

Global environmental impacts of consumption and production in Switzerland from 1996 to 2011

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Overview

- Starting point and research questions
- Model and methods
- Eutrophying impacts of Swiss consumption
- Model comparison
- Planetary boundaries applied on Eutrophication
- Conclusions

Swiss Federal Policy

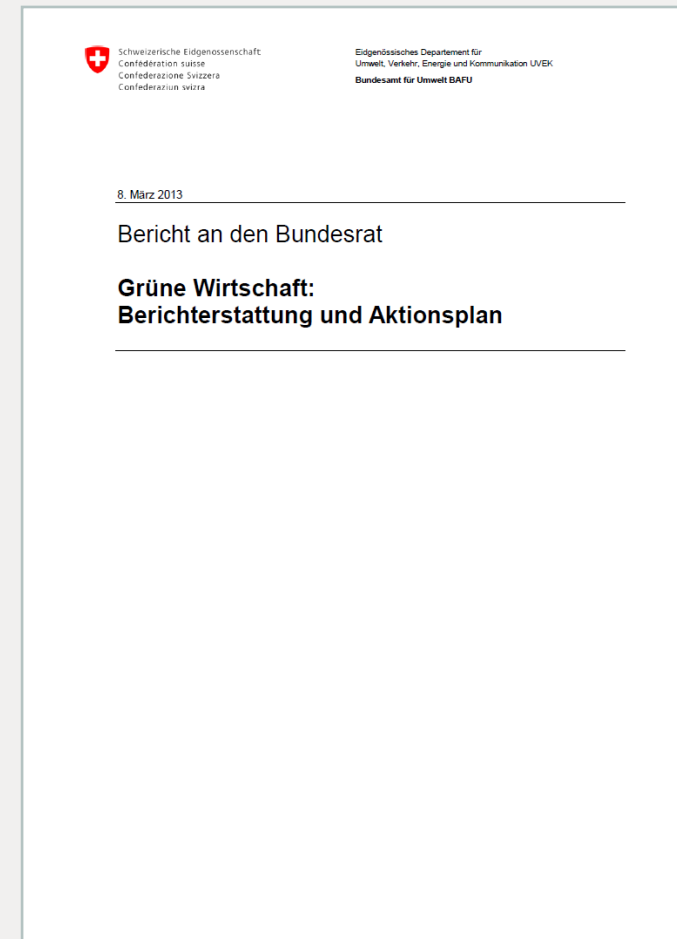
Action plan «Green economy»

27 individual measures in the areas:

- Consumption and production
- Wastes and resources
- Comprehensive instruments
- Goal, measurement, information, reporting

Measure 23:

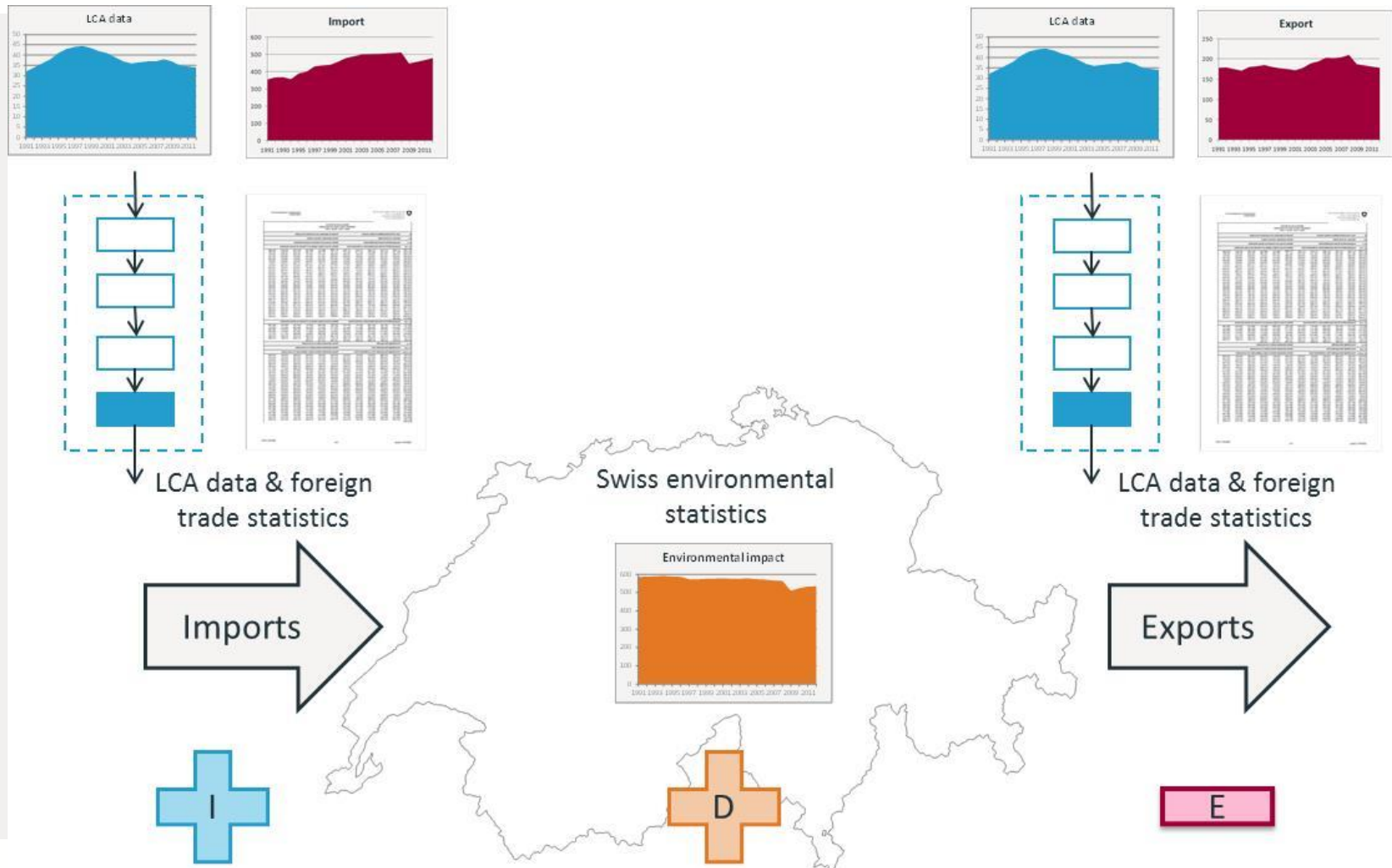
Define goals and reporting



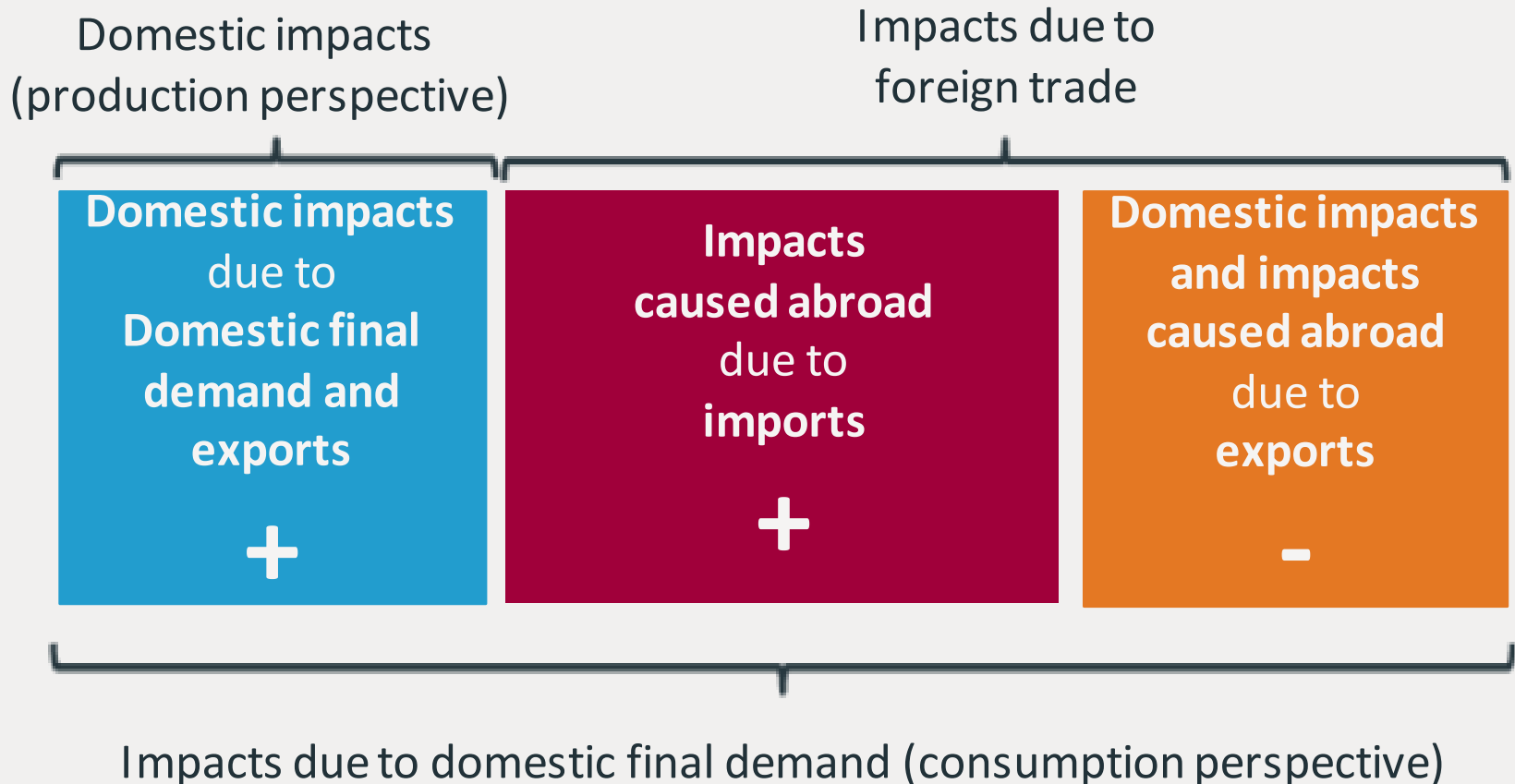
Research questions

- How did Swiss domestic and consumption based environmental impacts develop since 1996?
- How did the shares between domestic, imported and exported environmental impacts develop?
- How do the results differ using two different models
- Do the environmental impacts of Swiss consumption **exceed planetary boundaries?**

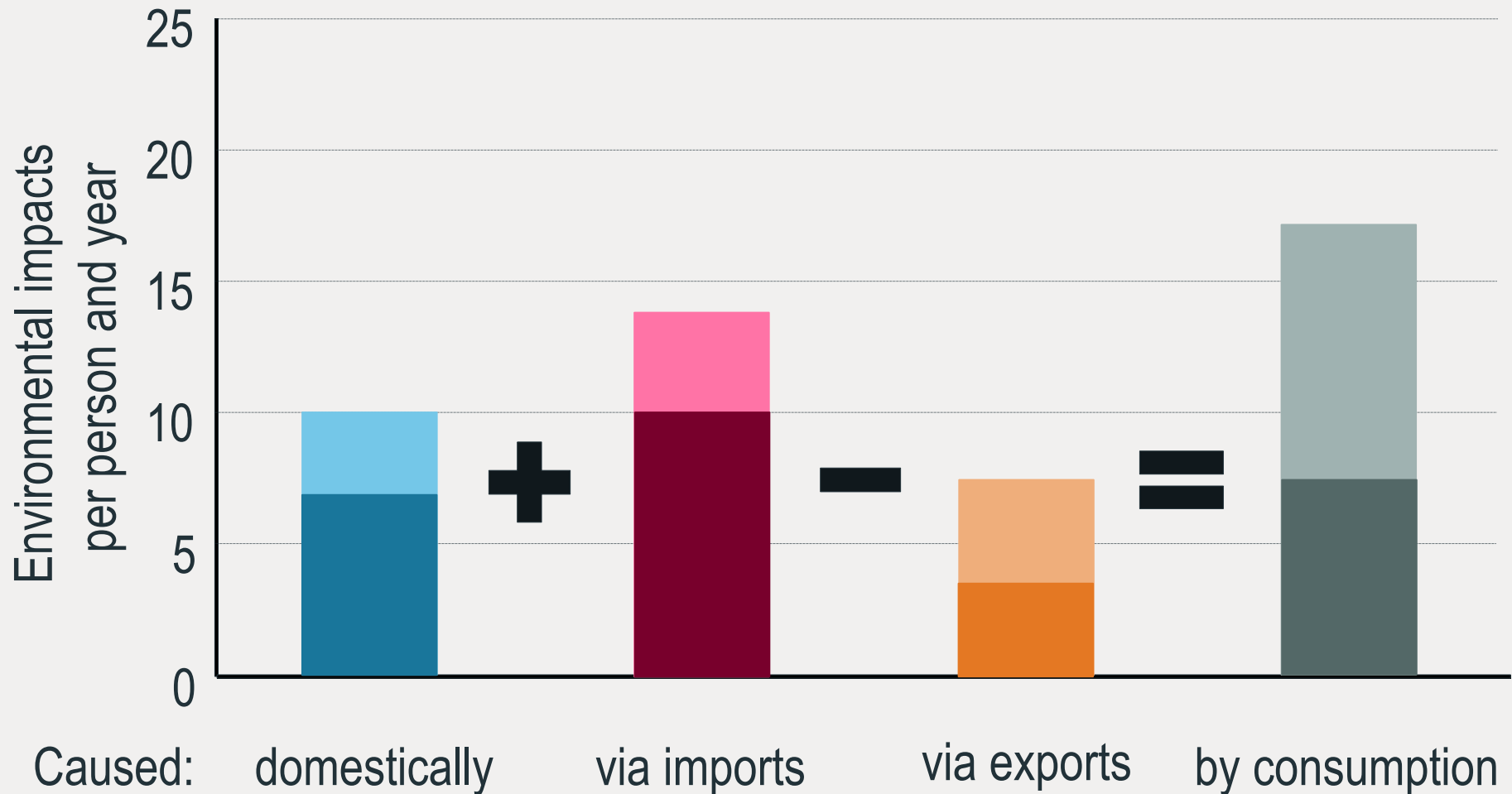
Basic scheme of the model



Consumption versus Production perspective



Domestic and foreign impacts



consumption based environmental impacts

domestic

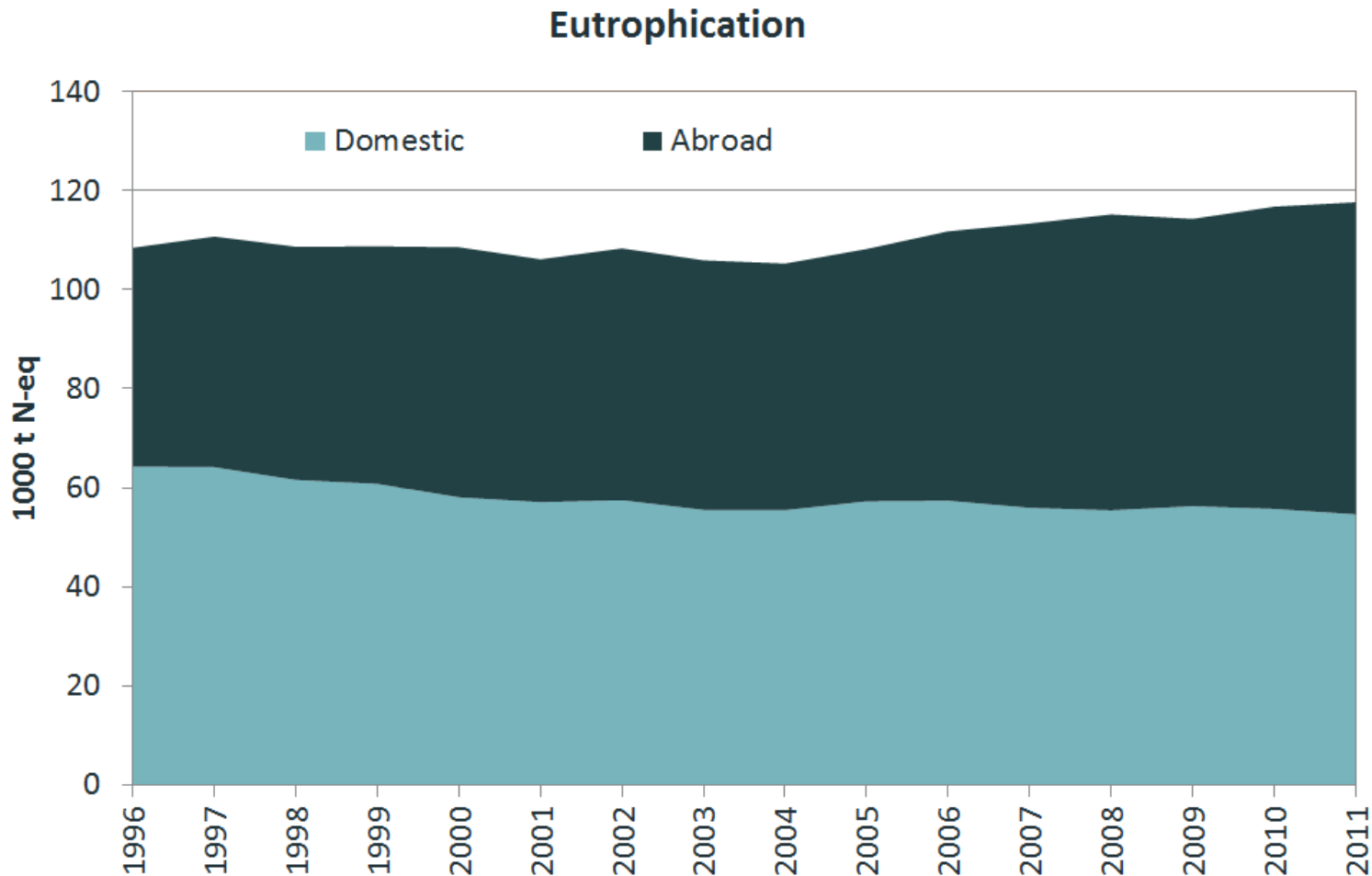
$$E_{c-b,d} = \frac{E_d}{E_d + E_i} \times (E_d + E_i - E_e)$$

foreign (abroad)

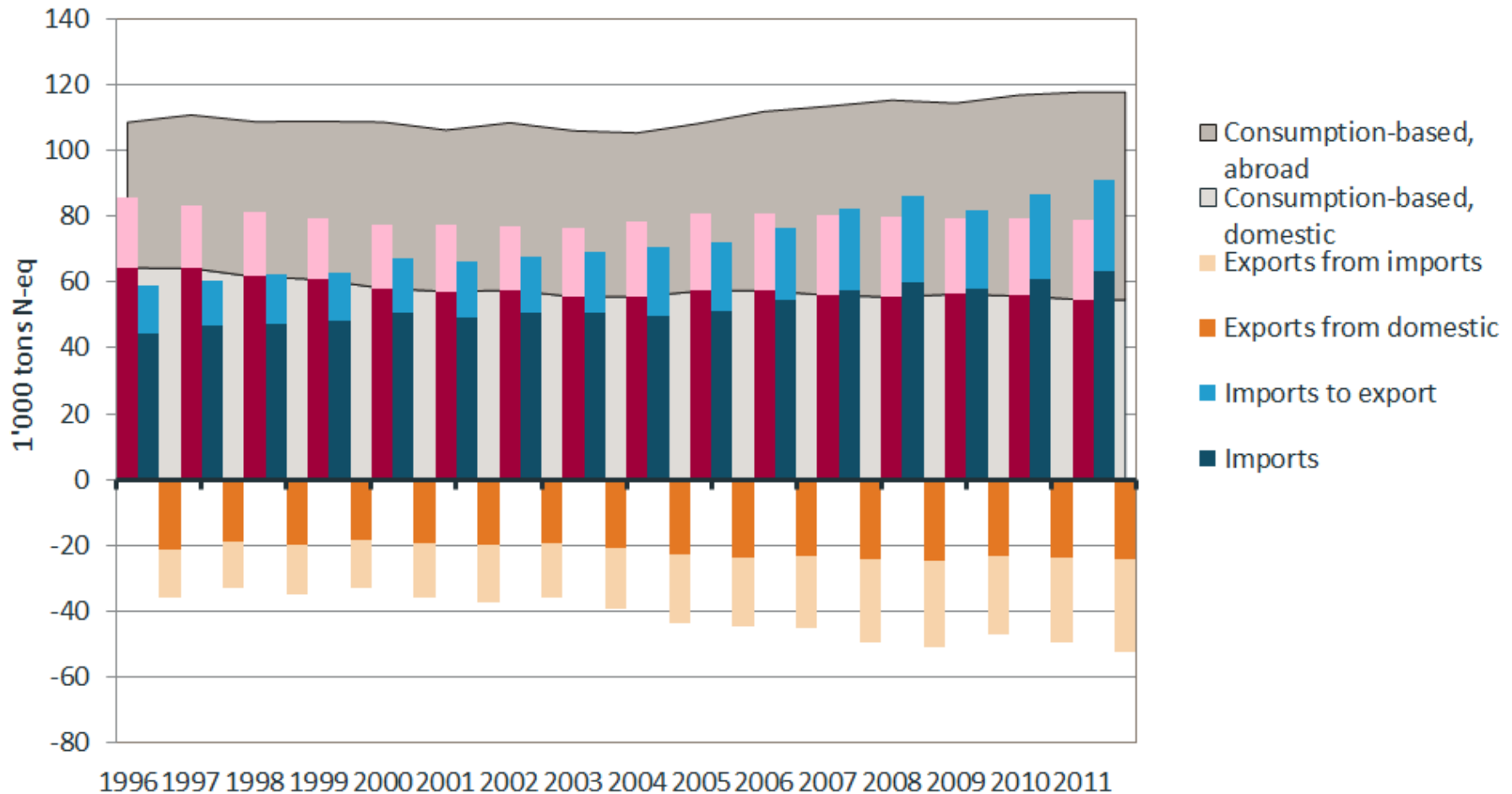
$$E_{c-b,a} = \frac{E_i}{E_d + E_i} \times (E_d + E_i - E_e)$$

- $E_{c-b,d}$ domestic consumption-based environmental impacts,
- $E_{c-b,a}$ foreign (abroad) consumption-based environmental impacts,
- E_d domestic environmental impacts,
- E_i imported environmental impacts
- E_e exported environmental impacts

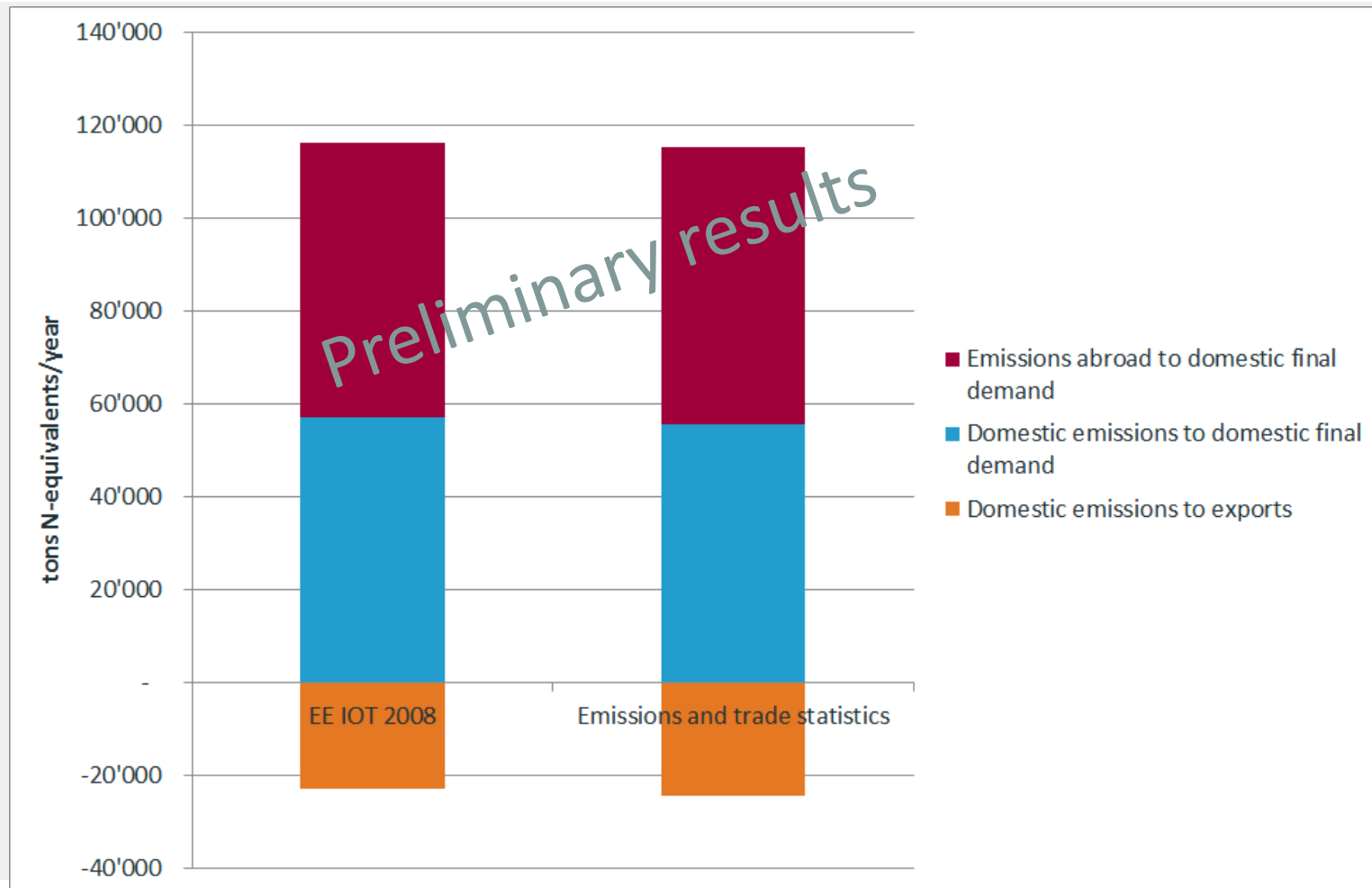
Trend in marine eutrophication caused by Swiss consumption



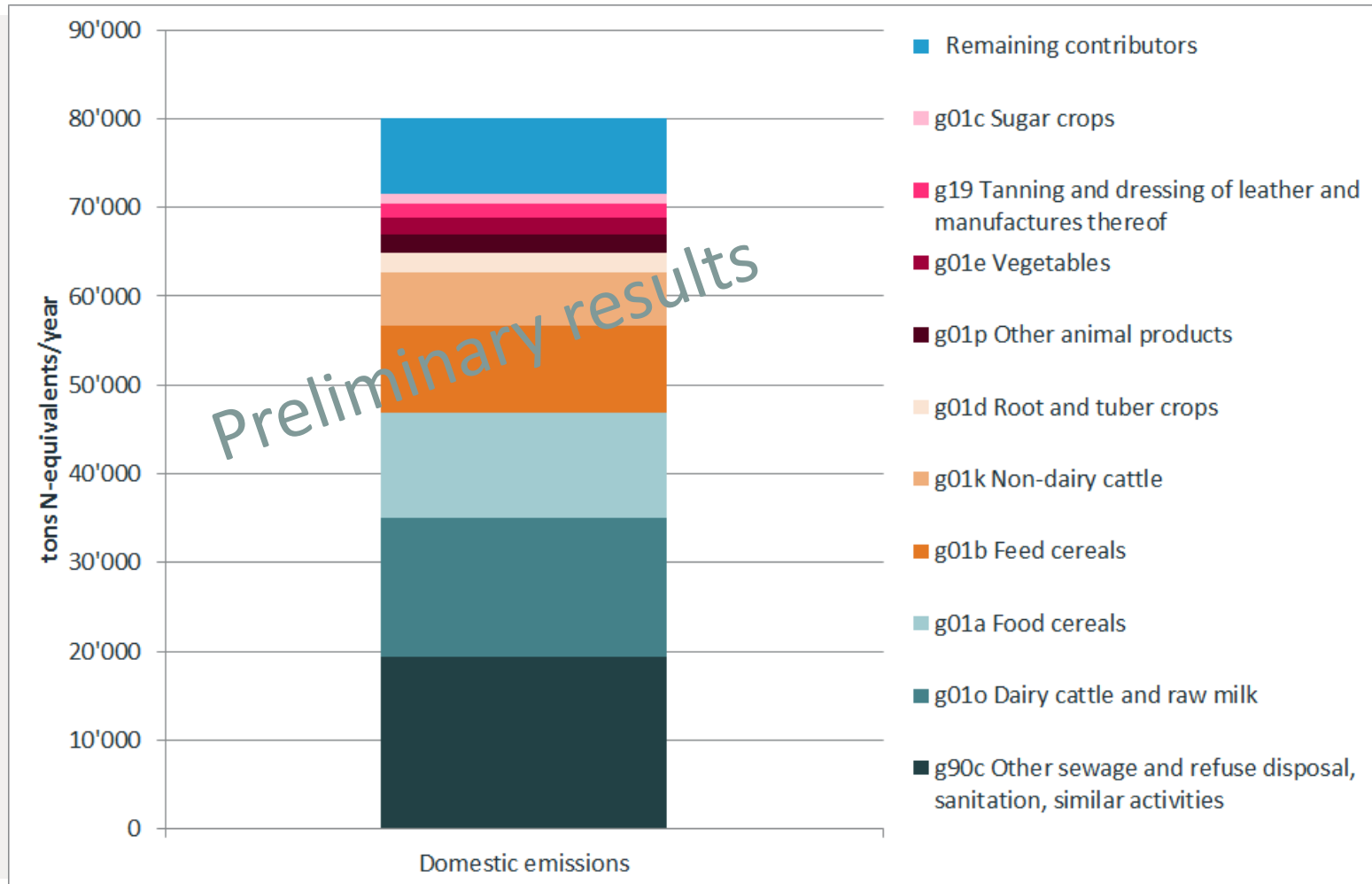
Trend in marine eutrophication: imports and exports



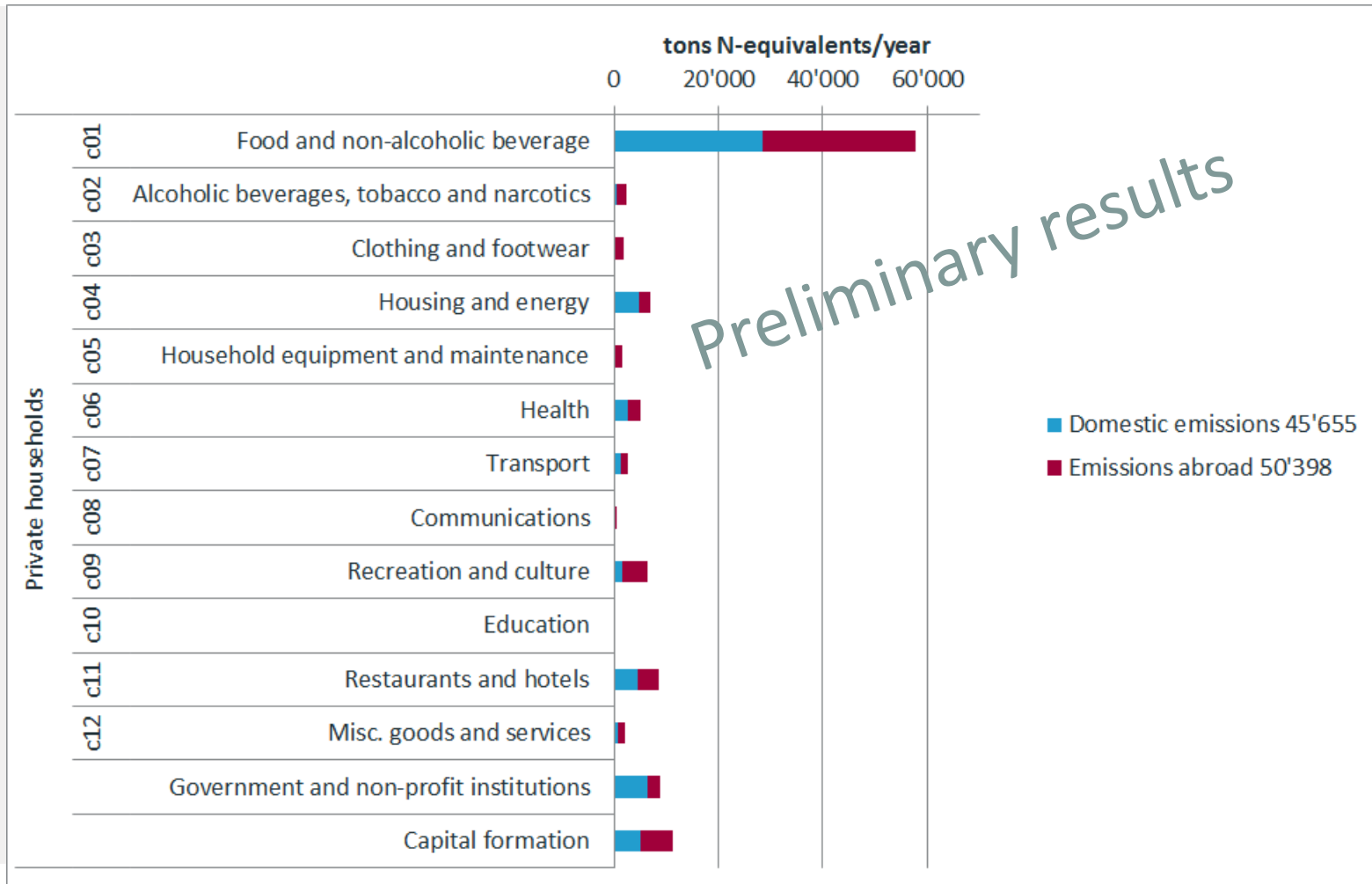
Eutrophication in 2008: Comparison of two approaches



Eutrophication in 2008: Domestic emissions



Eutrophication in 2008: Consumption categories



Sustainable level of N footprint?

- Are 117'000 tons N-eq emissions per year due to Swiss consumption sustainable (within a safe operating space)?

How to define a limit value for of consumption based eutrophication impacts based on planetary boundaries:

An alterntative approach to Dao et al. (2015)

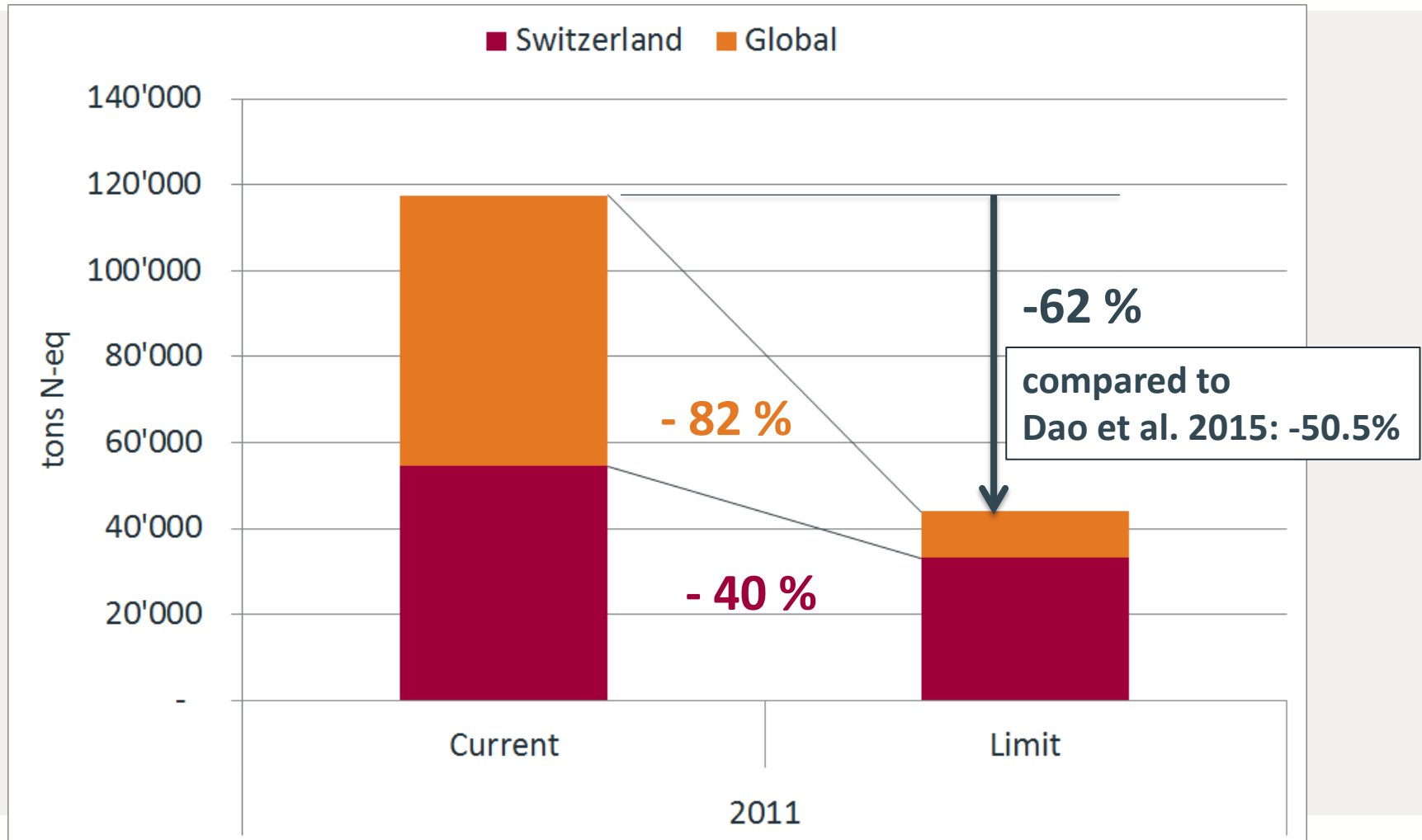
Approach: domestic and global planetary boundaries

- Subdivide emissions into foreground (national) and background (global) part
- **Reduction of domestic (Swiss) emissions of nitrogen compounds (leading to marine eutrophication):**
Swiss environmental laws and OSPAR convention:
minus 40 %

Approach: domestic and global planetary boundaries

- **trade related (global) emissions** of nitrogen compounds:
Equal per capita target for all earth-dwellers
- **Steffen et al. 2015 (Science):**
Global target N-fixation: 8.5 kg/cap/a
Swiss share: 73'000 tons N/a
- Global N-fixation due to Swiss consumption today:
426'000 tons N/a
- **Reduction of trade related (global) emissions:**
minus 82 %

Planetary boundary of Swiss consumption based eutrophication



Conclusions

- Consumption based eutrophication impacts in 2011 higher compared to 1996
- increase in impacts abroad overcompensate the decrease in domestic impacts
- Cumulative emissions based on two approaches (IOT and trade statistics) are very similar
- Eutrophication impacts need to be reduced by nearly **two third** to comply with planetary boundaries
- Eutrophication-Limit similar but slightly stricter than with original approach (Dao et al. 2015)

Thank you very much for your attention!

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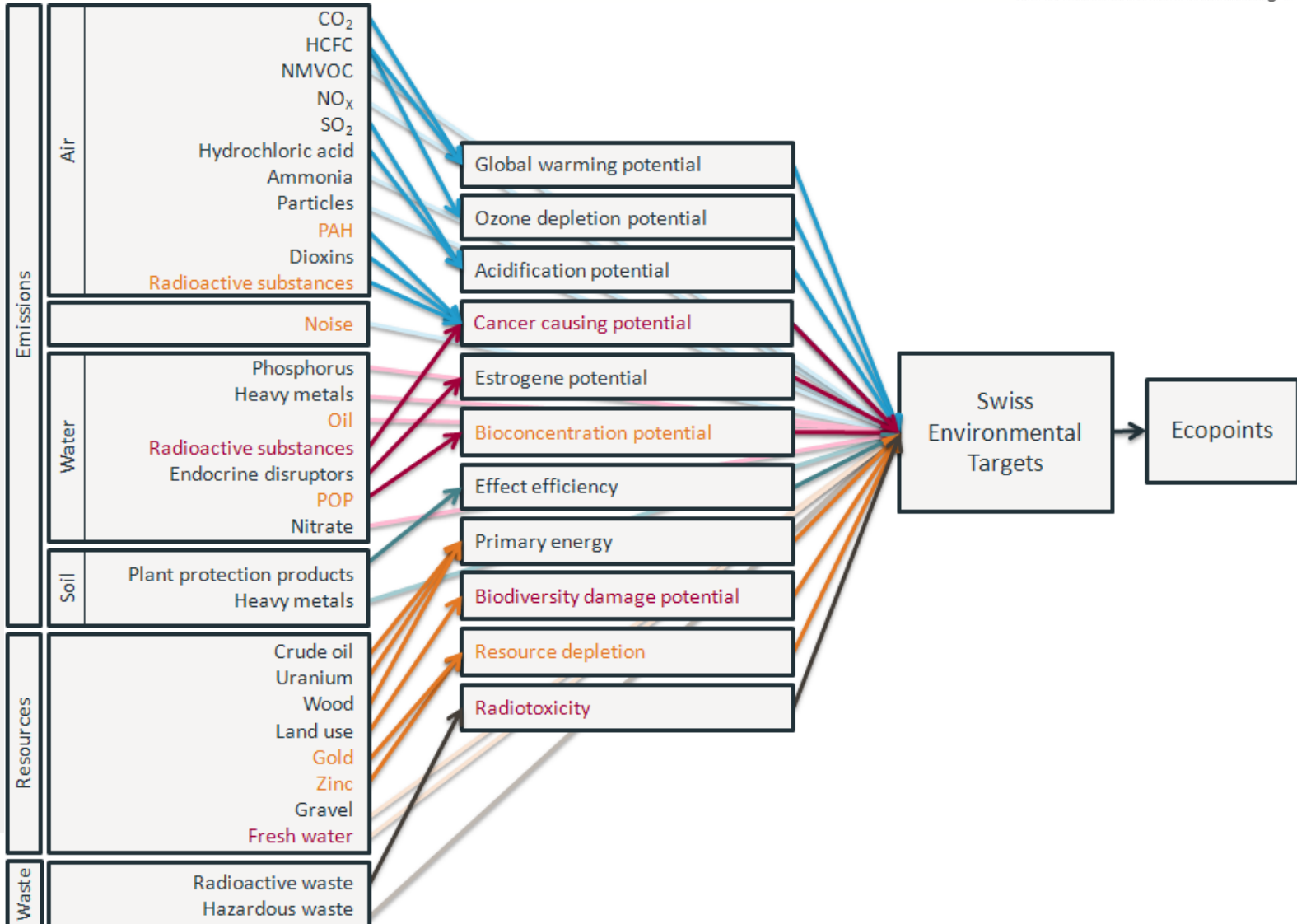
Websites:

www.treeze.ch
www.ruetter-soceco.ch

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Swiss Federal Office for the Environment FOEN
Swiss National Science Foundation SNSF

Environmental impacts quantified with Swiss ecofactors '13



The ecological scarcity formula:

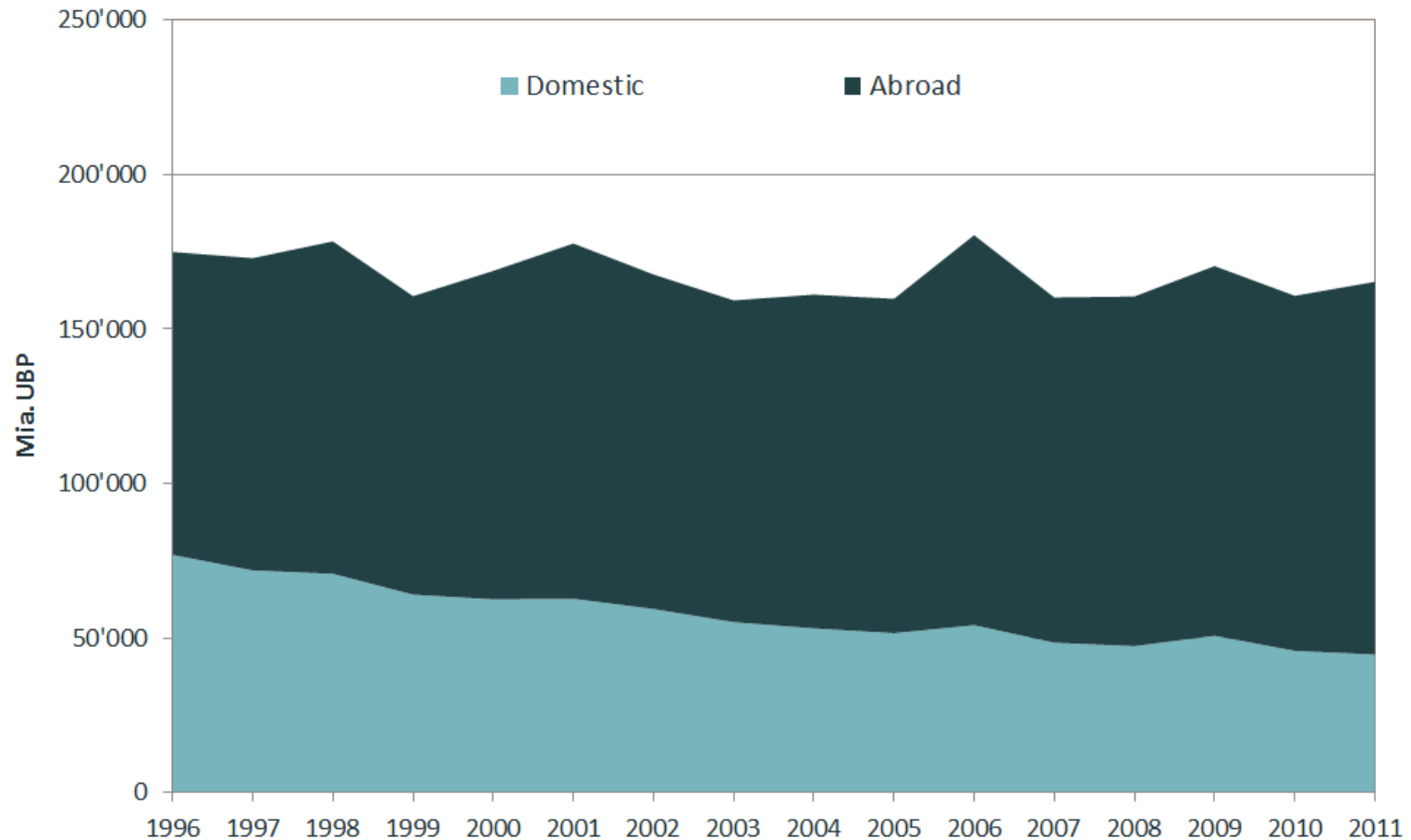
Distance to target

$$\text{Eco - factor} = \underbrace{K}_{\substack{\text{Characterization} \\ \text{(if applicable)}}} \cdot \underbrace{\frac{1 \cdot \text{UBP}}{F_n}}_{\text{Normalization}} \cdot \underbrace{\left(\frac{F}{F_k}\right)^2}_{\text{Weighting}} \cdot \underbrace{c}_{\text{constant}}$$

- K = Characterization factor of a pollutant or a resource
- Flow = Load of a pollutant, quantity of a resource consumed or level of a characterized environmental pressure
- F_n = Normalization flow: Current annual flow with Switzerland as the system boundary
- F = Current flow: Current annual flow in the reference area
- F_k = Critical flow: Critical annual flow in the reference area
- c = Constant ($10^{12}/a$)
- UBP = Eco-point: the unit of the assessed result

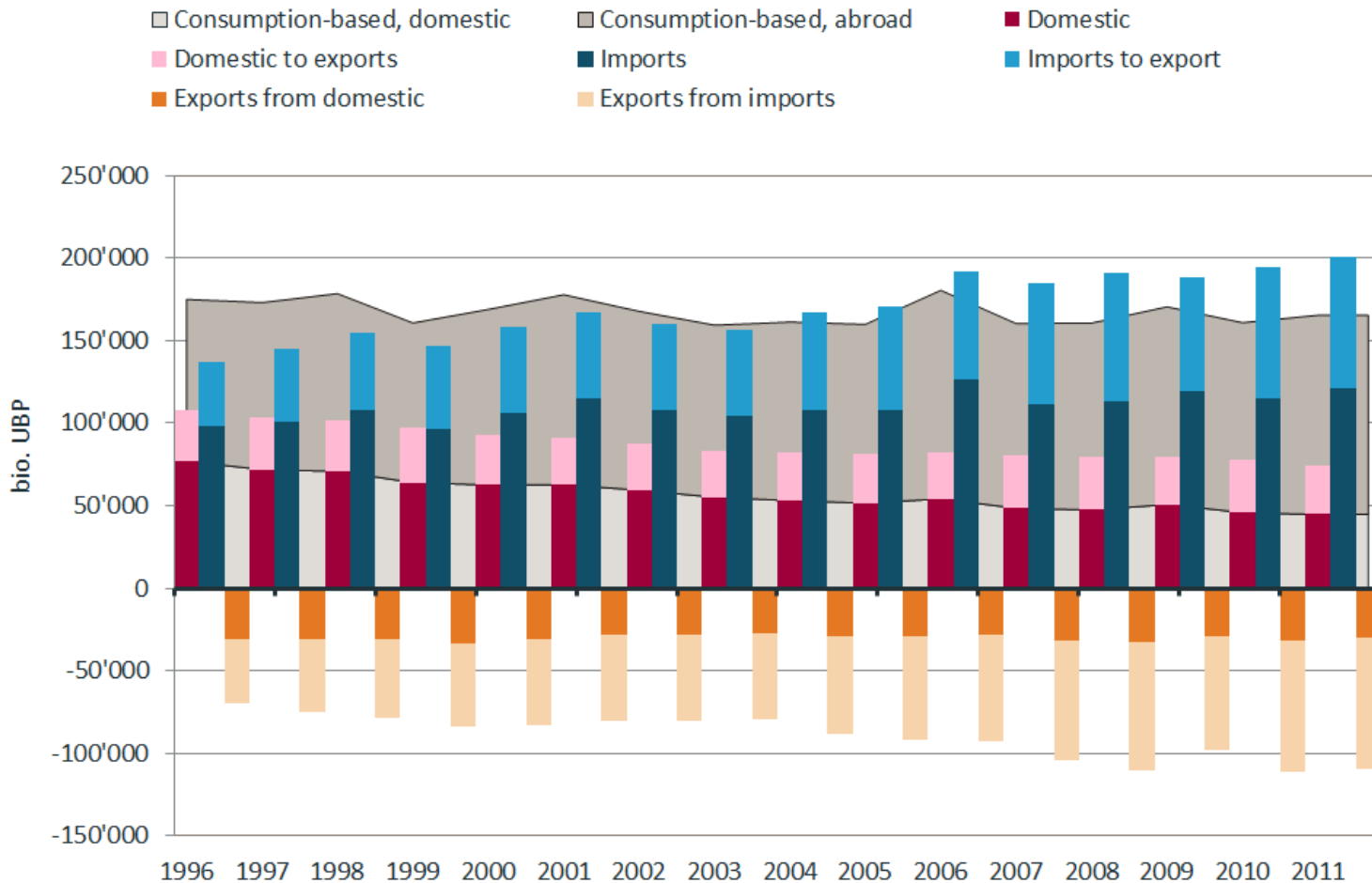
Environmental impacts

Consumption perspective



Environmental impacts

Imports and exports



Trend in Nitrogen fixation due to Swiss consumption

