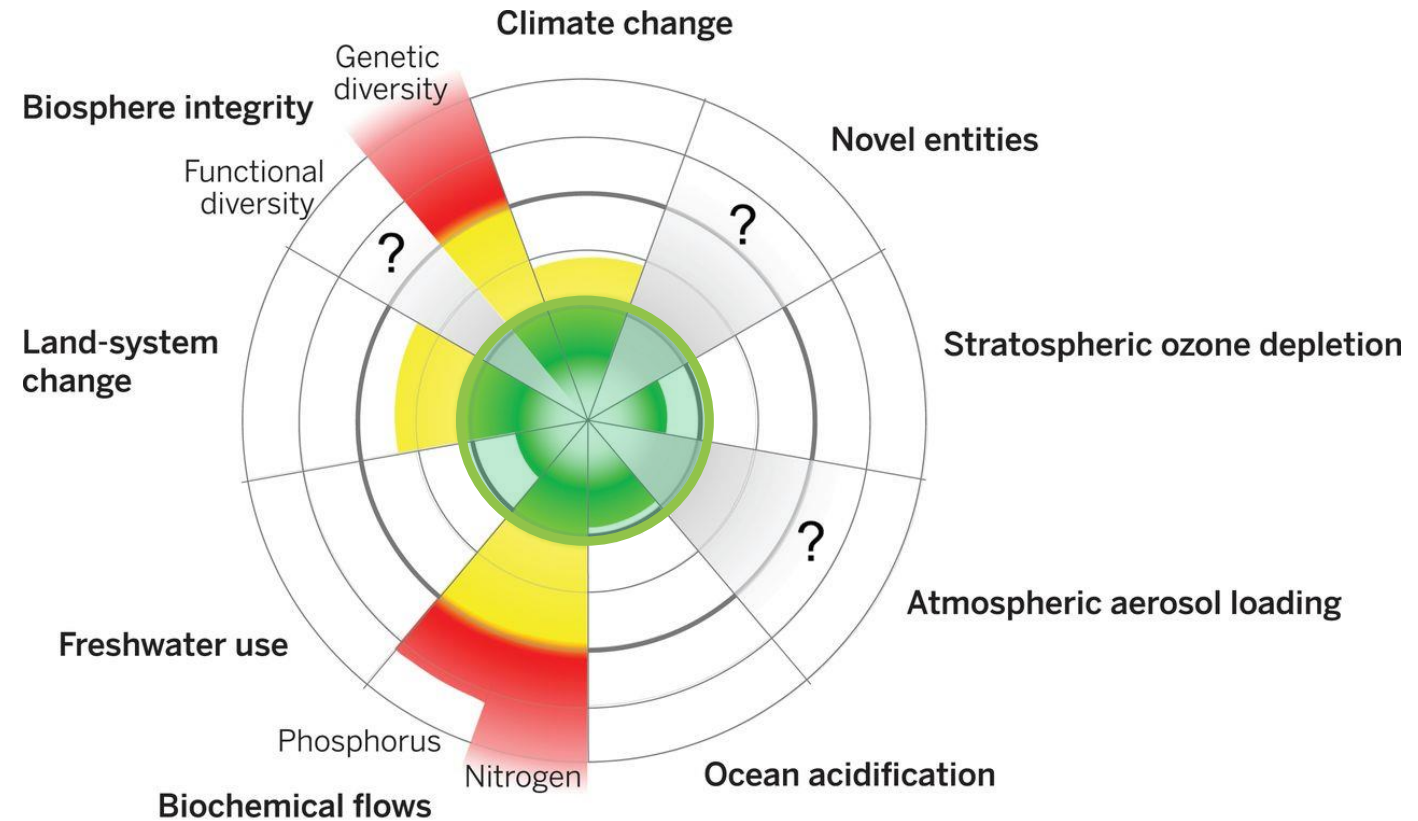


# Growth within the Planetary Boundaries?

## What to teach in the classroom?

BOUNDARY COMPLIANCE THROUGH SUSTAINABLE SOCIOECONOMIC ACTIVITIES

*We need to stay within an equilibrium with the Earth System and to do so we need new ideas of socioeconomic growth disconnected from resource consumption.*







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**Thank you**