

Handling GeoEndowments Geoethically

A systems perspective:

a) The contemporary human-niche is a planetary-wide network of complex-adaptive socio-ecological systems, which exhibits non-separable societal and environmental dynamics. **b)** The rational and affective sense-making processes of people are intrinsic parts of these systems. **c)** Together with people's behaviour sense-making provides a critical feedback loop; e.g. for a sustainable use of GeoEndowments

(1) Throughout times, people have carved out ecological niches from Earth systems, so called 'anthropogenic biomes' or human-niches [1, 2]. They encompass resources such as air, water, soils, fuels or minerals, which are GeoEndowments, also for future generations.

How to facilitate their sustainable use?

(2) Taking a systems perspective, the fate of GeoEndowments depends on the daily action of numerous agents (individual, institutional and corporate), which happen within the overbearing need to constrain modes of exploitation that are 'free-riding'.

(3) Combining three ethical frameworks, a 'geoethical imperative' may be based on the principles that the governance in the human-niche shall be actor-centric, virtue-ethics based, responsibility focused, knowledge-based, all-actor inclusive, and universal rights-based.

Ethical frameworks:

i) The Cape Town Statement on Geoethics promotes an actor-centric virtue-ethic to act knowledge-based, responsible, and all-actor-inclusive [3]. Geoethics should mitigate temptations of 'free-riding'. **ii)** Experience and theoretical insights show [4, 5] that agents cooperate better to use common resources sustainably when their mental concepts match a high level of 'moral adequacy' (Kohlberg's model) [6]. **iii)** Considering the role of geosciences and engineering in shaping the human-niche, Jonas' 'Imperative of Responsibility' [7] should be a further component to strengthen a sustainable use of GeoEndowments.

[1] Ellis et al. 2016 <https://doi.org/10.1073/pnas.1609425113>, [2] Bohle, M. (2017). <https://doi.org/10.3390/geosciences7010018>, [3] Di Capua et al. (2017). <https://doi.org/10.4401/ag-7553>, [4] Pereira, L. M. et al. (2018). <https://doi.org/10.5751/ES-09907-230119>, [5] Bohle, M., C.E. Nauen, E. Marone 2019 <https://doi.org/10.3390/su11030773>, [6] Kohlberg, L. (1981). Essays in Moral Development and the Idea of Justice. San Francisco: Harber & Row. [7] Jonas, H. (1984). The Imperative of Responsibility. Chicago: University of Chicago Press.

Martin Bohle ^(1,4,5), Rika Preiser ⁽²⁾, Eduardo Marone ^(3,4,6)

(1) European Commission, Research and Innovation, Brussels, Belgium, (2) Centre for Complex Systems in Transition, Stellenbosch University, South Africa, (3) Centre for Marine Studies, Federal University of Paraná (CEM-UFPR), Curitiba, Brazil, (4) International, Association for Promoting Geoethics, Rome, Italy, (5) Ronin Institute, Montclair, NJ, USA (martin.bohle@ronininstitute.org), (6) International Ocean Institute Training Centre for Latin America and the Caribbean

