

Planetary Limits Academic Network (PLAN)  
Working Hypotheses

Below are a set of assertions that, unlike the foundational principles listed on our website ([planetarylimits.net](http://planetarylimits.net)), may not be self-evident, but which we consider to be almost certainly true, based on current evidence. Together with the foundational principles, these “working hypotheses” constitute the essence of our worldview. While we remain open to evidence that contradicts these working hypotheses, we believe that PLAN can make the biggest impact through a scholarly examination of the consequences of these hypotheses.

1. [Net energy] Industrial civilization is currently dependent on large and inexpensive flows of energy from resources/technologies with high energy return on energy invested (ERoEI).
  - a. The amount of (net) energy available flowing to society from fossil fuels is in, or very nearly in, decline.
  - b. Typically, energy sources with the highest ERoEI are harvested first.
  - c. World production of conventional crude oil plateaued ~2005 and is likely to decline.
  - d. Unconventional oil sources are much more expensive than conventional crude oil and have lower ERoEI, especially in the case of oil sands.
  - e. Though the price of oil and natural gas is low currently, these are exhaustible fuels that will, at some point, reach a supply constraint that will make them increasingly unaffordable (which may or may not be reflected in nominal pricing).
  - f. The ERoEI of coal is now below that for wind and equal or below that of solar PV. The ERoEI of oil and gas is variable, but the trend over time is downward. The ERoEI of renewables has increased rapidly in the past decade, providing favorable prospects for replacing at least some fossil energy with renewables. Many wind and PV developments are on par or better than most new unconventional oil development.
  - g. Fossil fuels are becoming more environmentally, energetically, and economically costly to develop, ushering in the end of abundant cheap energy.
  - h. It is critical that humanity adapt to using less energy (through both efficiency and curtailment) and to primarily utilizing renewable energy sources (which cannot be expected to serve as a drop-in replacement for fossil fuels).
  - i. A shift from conventional energy sources to renewables will require a vast energy investment for new infrastructure, which may be difficult in case of an energy shortage and would be easier to execute in advance of any energy crisis.
2. [Climate] We are already experiencing dangerous climate change, and it will likely get worse.
  - a. Current CO<sub>2</sub> levels exceed any in the past 800,000 years.

- b. We have pushed the climate away from the stability of the Holocene (last 10,000 years) during which humankind developed agriculture and advanced civilizations.
  - c. Sea level rise will inundate many coastal areas, leading to mass migrations.
  - d. Extreme weather events will threaten agriculture, infrastructure, public health and safety.
  - e. It is critical that humanity eliminate virtually all CO2 emissions and begin to remove CO2 from the atmosphere, especially by methods that have a positive impact on the biosphere, such as reforestation and regenerative agriculture.
3. [Land use] Humanity's land use is destabilizing ecosystems and causing mass extinctions.
- a. Modern chemical-industrial agriculture sterilizes and depletes soils, poisons the environment, robs habitat from wildlife, and releases soil carbon, all while being a tremendous net energy sink (agriculture was traditionally an energy source).
  - b. Clearing of forests and other natural habitat for ranching and farming is further reducing earth's more complex ecosystems.
  - c. Elimination of native species from managed landscapes reduces populations of beneficial insects, birds, and other flora and fauna.
  - d. Humanity ultimately depends on the life support from natural systems for its very survival, so it is critical that these trends in land use are quickly reversed.
4. [Economics] Our economic system was designed for an era of cheap abundant energy and continuous growth, and is ill-suited for an era of scarce energy and planetary limits.
- a. The current economic model is entirely based on economic growth, itself inexorably linked to increasing material consumption, which cannot be sustained in the long run due to energy scarcity and ecological limits.
  - b. The political economy has responded to these challenges in recent decades through a significant and unsustainable expansion of debt, which represents claims on presumed future resources and that depends on future growth, ultimately threatening both current and future prosperity.
  - c. Relentless focus on short-term performance and growth, together with a discount rate that devalues the future, blinds decision-makers to long-term challenges.
  - d. Our current economic model emphasizes means (income, spending) over ends (wellbeing).
  - e. Our economy is increasingly fragile to disturbances due to globalization, mechanization, and complex supply chains. Efficiency is typically pursued at the expense of resilience.
  - f. The free market may not be the best way of meeting basic human needs, such as water, food, and air quality.
  - g. While economic growth is often relied on as a cure for income inequality, the trend has been for growth to be accompanied by increased inequality.

5. [Addressing the predicament] There is no solution to these challenges, in the sense of actions that can preserve “business-as-usual.” Technical know-how and technology itself are not silver bullets, and many of the appropriate responses are socio-cultural and could be considered paradigm shifts.
  - a. Underlying many of our challenges are unspoken cultural values of continuous growth and progress (which in turn are tied to 4a and 4b), along with reductionist thinking and an anthropocentric worldview that places human needs above all else, ironically to our ultimate detriment.
  - b. Humanity will need to reevaluate its place in the natural world, shifting from consumerism to conservation, and accepting planetary boundaries.
  - c. Despite a secular trend of increasing societal complexity since the Neolithic transition began 10,000 years ago, human history is marked by frequent collapse and reorganization of these societies. This suggests that societal complexity is difficult to sustain, for a variety of reasons including rigidity of systems, scale and decreasing (and eventually negative) marginal return on investments in complexity. Our current global industrialized civilization is not immune to such factors.
  - d. It is essential that humanity reframe its decision-making processes to value ecosystem health, resilience, sustainability, human rights, and true quality of life above traditional economic indicators predicated on unsustainable material and energetic growth.
  - e. However challenging, it is completely possible, and indeed desirable, to make deep cultural, paradigm-shifting changes that could lead to a more resilient society with a higher quality of life.
  - f. Issues of collapse and change are now global in scale and, as such, unprecedented in human history.