An Absolute Sustainability Assessment Method for Estimating Environmental Impact Reduction Targets

Chanjief Chandrakumar, Sarah J McLaren

New Zealand Life Cycle Management Centre, Massey University, New Zealand

EIANZ ANNUAL CONFERENCE

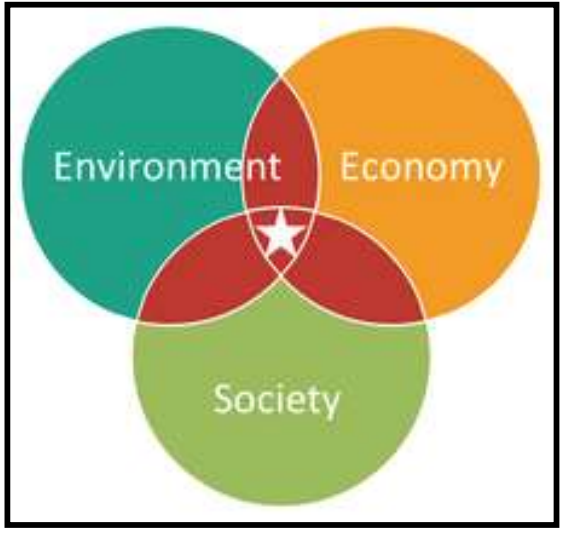
Tu Kaha: Stand Tall

Fronting up with wicked solutions

29 October - 1 November 2017 | Wellington | New Zealand

Sustainable Development

- Brundtland Definition: "*meeting the needs of the present human societies without compromising the ability of future generations to meet their needs*" [1].
- Achieving a balance within the triple bottom-line dimensions of sustainability:
  - economic
  - environmental
  - social



Life Cycle Assessment (LCA)

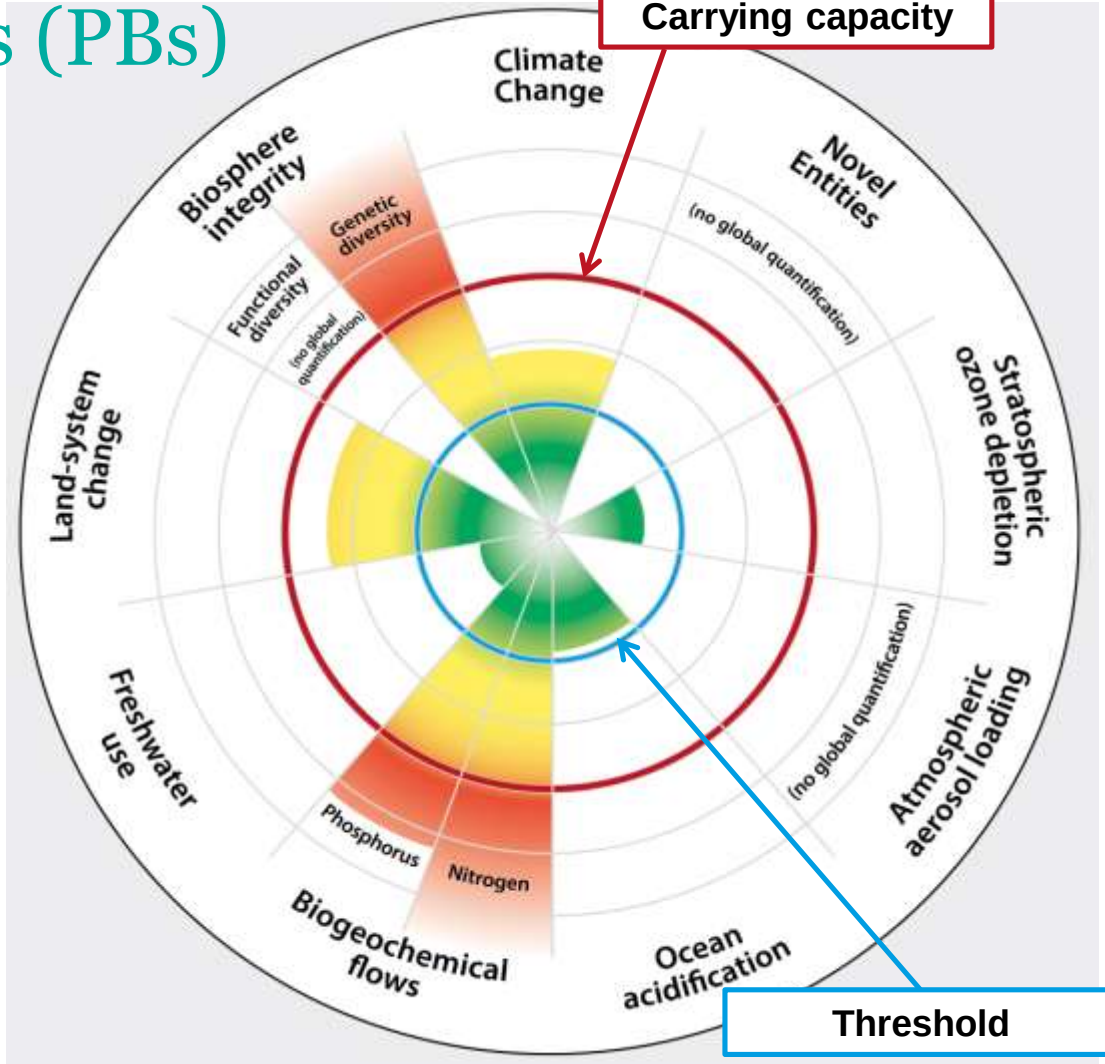
- A tool used to assess
  - a range of environmental impacts
  - using a life-cycle thinking perspective (from cradle to grave)
- Underpins eco-efficiency improvements
- Based on a weak sustainability perception
- Generally, evaluate on a relative scale
- Overlook the variations in the overall magnitude of production and consumption[1,2].

[1]Hauschild, M. Z. (2015). Better – But is it Good Enough? Procedia CIRP, vol. 29, pp. 1-7, 2015

[2]Bjørn, A., & Hauschild, M. Z. (2013). Absolute versus Relative Environmental Sustainability. J. Industrial Ecology, vol. 17, pp. 321-332, 2013

Planetary Boundaries (PBs)

- Control variables for nine environmental problems[1]
- Science-based environmental boundaries
- The boundaries are global
- Some environmental problems are not addressed (e.g. human health, soil quality)[2]



[1]Adapted from Steffen et al., (2015). Science, vol. 347, p. 1259855

[2]Chandrakumar, C., & McLaren, S. J. (forthcoming). *Designing Sustainable Technologies, Products and Policies: From Science to Innovation*: Springer.

Sustainable Development Goals (SDGs)

NEW ZEALAND LIFECYCLE MANAGEMENT CENTRE

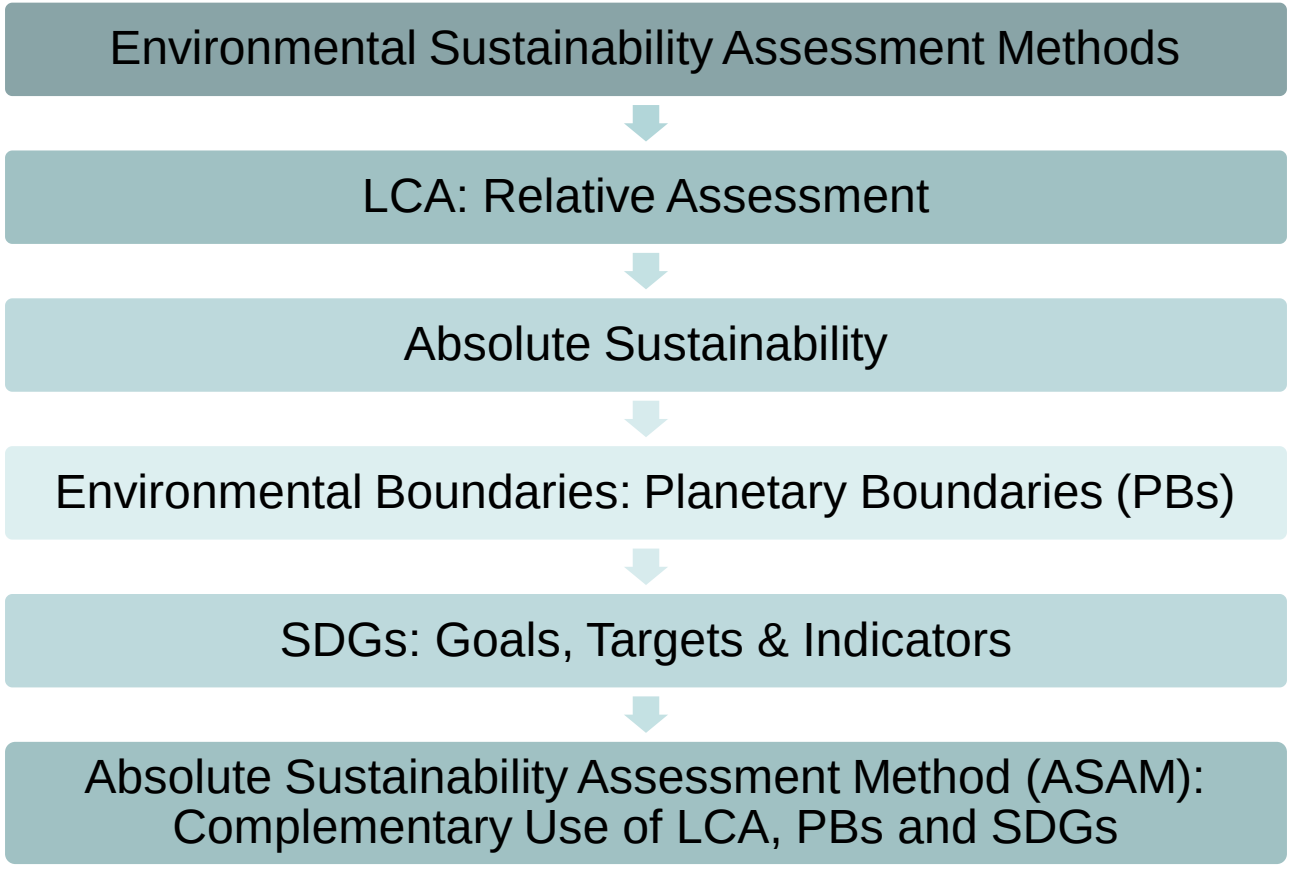
- A set of 17 goals, 169 targets and 232 indicators
- Addresses all three dimensions of sustainability
- Address additional environmental impacts compared to the PBs[1]
- Some indicators are poorly defined[1,2]
- Targets are mostly global and policy-based[2]

(United Nations, 2015)

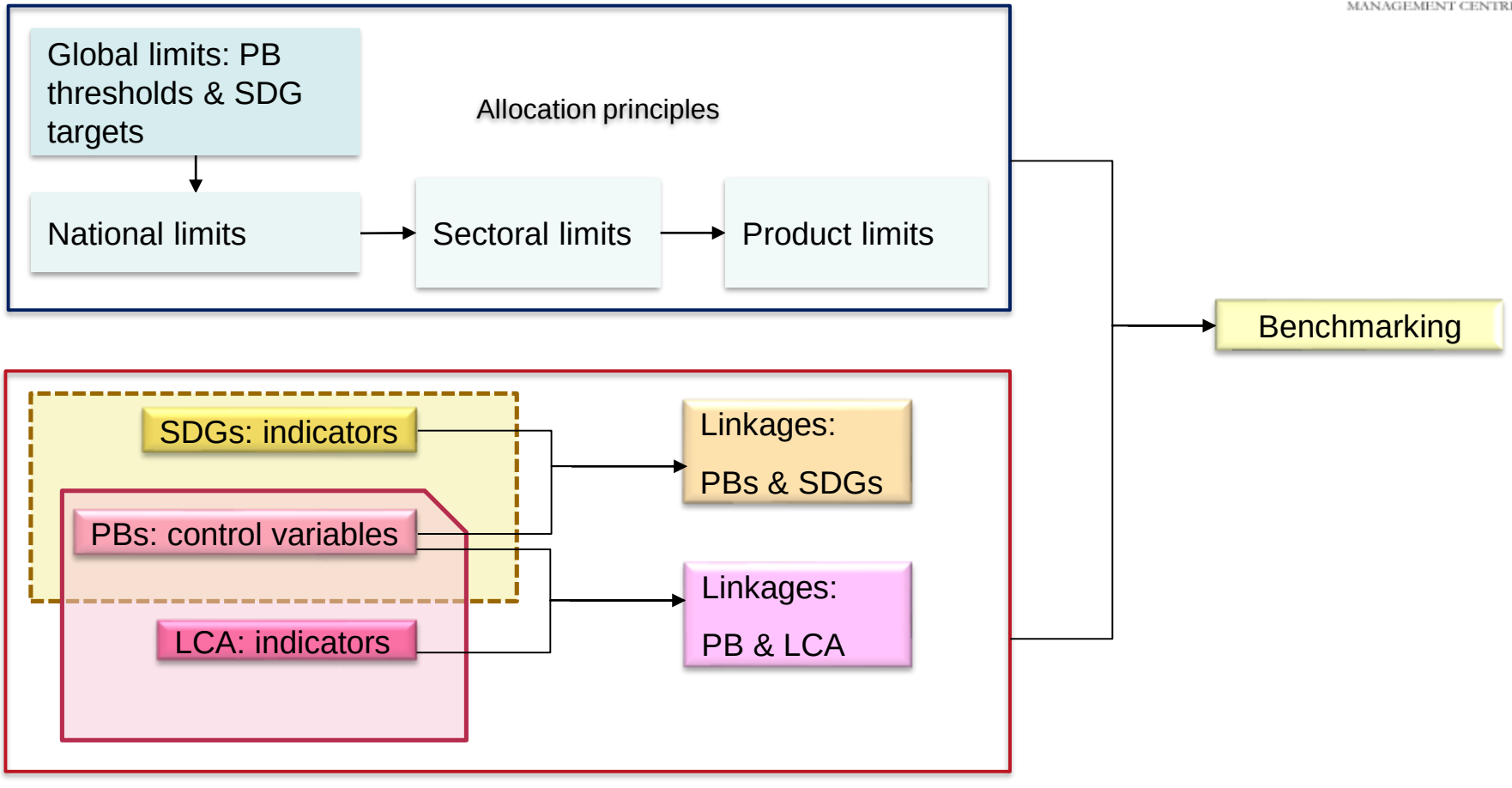
[1]Chandrakumar, C., & McLaren, S. J. (submitted). *Ecological Indicators*

[2]Chandrakumar, C., & McLaren, S. J. (forthcoming). *Designing Sustainable Technologies, Products and Policies: From Science to Innovation*: Springer

In a Nutshell

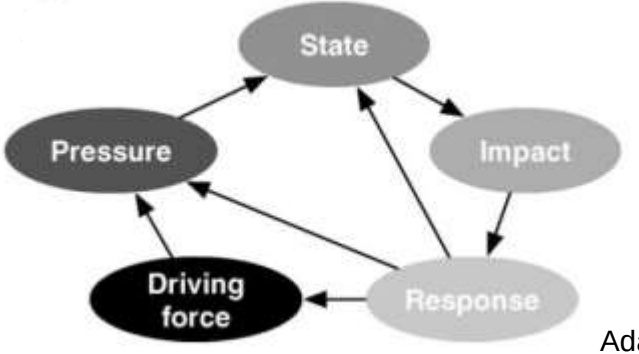


Proposal: ASAM



The Driver Pressure State Impact Response (DPSIR) Framework

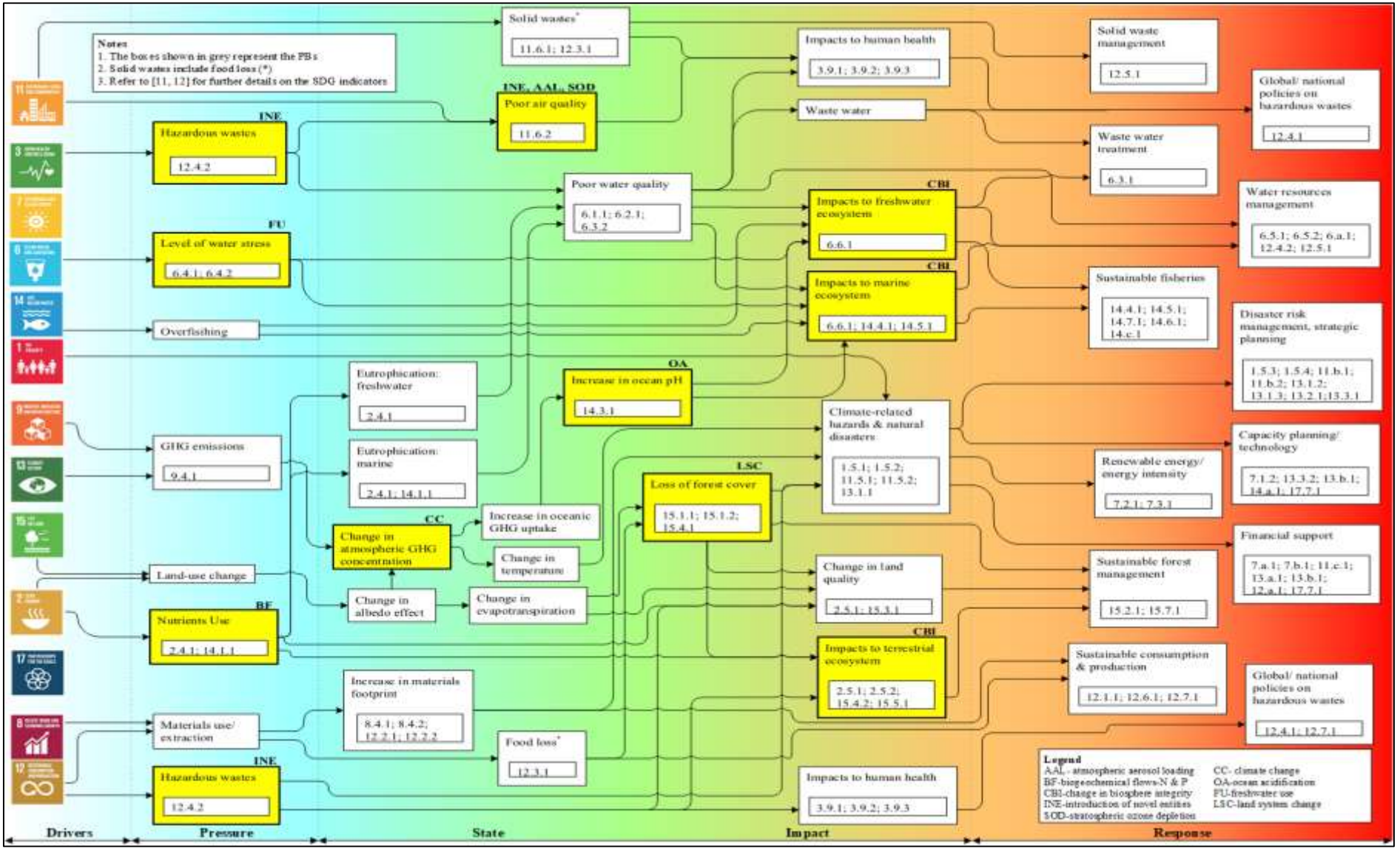
- An indicator-based environmental reporting approach[1,2]
- Describes environmental problems by identifying the cause-effect relationships between human activities and the environment[1]



Adapted from [2]

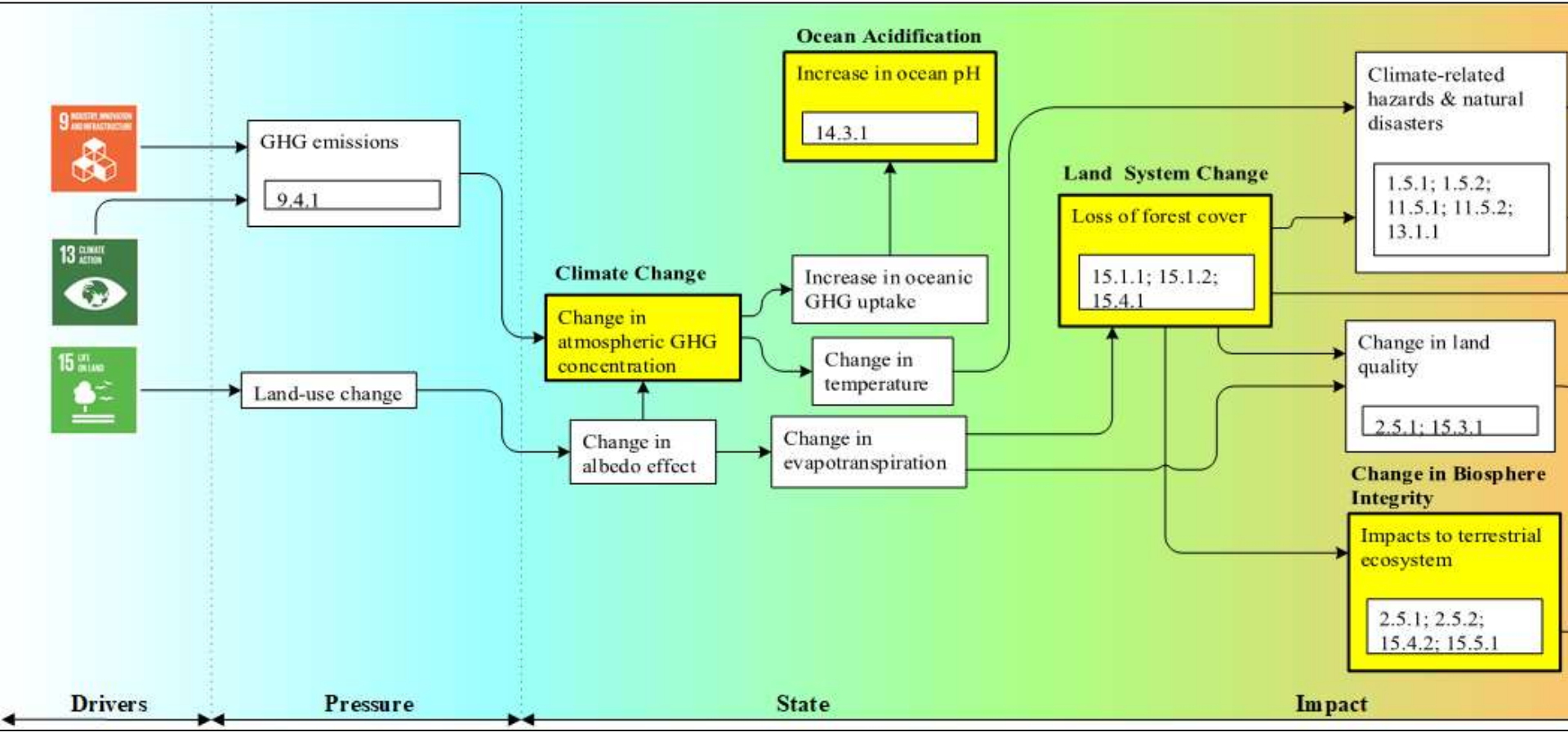
[1]Song and Frostell. Water, vol. 4, pp. 670-682, 2012

[2]Niemeijer, de Groot. Ecological Indicators, vol. 8, pp. 14-25, 2008

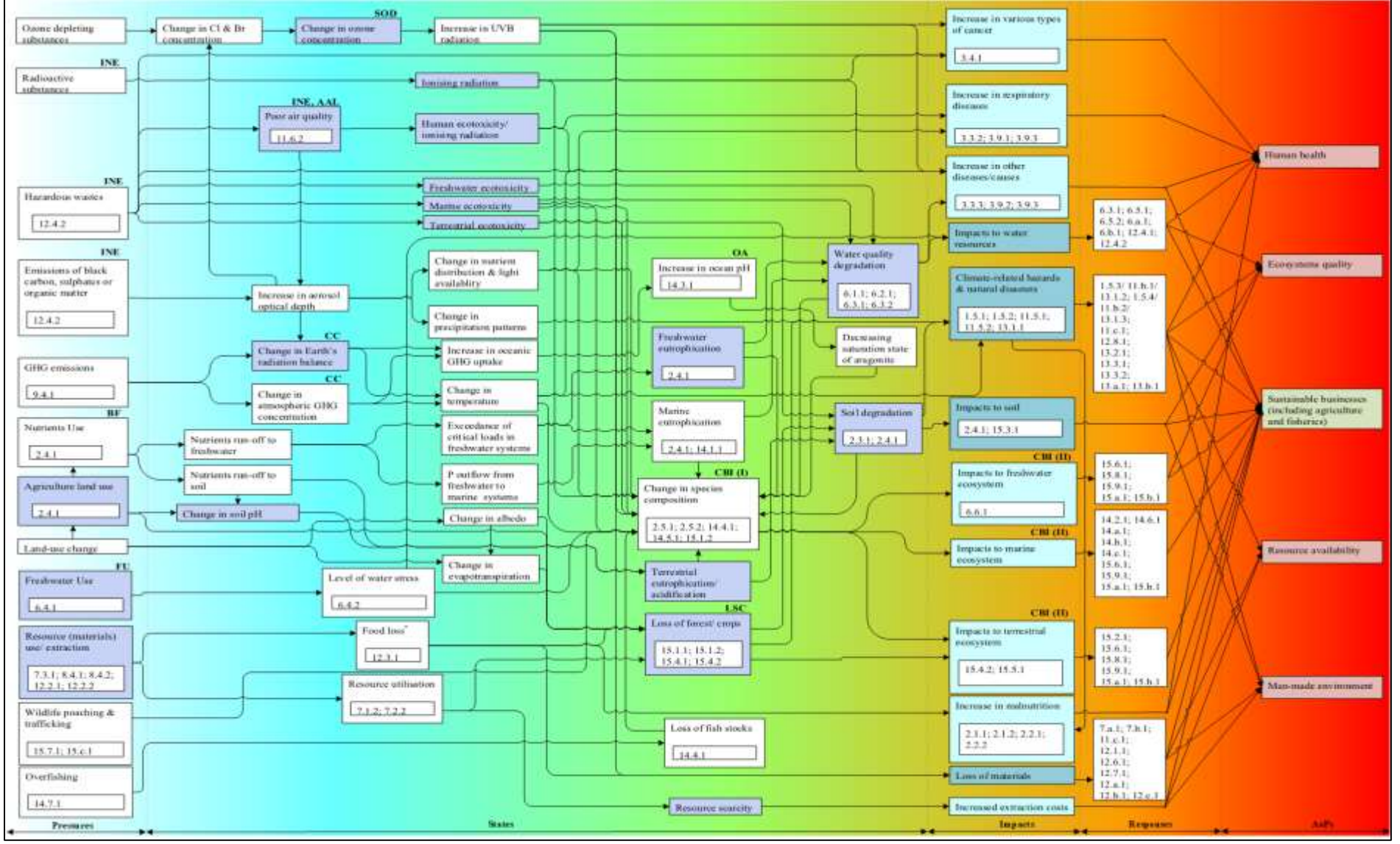


Chandrakumar, C., & McLaren, S. J. (forthcoming). *Designing Sustainable Technologies, Products and Policies: From Science to Innovation*: Springer.

Climate Change

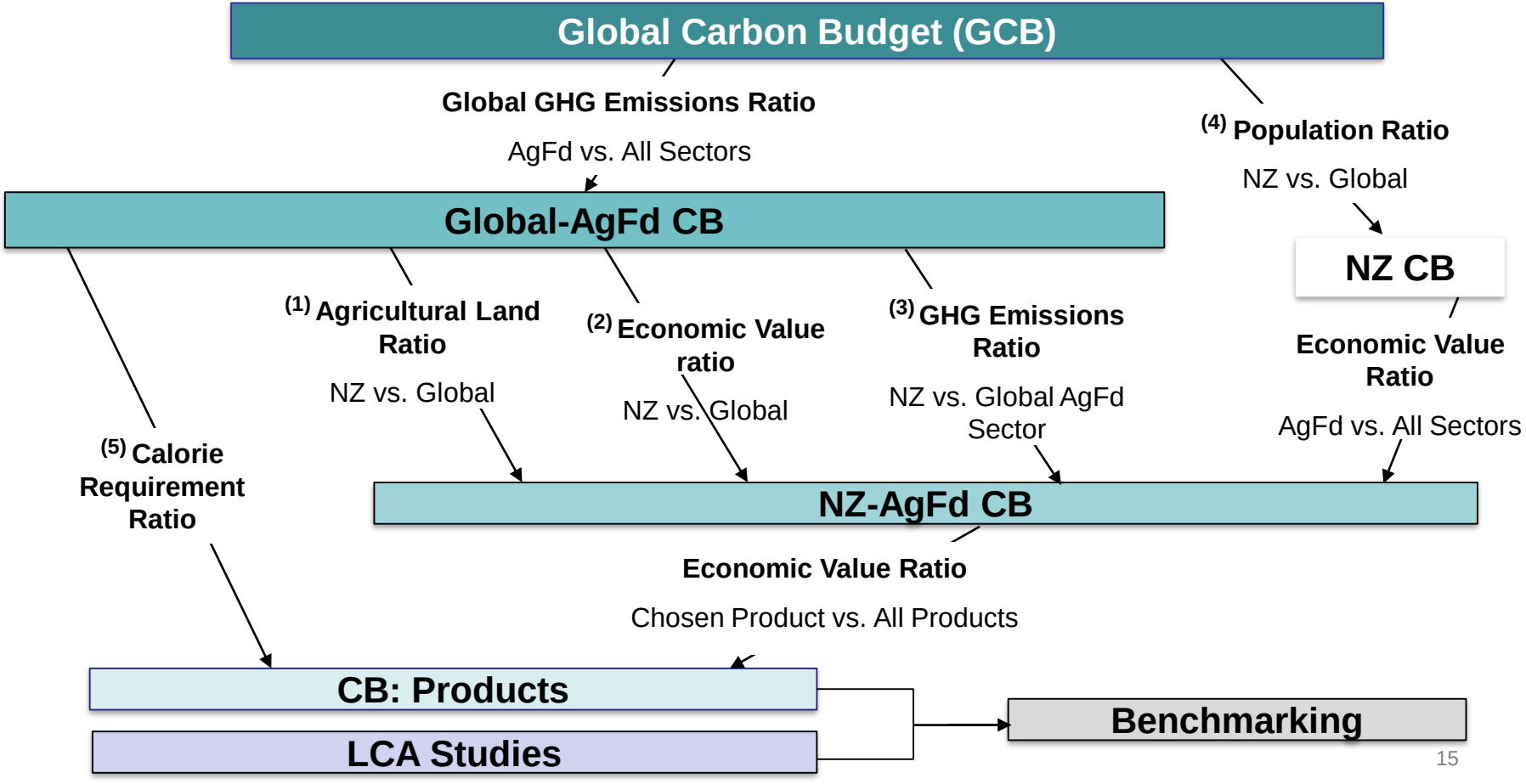


Chandrakumar, C., & McLaren, S. J. (forthcoming). *Designing Sustainable Technologies, Products and Policies: From Science to Innovation*: Springer.

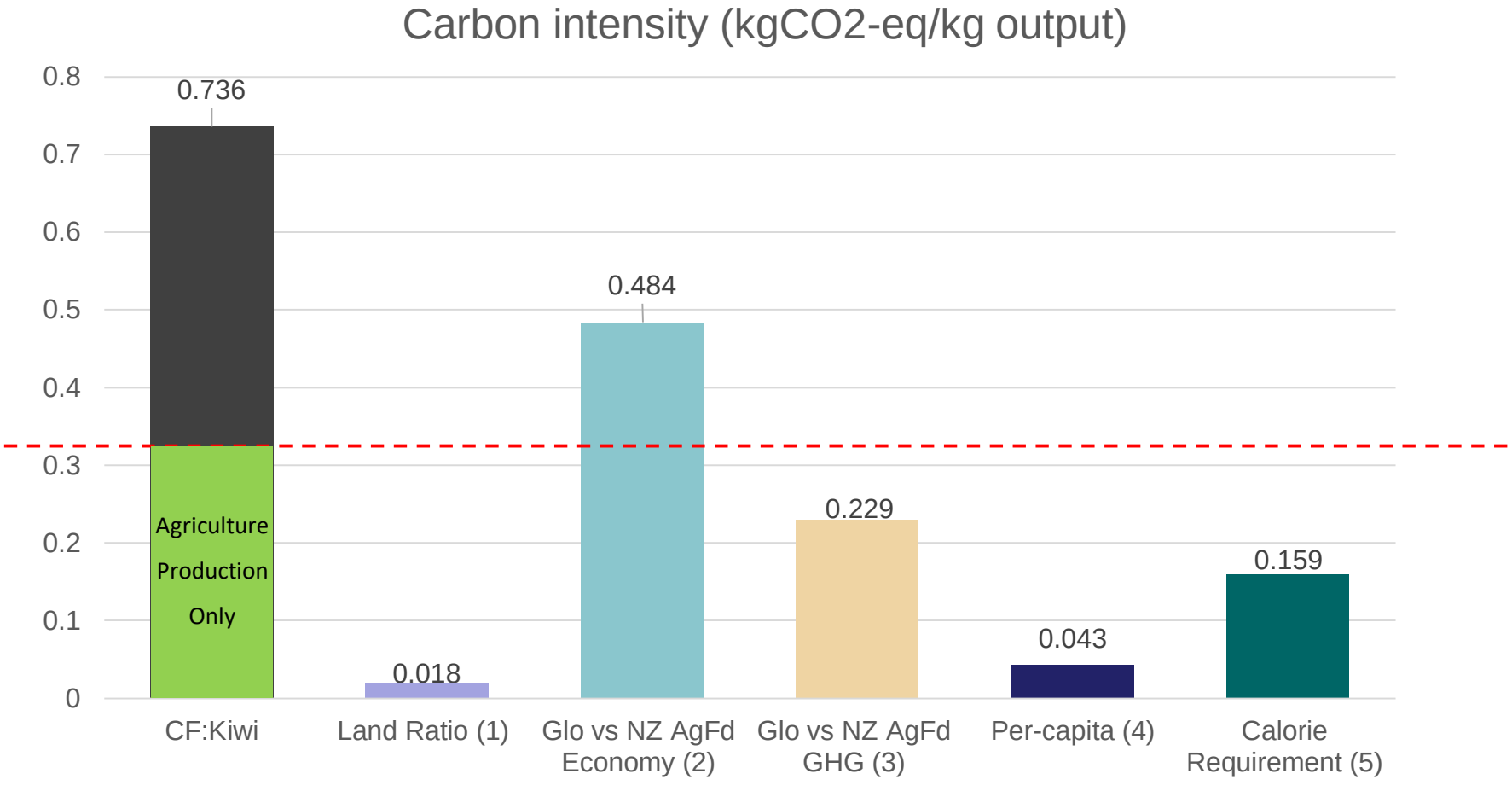


Chandrakumar, C., & McLaren, S. J. (submitted). *Ecological Indicators*

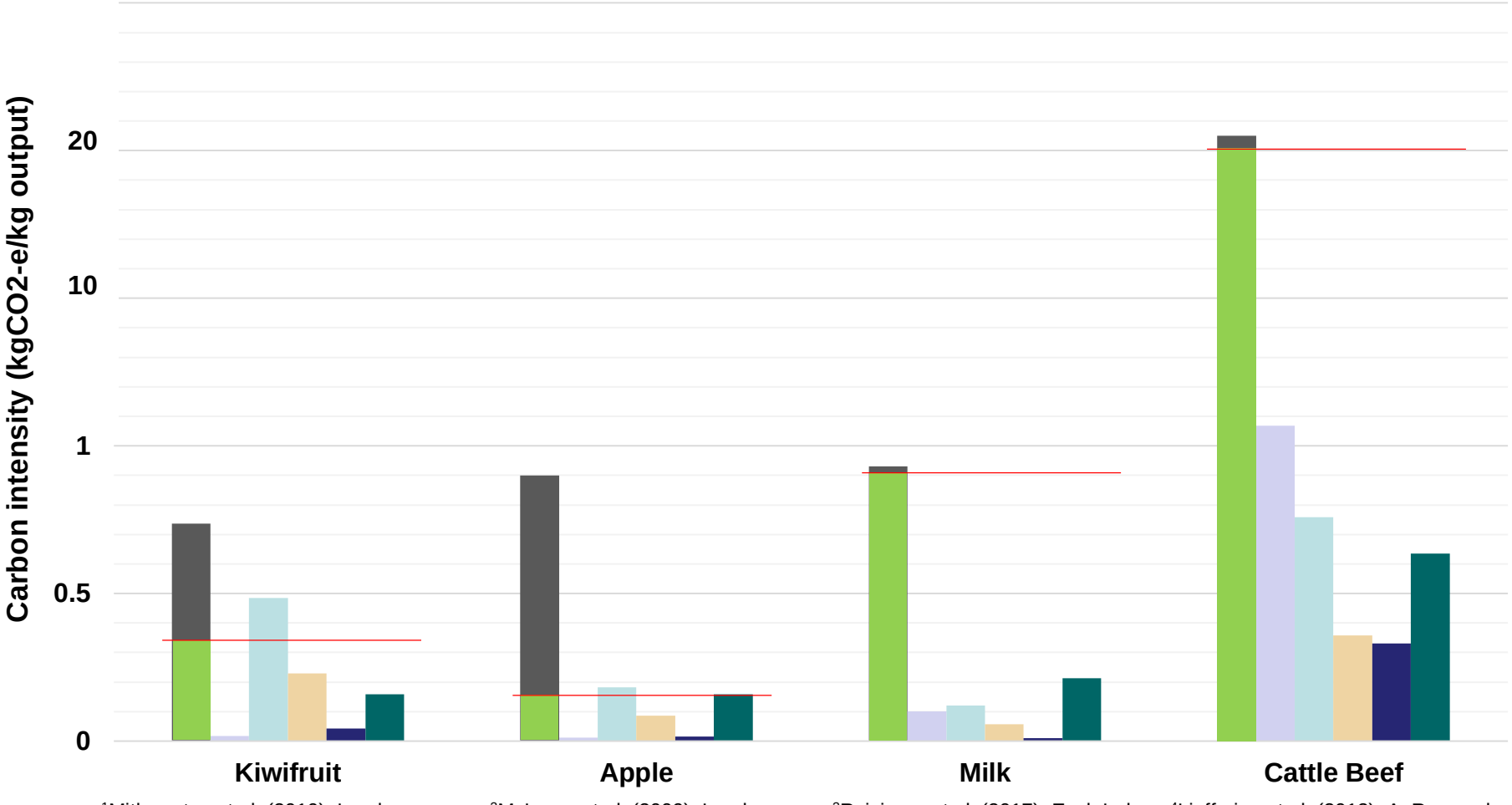
NZ Agrifood (AgFd) Sector & Climate Change



Results: NZ Kiwifruit



Results: Kiwifruit, Apple, Milk & Beef



[1]Mithraratne et al. (2010), Landcare; [2]McLaren et al. (2009), Landcare; [3]Reisinger et al. (2017), Ecol. Ind.; [4]Lieffering et al. (2012), AgResearch

Conclusion

- Non-livestock products are sustainable compared to livestock products
- The proposed ASAM guides in benchmarking the sustainability performance of
  - different systems
  - against a set of environmental boundaries
- Provides the basis for policy- and decision-making
  - e.g. agricultural intensification and expansion

The Way Forward

- Absolute environmental boundaries are essential for achieving global sustainability
- Allocation of global boundaries to sub-global levels involves value- and policy-based decisions
- Regional and local boundaries are required to benchmark at different economic levels (e.g. water contamination, soil quality degradation)
- Further case-studies are required to understand the practical implications associated with similar ASAMs

Thank you

EIANZ ANNUAL CONFERENCE

Chanjief Chandrakumar

C.Chandrakumar@massey.ac.nz