

Economists often talk about the social cost of carbon, which basically translates the harm done by a ton of CO<sub>2</sub> into dollars. The dollar metric is less useful as applied to ecological impacts like species extinctions than impacts of humans. It may be better to skip the dollar conversion, and just ask how much a ton of CO<sub>2</sub> raises the likelihood of an additional species going to extinct. In short, what's the extinction cost of carbon?

There are uncertainties in climate modeling, and greater uncertainties in estimating the number of species impacted by climate change. It still seemed like a sufficiently interesting question to be worth a rough try. You can skip the next three paragraphs if you're not interested in the details. The answer is that saving one species equates to about a 7.8 megaton reduction in emissions.

Here's how we get to that number. The first question is how an increase in temperature translates into an increase in extinctions. This involves significant uncertainties. One credible [estimate](#) is that the extinction risk would go from 2.8% at the present temperature to 5.2% for 2° of warming over the pre-industrial level. (If the Earth warms to 3°C, the extinction risk rises to 8.5%.) The 2.8% baseline rate is a tribute to the other things we're doing to destroy species apart from climate change. Now we need to know, if an additional 2.4% of species go extinct, what is that 2.4% of? In other words, we need the total number of species.

Counting plants and animals (but not fungi or single-cell organisms), a plausible [estimate](#) is that there are about 8 million species altogether. Doing a little simple arithmetic, going from the present temperature to 2° of warming will result in the extinction of 192,000 species, each of them unique and irreplaceable. (When I say "simple arithmetic," I mean that I only had to check it about three times to make sure it was right.) I'm not sure whether 192,000 sounds like a big number to you, but each one of those species is unique and irreplaceable.

Now that we know how many extinctions will result from two degrees in warming, we need to connect that to the quantity of carbon emissions. What does a rise to 2° require in terms of carbon emissions? The amount of additional carbon we can allow if we want to keep the temperature to 2°C above the preindustrial level is approximately 1690 GtCO<sub>2</sub> for a 50/50 chance of reaching the target, or 1320 GtCO<sub>2</sub> for a two-thirds chance (2015 [estimate](#)). I'll use the average of those two for convenience, which is very close to 1500 gigatons, or 1.5 million megatons. A little more arithmetic says that the amount of carbon per extra extinction is 7.8 megatons. (That's  $1.690 \times 10^{12} / 1.92 \times 10^5$ ) The extinction cost of a single megaton of carbon is therefore about a 13% increase in the likelihood that some species will go extinct.

We can also flip the numbers to answer another question: If a carbon reduction project would result in the extinction of one species, how much would the project have to cut carbon over its lifetime in order for us to break even in biodiversity terms. The answer is 7.8 megatons.

Here's another way to look at it. Suppose we have a program that removes conventional cars from production and replaces them with electric cars that will be entirely charged with renewables. How many of the replacement EVs will we need to save a single species? The average U.S. car [emits](#) about 4.5 tons of CO<sub>2</sub> per year and lasts about 12 years, or 54 tons of carbon total. With yet a bit more arithmetic – thank heaven for calculators! — we find that 144,000 new EVs save 7.8 megatons of carbon, which translates into the survival of a species somewhere on earth. If you do the math, having sold over a million electric cars, Tesla has saved around about seven species from extinction. In a strange way, that makes Elon Musk count as a protector of biodiversity.

This may seem like a strange way to look at things. Still, asking about the relationship between tons of carbon and species loss may be better than trying to translate the cost of species loss into dollars and including that in the social cost of carbon. The extinction cost of carbon is an unusual metric to use, but it does tell us something important about the value of reducing carbon emissions.