



Handling GeoEndowments Geoethically

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Throughout times, people have carved out ecological niches ('anthropogenic biomes') from local and regional Earth systems [1]. Nowadays, global supply-chains amalgamate them into a planetary human-niche; a process enabled by geosciences knowledge combined within engineering sciences [2]. The human-niche encompasses resources such as air, water, soils, fuels, minerals, which are geo-endowments, also for future generations. It is ethically imperative that the individual, collective or institutional 'niche-builder' uses them sustainably. Beyond geo-resources, the human-niche holds other common resources such as biodiversity or ecosystem services.

Taking a systems perspective, the human-niche is a network of complex-adaptive socio-ecological systems of non-separable societal and environmental dynamics. The rational and affective sense-making processes of people are intrinsic parts of these systems, which together with people's behaviour provide a critical feedback loop, for example whether to use geo-endowments sustainably. Any action of people is undertaken within the human-niche and, potentially has a threefold impact: at 'sense-making level', at 'technology level' and at 'environmental level'.

The fate of geo-endowments depends on daily actions of numerous agents (i.e. individual, institutional and corporate) who pursue different interests, hold various perceptions or world-views, and are motivated by diverse mental constructs. To act together sustainably within the human-niche and to benefit from its resources, a mutually recognized guidance would facilitate inter-agent cooperation. Its minimum functionality should be to bundle the various values, world-views and interests to constrain attempts of 'free-riding' modes of exploitation.

As experience and theoretical insights show [3, 4]: cooperation favourable to use common resources sustainably could emerge when the agents' mental concepts match a high level of moral adequacy in Kohlberg's model [5], emphasize the role of the responsible agent, be all-agent inclusive, and be knowledge-based. The highest level of moral adequacy, Kohlberg's 'upper post-conventional level', is described by a morality that is based on individual rights and justice, by acts that are based on universal ethical principles, and by principled self-conscience and mutual respect.

The Cape Town Statement on Geoethics outlines an actor-centric virtue-ethic promoting to act responsible, knowledge-based, all-actor-inclusive [6], which should mitigate temptations of 'free-riding'. Mental concepts of geoethical acting people founded on universal rights should weaken further any such temptation. Finally, reconsidering the role of geosciences and engineering in shaping the human-niche, Jonas' 'Imperative of Responsibility' [7] should be mobilised for a more sustainable use of geo-endowments. Combining these approaches, a 'geoethical imperative' may be outlined, to call for the governance in the human-niche to be actor-centric, responsibility focused, knowledge-based, all-actor inclusive, and universal rights-based.

[1] Ellis et al. 2016 <https://doi.org/10.1073/pnas.1609425113>

[2] Bohle, M. (2017). <https://doi.org/10.3390/geosciences7010018>

[3] Pereira, L. M. et al. (2018). <https://doi.org/10.5751/ES-09907-230119>

[4] Bohle, M., C.E. Nauen, E. Marone (2018). Not Out of the Blue: Ethics to Intersect Civic Participation and Formal Guidance, Earth System Governance Conference 2018 (The Utrecht, Netherlands)

[5] Kohlberg, L. (1981). *Essays in Moral Development and the Idea of Justice*. San Francisco: Harber & Row.

[6] Di Capua et al. (2017). <https://doi.org/10.4401/ag-7553>

[7] Jonas, H. (1984). *The Imperative of Responsibility* (p. 263). University of Chicago Press.