Environmental Case Study

What Is Earth’s Carrying Capacity for Humans?

Human numbers are doubling about every 40 years. At that rate there would be an astounding 170 quadrillion people 600 years from now. That would put one person on each square meter over the entire land surface of the earth. Carrying capacity reflects the limits imposed on population growth by finite space and finite resources. Earth’s resources would never support such ludicrous numbers. So, what is the carrying capacity of the earth for humans? That question cannot be meaningfully addressed without clarifying a basic assumption: the type of lifestyle on which to develop the estimates.

Different lifestyles have different resource requirements. Are people to be vegetarians or will meat be a significant part of the diet? Will the earth’s resources be counted upon to provide additional amenities beyond food? The answers to those questions have a profound effect on the numbers of people the earth can sustain. For illustration purposes imagine a miniature planet we could call Terrabase. Consider the following scenarios to see how lifestyle affects carrying capacity.

**Scenario 1**

In this scenario, the humans living on Terrabase are vegetarians, and 100 percent of the planet’s space is devoted to raising human food. Let’s assume that under these conditions 1,000 people can be sustained. Carrying capacity equals 1,000.

**Scenario 2**

Most people enjoy meat in the diet. Assume that the people of Terrabase do not live as vegetarians, but obtain half their calories by eating herbivores such as beef cattle. This would require a significant amount of plant mass to be fed to animals. But, as you learned in chapter 3, much energy is lost in transfer between trophic levels. It takes about 10 calories of plant food to produce one calorie of beef. After doing the calculations, it turns out that under these conditions, Terrabase will produce enough food to sustain only 180 people. Simply by eating meat, the carrying capacity has been reduced by over 80 percent.

**Scenario 3**

In both scenarios 1 and 2, all of the land has been used exclusively for human food production. But people have consumer needs as well: cars, parking spaces, televisions, washers, dryers, clothing, shopping centers, and much more, all of which require space that would have to be subtracted from that used to produce food. Recreational space is also important to us. We want athletic fields, golf courses, bird sanctuaries, nature preserves, and hunting lands. All of which divert even more land away from food production.

Assume the residents of Terrabase had the high living standard of industrialized nations, requiring the immense and continuous input of chemicals, energy, paper, and other raw materials, as well as requiring land for waste disposal. How much of Terrabase would be devoted to these uses? If it is 20 percent, the carrying capacity is reduced to 140.

Wild organisms also play ecological roles important to our well-being. Leaving space for wild nature further reduces land available to produce human food.

“What is the earth’s carrying capacity for humans?” is not a meaningful question until the cultural context within which people are to live has been clarified.
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The magnitude of the cultural impact on carrying capacity is underlined by information provided by Robert Goodland and others. It is estimated that the continuous production of 10 to 15 acres are necessary to sustain just one person at our affluent lifestyle. To support all of the earth’s 5.6 billion humans at such a lifestyle would require three times as much productive land as is available. Defined in those terms, the carrying capacity of the earth is around 1.8 billion people, one-third the world’s current numbers. On the other hand, if carrying capacity is defined as the number of humans the planet could adequately feed without providing other amenities, that number is obviously much larger.