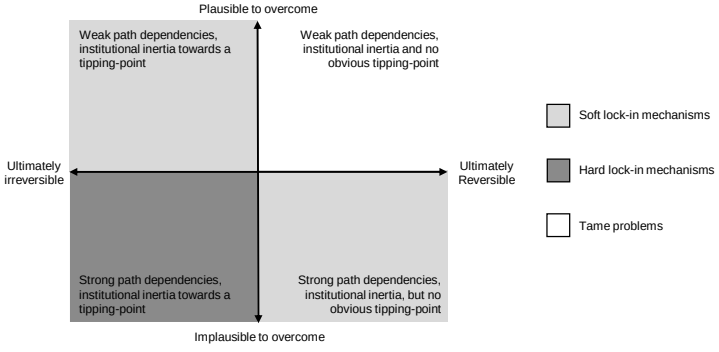
Supplementary Figure S5 – Quadrant of essential characteristics of 'lock-in' mechanisms: reversibility and plausibility to overcome problems.



Reversibility refers to the capacity of social-ecological systems to recover functions and services after exceeding "safe-limit" thresholds, planetary boundaries or tipping points (Newbold et al., 2016). Although there are variable degrees of uncertainty (Oliver, 2016) and non-linearity (Milkoreit et al., 2018), if trajectories within parts of a system are likely to lead to irreversible consequences, then interventions aiming to prevent and/or mitigate outcomes are required (IPCC, 2014). IPCC (2018), for example, concluded with high confidence that global warming of ≥2°C above pre-industrial levels carries an increasing "*…risk of irreversible loss of many marine and coastal ecosystems*" (p. 10), while, from a perspective of stunting in early childhood, de Onis and Branca (2016) emphasized that "*the severe irreversible physical and neurocognitive damage that accompanies stunted growth poses a major threat to human development*" (p. 23). In parallel, plausibility refers to the likelihood of implementing reconcilable interventions aiming to transform trajectories, which may or may not lead to irreversible consequences. Factors impairing the plausibility of overcoming persistent dynamics include concentration of power (Woodall & Shannon, 2018), siloed approaches (i.e. artificially deconstructing intertwined parts of a system in isolation (Reyers et al., 2018)), and various underlying cultural and/or epistemic lock-ins - e.g. resilient production and consumption of inefficient, resource-intensive foods, particularly red and processed meat (Bruce & Spinardi, 2018; Heinz & Lee, 1998), persistent justifications for excluding women from education and society (Moaddel, 1998); or resilient preconceptions about science and policy (Sunstein et al., 2017). Rather than addressing these lock-ins as mere consequences of lack of awareness or epistemic gaps, exploring environmental nudges, conscious and non-conscious interacting processes seems to enable (unlock) potential leverage points for transformation (Hassink, 2005; Marteau, 2018). See main text for further discussion.

References:

Bruce, A., & Spinardi, G. (2018). On a wing and hot air: Eco-modernisation, epistemic lock-in, and the barriers to greening aviation and ruminant farming. *Energy Research & Social Science*, *40*, 36–44. https://doi.org/10.1016/j.erss.2017.11.032

de Onis, M., & Branca, F. (2016). Childhood stunting: a global perspective. *Maternal & Child Nutrition*, *12*, 12–26. https://doi.org/10.1111/mcn.12231

Hassink, R. (2005). How to unlock regional economies from path dependency? From learning region to learning cluster. *European Planning Studies*, *13*(4), 520–535. https://doi.org/10.1080/09654310500107134

Heinz, B., & Lee, R. (1998). Getting down to the meat: The symbolic construction of meat consumption. *Communication Studies*, *49*(1), 86–99. https://doi.org/10.1080/10510979809368520

IPCC. (2014). *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Retrieved from https://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full_wcover.pdf

IPCC. (2018). *Global Warming of 1.5 °C*. Incheon. Retrieved from http://www.ipcc.ch/report/sr15/

Marteau, T. M. (2018). Changing minds about changing behaviour. *The Lancet*, *391*(10116), 116–117. https://doi.org/10.1016/S0140-6736(17)33324-X

Milkoreit, M., Hodbod, J., Baggio, J., Benessaiah, K., Calderón-Contreras, R., Donges, J. F., … Werners, S. E. (2018). Defining tipping points for social-ecological systems scholarship—an interdisciplinary literature review. *Environmental Research Letters*, *13*(3), 33005. https://doi.org/10.1088/1748-9326/aaaa75

Moaddel, M. (1998). Religion and Women: Islamic Modernism versus Fundamentalism. *Journal for the Scientific Study of Religion*, *37*(1), 108. https://doi.org/10.2307/1388032

Newbold, T., Hudson, L. N., Arnell, A. P., Contu, S., De Palma, A., Ferrier, S., … Purvis, A. (2016). Has land use pushed terrestrial biodiversity beyond the planetary boundary? A global assessment. *Science*, *353*(6296), 288–291. https://doi.org/10.1126/science.aaf2201

Oliver, T. H. (2016). How much biodiversity loss is too much? *Science*, *353*(6296), 220–221. https://doi.org/10.1126/science.aag1712

Reyers, B., Folke, C., Moore, M.-L., Biggs, R., & Galaz, V. (2018). Social-Ecological Systems Insights for Navigating the Dynamics of the Anthropocene. *Annual Review of Environment and Resources*, *43*(1), 267–289. https://doi.org/10.1146/annurev-environ-110615-085349

Sunstein, C., Bobadilla-Suarez, S., Lazzaro, S., & Sharot, T. (2017). How People Update Beliefs about Climate Change: Good News and Bad News. *Cornell Law Review*, *102*(6). Retrieved from https://scholarship.law.cornell.edu/clr/vol102/iss6/1/

Woodall, P., & Shannon, T. L. (2018). Monopoly Power Corrodes Choice and Resiliency in the Food System, *63*(2), 198–221. https://doi.org/10.1177/0003603X18770063