

Long-Term Sustainability
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A hallmark of sustainability is concern for what happens in the future. Competing definitions of sustainability are generally either *anthropocentric*, where concern is for future humans, *ecocentric*, where concern is for future ecosystems, or a combination of the two.

How long is this future that we might care about, and what does its length mean for us?

We do not know how long the future might be. The physics of the fate of the universe remains very much unsettled. It might or might not be possible for humans, ecosystems, or anything else we might care about to continue existing for an infinite amount of time. What we do know is that these things can continue existing for a very long time, perhaps 10^{32} years.

Earth, however, has a much shorter – but still long – inhabitable lifetime. The physics of Earth's fate is much better understood. In about 500 million years, the sun will be much warmer, possibly ending life on Earth as we know it. In about 5 billion years, the sun will expand and engulf Earth, at which point Earth-life will almost certainly end.

The key detail here is that the universe will be inhabitable for much, much, much longer than Earth will. Therefore, if we care about the future, it is crucial for whatever it is we care about – humans, ecosystems, etc – to survive beyond Earth's end. This requires that Earth-life colonize space. Space colonization in turn probably requires human civilization (or the civilization of whatever humans might evolve into). After all, humans are already performing some space travel, and no other species is anywhere close.

The eventual necessity of space colonization does not mean that we should focus our current sustainability efforts on space colonization. This is because we have at least 500 million years or so to leave Earth. By then, we should be able to successfully colonize space (assuming it's possible in the first place) – as long as nothing really bad happens first. These “really bad” things are the civilization-ending catastrophes that would prevent us from ever colonizing space. Such catastrophes might include nuclear warfare, pandemic outbreaks, catastrophic climate change, or runaway technology. *Avoiding these catastrophes should be the top priority for anyone wishing to sustain Earth-life – human or otherwise – into the distant future.*

For more on this theme, see:

- Baum, S.D. 2009. [Cost-benefit analysis of space exploration: Some ethical considerations](#). *Space Policy* 25(2) 75-80.
- Bostrom, N. 2003. [Astronomical Waste: The Opportunity Cost of Delayed Technological Development](#). *Utilitas* 15(3) 308-314.
- Bostrom, N., M. Čirković. 2008. [Global Catastrophic Risks](#). Oxford: Oxford University Press.
- Posner, R. 2004. *Catastrophe: Risk and Response*. Oxford: Oxford University Press.
- Rees, M. 2003. *Our Final Century: Will the Human Race Survive the Twenty-first Century?* Oxford: William Heinemann.
- Smil, V. 2005. [The next 50 years: Fatal discontinuities](#). *Population & Development Review* 31:201-236.
- Tonn, B.E. 2002. Distant futures and the environment. *Futures* 34 117-132.