

The “Doughnut Economics” diagram can provide a visual for why to learn Earth Sciences

1. Introductions

Our Embedded Economy. Our daily needs and wants are supposed to be provided by the Economy through financial flows between our household, the market, the state and the commons (Fig.1). The word “Economy” originates from *oikos* or “house” and *nemein* “to manage”. Our economy is embedded within Earth. It is from our planet and from the Sun where we obtain the energy, materials and living matter essential for the economy to function. It is also within Earth where any waste matter and waste heat resulting from our economic activities need to be managed. How we manage our house, planet Earth, determines how we live, now and in the future.

Doughnut Economics. Kate Raworth (2017, 2025) proposes “Doughnut Economics” as a big-picture compass to help us manage our house (Fig. 2). The doughnut contains the safe and just space for humanity, our livable space. The inner part of the doughnut or its base is supported by twelve social foundation dimensions. Falling short of these dimensions results in critical human deprivation. The outside part of the doughnut represents the nine planetary boundaries. Moving beyond this ecological ceiling can result in critical planetary degradation (Steffen et al. 2015). Countries normally aim for continuous economic growth, measuring their wealth and progress based on the Gross Domestic Product (GDP). The Doughnut provides an alternative indicator of the status of our economy, including how we manage resources and the resulting waste. In addition, they provide a visual of the status of the society and of the planet.

This framework can be applied to different spatial and temporal scales. Fanning & Raworth (2025) identify various indicators to quantify the social dimensions and the planetary boundaries and how these dimensions and boundaries levels change through time at a global and at country-clusters based on their economy scales.

Earth Science Literacy Principles. Earth scientists defined nine principles that can help us to know how Earth influence us and how we influence Earth (Table 1).

Table 1. Earth Science Literacy Principles		
1	Earth scientists use repeatable observations & testable ideas to explain our planet	1
2	Earth is 4,600 Ma old	2
3	Earth is a complex system of interacting rock, water, air and life	3
4	Earth is continuously changing	4
5	Earth is the water planet	5
6	Life evolves on a dynamic planet & continues modifying Earth	6
7	Humans depend on Earth's natural resources	7
8	Humans are subject to Earth's natural hazards	8
9	Humans actions modify Earth	9

“Doughnut Economics” as a lens to build Earth Science Literacy to support society's social foundation and prevent ecological ceiling overshoot. Laura Rosales-Lagarde, laura.rosales@nevadastate.edu

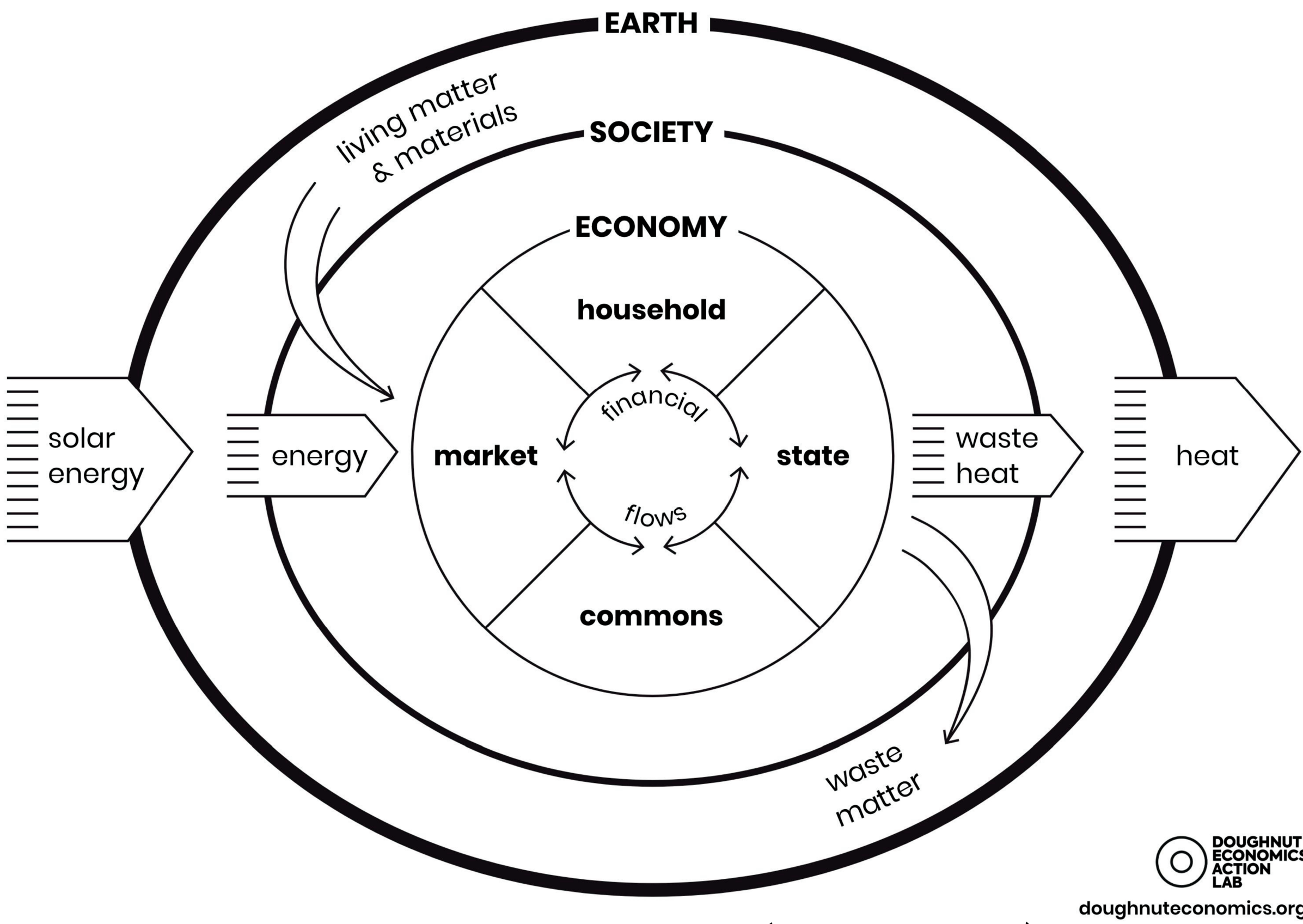


Fig. 1 Embedded Economy (Raworth 2017)

- Four Spheres of the Economy which interact to satisfy our needs or wants:
- **The Market:** A physical or virtual place or venue that facilitates the exchange of goods & services. Eg. stores, businesses.
 - **The State:** A system made up of different parts that work together to meet public needs, from local to national. It may be a provider & a rule-setter. Eg. public schools, roads.
 - **The Household:** A social unit composed of those living together under the same dwelling. Eg. living space, home-cooked meals.
 - **The Commons:** A way of people self-organizing to manage shared resources outside the governing of the market or state. Eg. community gatherings, Wikipedia, Open-source data.

2. How can “Doughnut Economics” build Earth Science Literacy?

- How do the “Doughnut Economics” framework relates to Earth Science Literacy Principles?
- Makes the why learn geosciences visible by highlighting basic humanity needs & pressing natural challenges to our planet resulting from our economic activity.
 - Includes topics taught in Introductory Geoscience classes:
 - Soils, Water, Minerals, Rocks, Earth Resources relate to our basic needs (food, water, housing & energy) are part of the social foundation dimensions in the doughnut (Principle 7). Health is promoted by avoiding or decreasing the overshoot of the planetary boundaries.
 - Water, Climate change, Weather, Natural hazards relate to the planetary boundaries in the doughnut. All of these boundaries are being trespassed as a result or favored by human's actions (Principles 8 & 9).
 - Could help build our responsibility in providing every person with dignity, community & opportunities within the means of our life-living planet. This can be achieved by building relationships between our everyday life decisions and Earth Sciences that can prompt us to stay inside the doughnut.

- Examples of how the Earth Science Literacy principles are supported by the doughnut visual:
- Most grains are produced with the help of soil nutrients, water, and solar energy under a relatively constant climate. The best soil type to grow them results from complex interactions through time of organisms, topography, parent material, & climate. Soil erosion can be promoted by land conversion. Excess of nitrogen-based fertilizers derived from oil can result in nutrient pollution of the oceans, surface water, groundwater and soil. They can also contribute to climate change.
 - Gas prices increased in 2026 associated partially with the Iran-US war and the closure of the Hormuz Strait. Gas prices in Nevada are higher than in the rest of the US, closer to those in California because this is where most of our gas comes from. State regulations on oil production & refinement help to reduce air pollution that can potentially affect our health. Regardless, the gas I burn in my car contributes to climate change.

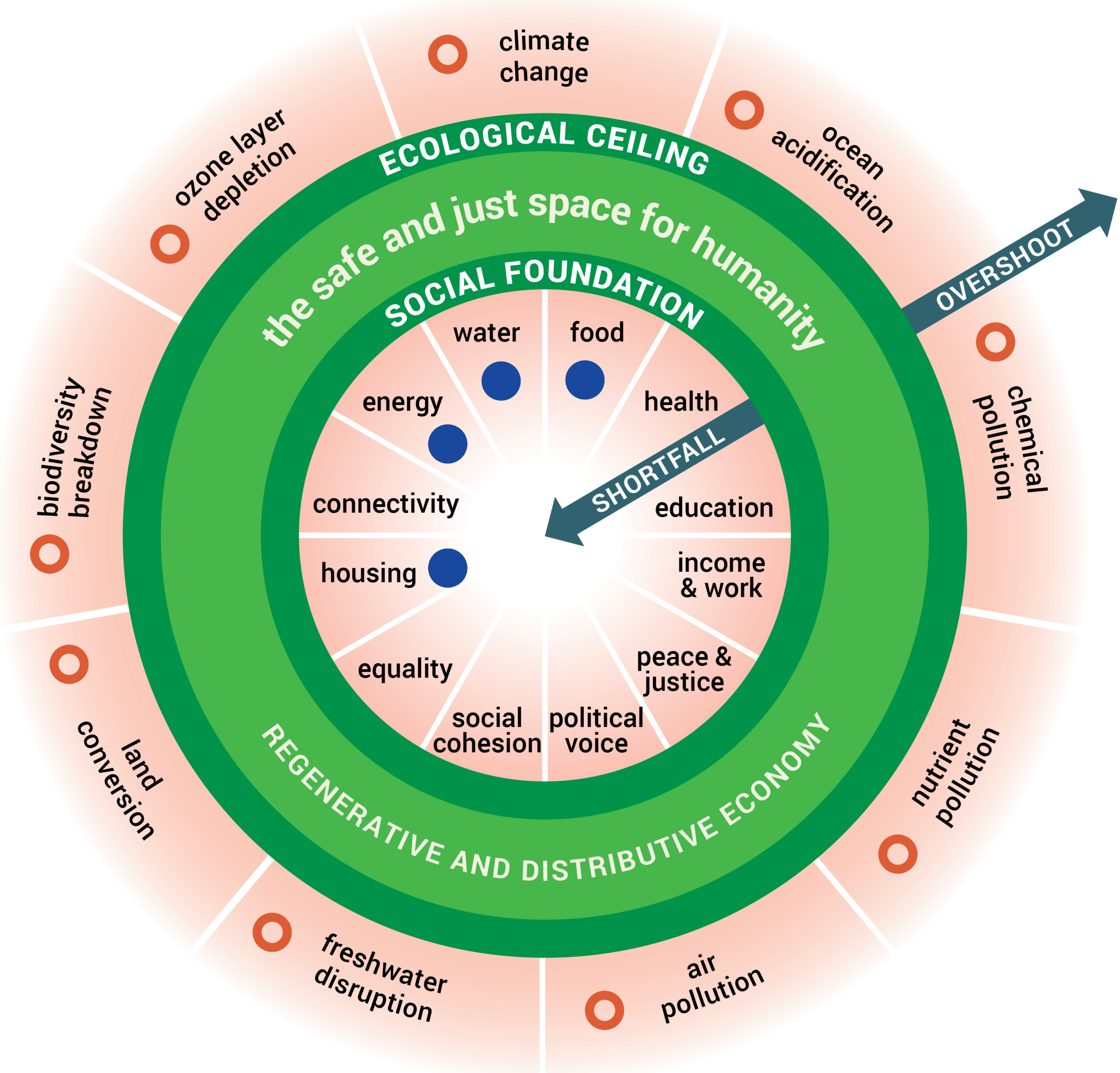


Fig. 2. Classic Doughnut. Filled circles relate to Earth Science Literacy Principle 7 while empty circles relate to Principle 9 as is also indicated in Table 1. (Raworth 2025, doughnuteconomics.org)

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