

# Does God Command Birth Control?

*Daniel M. Berry and Karljürgen G. Feuerherm*

## 1. Introduction

What is taken traditionally as God's first commandment to man, "Be fruitful and multiply" (Gen. 1:28), is only the first part of a three-part compound sentence, "Be fruitful and multiply and fill the earth and subdue it." This three-part sentence can be read as putting a limitation on the mitzvah of procreation, namely when the earth is filled and subdued. An examination of commentary over the centuries shows that Jewish tradition does not recognize this limitation. In the past, that the earth could or would ever be filled was so inconceivable that there was no reason to recognize any limitations on the mitzvah of procreation. A new interpretation of the full three-part sentence is given that is consistent with the world as we know it today: as the earth becomes more and more filled and subdued we need to slow down being fruitful and multiplying.

## 2. Genesis 1:28

Genesis 1:28 contains what is traditionally called God's first commandment to man:<sup>1</sup>


פרו ורבו ומלאו את-הארץ וכבשה

Be fruitful and multiply and fill the earth and subdue it.

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This commandment, hereinafter called “TC” for “the commandment,” is interesting because it consists of three commands:

1. Be fruitful and multiply.
2. Fill the earth, and
3. Subdue it [the earth].



The first can be done repeatedly and is clearly expected to be done repeatedly. The last two can be done only once. Once the earth is filled, there is no more room. We cannot keep filling it thereafter. If you keep pouring water into a full cup, it overflows. If we keep filling a full earth, there is no place for the overflow to go, except into outer space. Likewise, once the earth is subdued, there is no need to continue to subdue it.

It is clear that if we keep doing the first, eventually we will fulfill the last two. Since fulfilling the last two can be done only once, perhaps the implication is that we are supposed to do the first only until we fulfill the last two. We cannot tell. The Bible is silent on what happens when we fulfill the last two.

Perhaps we have already fulfilled this command to the extent that it was meant to be fulfilled. If you go to South East Asia, you get a sense that the earth is filled. There are questions being raised about whether the earth can sustain our continued exponential population growth, whether there is sufficient arable land to produce the food needed for the population, especially given the climate change that seems to be happening as a result of our subduction of the earth.<sup>2</sup> Perhaps we have subdued the earth and the earth is now crying “Uncle!” or is fighting back with ever more violent weather. Perhaps, it is time to stop obeying the being fruitful and multiplying part.

The next part of this paper, Sections 3–6, is devoted to showing that nowhere in Jewish tradition is such a limitation recognized. Then, Sections 7–8 show how TC could be read as placing a limit on the duty to procreate. Sections 9–10 consider the limitation in today’s context and bring in science to conclude that the time has come to apply the limitation. Section 11 concludes the paper.

### 3. Commentary on TC in Jewish Tradition

Let us examine various Jewish commentaries, from the Mishnah through to modern day in order to see how they deal with TC.

### 3.1. *Mishnah Y'vamos*

*Mishnah Y'vamos* 6:6<sup>3</sup> discusses circumstances under which a man may be ~~unable~~—as opposed to unwilling—to procreate due to problems beyond his control, for example:

A man should not neglect the commandment of “be fruitful and multiply” unless he already has children. The school of Shammai teaches: two sons. The school of Hillel teaches: a son and a daughter, since it says: “male and female he created them.” If a man marries a woman and lives with her ten years and they have no children, he cannot neglect it any longer. When he divorces her, she is permitted to marry another. The second husband can wait for her ten more years. If she miscarries we begin the count from the time of the miscarriage. A man is commanded to be fruitful and multiply but not a woman. Rabbi Johanan ben Berukah said: Both are commanded as it says, “And God blessed them and said: ‘Be fruitful and multiply.’”<sup>4</sup>

It totally ignores any suggestion that there might be a commanded limit to being fruitful and multiplying.

### 3.2. *B'reishit Rabbah*

The commentary of Genesis in *B'reishit Rabbah*<sup>5</sup> ~~also~~ ignores the sentence except to give some interpretation of וַיִּבְשֹׁהָ (subdue) on pages 62 and 63:

R. Leazar said the name of R. Jose b. Zimra: *We-kibshuhah* [plural: and do *ye* subdue it] is actually written *we-kibshah* [singular: and do *thou* subdue it]: man is commanded concerning procreation, but not woman. R. Johanan b. Berokah said: Concerning both man and woman it says, AND GOD BLESSED THEM, etc.

*'We-kibsha'* (and subdue her) is written: the man must master his wife, that she not go out into the market place, for every woman who goes out into the market place, eventually comes to grief. Whence do we know it? From Dinah, as it is written, *And Dinah . . . went out*, etc. (Gen. xxxiv, 1). R. Isaac said in R. Hanina's name: The law is as stated by R. Johanan b. Berokah.

### 3.3. Rashi

The commentary of Genesis by Rashi<sup>6</sup> ignores the clause about filling the earth. His only comment about TC is:

**and subdue it:** The “vav” [in וַיִּבְרָא] is missing, [allowing the word to be read וְיִבְרָא, the masculine singular imperative] to teach you that the male subdues the female that she should not be a gad-about (Gen. Rabbah 8:12), and it is also meant to teach you that the man, whose way it is to subdue, is commanded to propagate, but not the woman (Yev. 65b).

□ In regard to the earlier verse, Genesis 1:22, where the same phrase פָּרוּ וּרְבוּ, “be fruitful and multiply,” is commanded to animals, Rashi does comment on “be fruitful and multiply”:

**Be fruitful:** [The word פָּרוּ is derived from פֶּרִי, fruit, meaning produce fruits.]

**and multiply:** If He had said only, “Be fruitful,” one would beget one and no more. “And multiply” was therefore said so that one could beget many.

### 3.4. Ramban

Nachmanides has two comments linked to TC:<sup>7</sup>

28. God blessed them directly saying,[48] “Be fruitful and multiply, fill the earth and have control over it,[49] and have control over the fish in the sea, the birds in the heavens, and all the animals which travel over the earth.”

□ The above is the full Genesis 1:28. The comments attached to it in Talmudic style are labeled “[48]” and “[49].” In [48], Ramban points out that, in v. 22, the text reads, “God blessed them saying,” while here it reads, “God blessed them and God said to them”; hence, he interprets that this is a direct blessing. Since this *vayomer* is not a creative word but a command, I render “saying.” That is, God blessed them directly, giving them the power to be . . . and to have control. In [49] Ramban specifically takes *vekiyshuha* [וַיְכַבְּשׁוּהָ] and *uredu* [וַיִּרְדּוּ] as synonyms. Notice that neither of these comments addresses the issue of “fill the earth,” מלאו את-הארץ.

### 3.5. Hershon

In the 1883 *The Pentateuch according to the Talmud*, Paul Isaac Hershon<sup>8</sup> translates TC as “be fruitful and multiply and replenish the

earth and subdue it." In his ensuing discussion, there is no commentary about "replenish the earth." The commentary is about only being fruitful and multiplying and about subduing the earth. On page 67, the commentary of verse 28 begins by quoting only, "And God blessed them, and God said unto them, Be fruitful and multiply." The next part of the text of verse 28 that is quoted is "And have dominion over the fish of the sea." "And replenish the earth and subdue it" does not warrant its own section. Nevertheless, under "And God blessed them, and God said unto them, Be fruitful and multiply" Hersheon says:

I. This precept (which is the first of the 613) is obligatory on man only, and not on woman. Rabbi Yochanan be Berokh says: It is obligatory on both; for it is said: "And God said unto *them*: Be fruitful and multiply." (The above is a Mishnah; and now follows the Guemara.)

II. Whence are these words (the first part of the Mishnah) proved? Rav Ilan said in the name of Rabbi Eliezer ben Shimon: Scripture says (in the same text): "And replenish the earth and subdue it;" it is for man to subdue the earth, and not for woman. But the very word "subdue," is in the plural. Rav Yitzchak replied: It is written *va'afu* (in the singular). The punctuation alone constitutes the difference between the plural and singular.

III. Rav Yoseph said : It is proved from Ge. xxxv. 11: "I am God Almighty, be fruitful and multiply" (singular). *Yevamoth*, fol. 65, col. 2.

□ This commentary quotes "replenish the earth and subdue it," but goes into depth about only "subdue it," basically ignoring "replenish the earth."

Even the subsequent synoptical notes about procreation focuses on only being fruitful and multiplying and mentions no commanded limitations. It does discuss circumstances, such as infertility, under which not being fruitful and multiplying may be *excused*.

### 3.6. Shapiro

A chapter titled "~~Be Fruitful and Multiply~~" by David S. Shapiro<sup>9</sup> quotes Genesis 1:28:

God blessed them, and said unto them: "Be fruitful, and multiply, and replenish the earth and subdue it; and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moves upon the earth."

and goes on to talk about being fruitful and multiplying with no commanded limitations.

The chapter later quotes Exodus 1:7 as saying: "The children of Israel were fruitful and prolific, they multiplied and increased very greatly, so that the land was filled with them." This quote using the words "the land was filled" *וּתְמַלֵּא הָאָרֶץ* with the same roots as "and fill the earth" *וּמְלֵא אֶת־הָאָרֶץ*, makes it clear that the meaning ascribed to filling the earth did not extend to stopping the commandment of being fruitful and multiplying. The Hebrews continued to be fruitful and continued to multiply past the date described by Exodus 1:7.

### 3.7. Schweid

The 2009 English translation *The Philosophy of the Bible as Foundation of Jewish Culture*, of Eliezer Schweid's Hebrew language book,<sup>10</sup> says:

Two imperatives are incumbent on him [the human being] to carry out his task. The first is embodied in his animal nature, and like the animals he is blessed/commanded: "Be fruitful and multiply and fill the earth." (Gen. 1:28) The second has its source in the divine spirit that was breathed into him: "Subdue the earth, and rule the fish of the seas and the fowl of heaven and all living creatures that crawl on the earth."

□ There is nothing in here about any limitations on procreation. In fact, in this commentary, "fill the earth" seems to be totally eclipsed by the "be fruitful and multiply" and by "subdue the earth."

### 3.8. Chabad

Chabad's website has an article titled "Be Fruitful and Multiply" by Aryeh Citron.<sup>11</sup> It immediately quotes parts of Genesis 1:28, including part of TC, and others:

The first mitzvah in the Torah is “to be fruitful and multiply.” As the verse in Genesis states: “And G-d said to them, ‘Be fruitful and multiply and fill the earth . . .’” After the Flood, G-d repeated this commandment to Noah: “And G-d blessed Noah and his sons, and He said to them: ‘Be fruitful and multiply, and fill the earth.’”

□ The first subsection, titled “The Basic Mitzvah” describes the details of being fruitful and multiplying including the number of sons a man should have. There is *no* mention of any commanded limitation. There are subsections dealing with reasons that one may not be able to obey the mitzvah, namely in subsections titled “Infertility” and “One Who Is Unable to Have Children,” but these are not commanded limitations.

#### 4. Do Rabbis Know of Any Commentary Considering Any Limitations?

An informal survey of rabbis known to the author and to some of the author’s friends indicates that there is nothing in Judaism that specifically addresses the issue of whether the phrase *וּמלאו את-הָאָרֶץ*, “and fill the earth,” implies that there are commanded limits on being fruitful and multiplying. Therefore, it seems safe to say that in Judaism, there is no notion of any limitations on the commandment to be fruitful and multiply.

It appears that we, in Judaism, are collectively guilty of not quoting an entire sentence, of quoting a phrase out of its sentential context. In this case, we are ignoring a context that seems to go against the message of the part that we are quoting.

#### 5. Google Search

Most references to TC in English quote only the first part of the sentence, “Be fruitful and multiply.” The focus seems to be on explaining a commandment to procreate, and in justifying prohibitions against inhibiting or obstructing any way this procreation. It is further used to justify prohibitions against any form of birth control other than abstinence,<sup>12</sup> which itself is discouraged as less desirable than procreating.

Evidence for this claim is the Google search of the phrase “Be fruitful and multiply” on April 14, 2014, yielded 380,000 hits.

However, a Google search of the phrase “Be fruitful and multiply and fill the earth” yielded only 80,900 hits, about 13 percent of the number of hits for “Be fruitful and multiply.” A Google search of “Be fruitful and multiply and fill the earth and subdue it” yielded even fewer hits, only 50,700. So, the culture seems to ignore the full sentence and seems to focus on only being fruitful and multiplying.<sup>13</sup> The Google search results make it clear that even the non-Jewish world is focused on only “Be fruitful and multiply” and is largely ignoring the rest of TC.

## 6. Why a Limitation Made No Sense in the Past

If one considers the world situation at the time the early commentaries of Section 3 were written, the notion that the earth could be filled any time soon was sheer nonsense, so much so that the notion was not worth any commentary. Indeed, natural disasters, such as the flood and the seven years of famine, and attempts at genocide, such as Pharaoh’s edict that all male Hebrew newborns were to be killed, were frequent and severe enough that it was clear that humans *needed* to be fruitful and multiply.

*The Torah: A Women’s Commentary* translates TC as “Be fruitful and multiply; fill the earth and tame it;”<sup>14</sup> Its commentary on TC says: “The harsh conditions and fragility of life in the ancient world make fertility a most valued gift and necessity. The plain sense of the text is that this ‘first commandment’ is issued to both female and male.”

As an example of the perception of the fragility of life, in Genesis 19:30–38, Lot’s two daughters thought that Lot and they were the last three people on earth when they procreated with Lot, their father, after the destruction of Sodom and Gomorrah.

However, recently, it has become clear that we could indeed be filling the earth, reaching the earth’s capacity to support life, and that we could indeed be subduing the earth to the point of permanent damage to the planet or to the point that the earth is fighting back with ever increasingly violent weather. Therefore, a phrase of the Bible that seemed totally irrelevant at the time traditional commentaries were written has become *very relevant*. It is necessary to reassess the meaning of TC based on what has only recently become clear.



## 7. A New Reality for TC

Perhaps, God<sup>15</sup> was anticipating a time in the future in which the earth would be filled and subdued and wrote the commandment in Genesis 1:28 so that it had its own sunset clause, when the command to be fruitful and multiply would have to cease to be obeyed. A literal reading of the whole sentence is that it commands both



1. Procreation and
2. Exercising restraint on the procreation (i.e., birth control), when the earth is filled and is subdued.

□ Barring a catastrophe at the time of filling or thereafter, filling the earth can be done only once. Therefore, one could argue that only the persons who would produce children after the earth is filled need to practice birth control.

However, a fairer interpretation is that as the earth gets closer and closer to being filled and subdued, *everyone* has to practice this restraint to slow down the procreation, perhaps to achieve a steady state of procreating only to replace the dying. This interpretation distributes the procreation and the restraint over the entire population. In addition, it is probably unwise to wait until there is no space left for a new person; we will have run out of other resources, such as agricultural land, long before that time.

Of course, if at any time before, or even after, the earth is filled, a catastrophe, such as a repeat of the Noachian flood, were to decimate the earth's inhabitants, then TC would once again have to be interpreted as it has been, with a focus on being fruitful and multiplying.

## 8. The Syntactic Structure of TC

There is plenty of evidence that in Genesis, the ׀, which is normally understood in modern Hebrew as meaning "and," was understood at the time of the writing of Genesis as meaning a variety of conjunctions and prepositions, including "in order to."<sup>16</sup> On this basis, let us consider again TC. One can read TC as:

(Be fruitful) *in order to* (multiply) *in order to* (fill the earth) *in order to* (subdue it).

In other words, each non-first command can be heeded only if and when its predecessor has also been heeded. However, a variety of different structures can be imposed by reading the normal “and” for ו at any point. Traditionally, פרו ורבו has been taken as a unit, and it makes sense to consider את הארץ וכבשה as a unit because of the implied pronoun “she” in וכבשה referring to הארץ. Therefore, a reasonable structure for TC is:



(Be fruitful *and* multiply) *in order to* (fill the earth) *and* (subdue it).

This structure fits the understanding of TC afforded by the modern reality.

In modern Hebrew, we might express “in order to” as “until,” because once one’s purpose for doing something has been achieved, he or she can stop doing the something. Thus, in modern Hebrew, TC might be rendered:



פרו ורבו עד שאתם תמלאו את הארץ ותכושעו

Be fruitful and multiply *until* you fill the earth and subdue it.

## 9. What Now?

So what now? We need to marvel at the foresight and wisdom of the Torah that placed the natural limit on being fruitful and multiplying, namely when the earth is filled and subdued, even if we humans did not see and understand until recently that filling and subduing the earth is indeed possible.

We humans that live on the earth need to have a general discussion addressing the following issues:

1. Are we filling and subduing the earth?
2. Are we about to fill and subdue the earth?
3. Have we already filled and subdued the earth?<sup>17</sup>

If the answer to any of these questions is “Yes,” then we need to have a discussion to decide what to do with the commandment of Genesis 1:28, that is to decide how fruitful and multiplying to be and how limiting of these to be. That is we need to decide on a balance between procreation and birth control that is appropriate given our answers to Questions 1, 2, and 3.

Some possible balances include:

1. Achieving a much slower population growth
2. Achieving a steady state in which births match deaths, and the population does not change
3. Achieving a population reduction

□ To make this decision, we will need additional science to tell us the effect of population, population growth, and population reduction on humans, animals, plants, the environment, and the earth in general. Then we will need to decide where on the passive–active spectrum we need to be on procreation and on birth control to achieve this balance.

An important issue for Jews to consider is that, more so than other peoples, they have been the target of extermination attempts, the most recent attempt succeeding to decimate 6 million of them. Should Jews exempt themselves from the balancing birth control, at least temporarily, until they have achieved the population that they would have had they not been the target of extermination efforts? On the other hand, as observed by Rabbi Lori Cohen, Deuteronomy 7:7 says, “It is not because you are the most numerous of people that the Lord set his heart on you and chose you.” This would suggest that Jews are destined to be a small part of the world population anyway. Still on the same other hand, Jews have always been at the forefront of *tikkun olam* (repairing the world) efforts. Balanced procreation and birth control are certainly aimed at repairing the world, repairing it from being filled and subdued. So, to set a proper example, maybe Jews should *not* exempt themselves.

## 10. Science Attempts to Answer the Question “Have We Filled the Earth?”

The recently developed concept of “ecological footprint”<sup>18</sup> suggests that we have indeed already filled and subdued the earth and gives an estimate of by how much we have done so. The ecological footprint is calculated from data gathered by the United Nations for its own purposes, and it is a standardized measure of mankind’s demand on the earth’s ecosystem. It compares mankind’s demand for the earth’s capital resources against the earth’s ecological capacity to regenerate them. The ecological footprint’s unit is “earths,” as it tells us how much of the earth or how many earths are needed to supply the resources mankind consumes

and to properly assimilate the waste that mankind produces. In 2007, the ecological footprint was calculated as 1.5 earths. That is, mankind was using the earth's resources 1.5 faster than the earth can provide them from its original or renewed supply. Moreover, if the population and consumption continue to grow at the current rates, by 2030, the ecological footprint is estimated to be 2 earths.<sup>19</sup> That is, we will need a whole new planet to accommodate mankind. Of course, we do not have this whole new planet at our disposal. We will need to get along with the only planet earth that we have.

The situation is a lot worse than most people perceive based on their experience. The problem is that population grows not linearly, but exponentially. Therefore, if in the last hundred years, the population grew from 1 billion to 2 billion people, then in the next hundred years, the population will grow *not* to 3 billion, but to 4 billion people. That is, if in the last hundred years the population has doubled, it will double again in the next hundred years.

We humans are not good at forecasting exponential growth. Our gut feelings appear to operate linearly based on past experience. The accompanying figure shows two plots on one graph. The horizontal axis of the graph is time, and the vertical axis is population. The plot labeled "Actuality" shows exponential growth. Let us say that we are at Point 1 in time. The way we humans tend to view our experience is captured by the plot labeled "Gut Feeling" to the left of Point 1. When we extrapolate to the future, we mentally follow that Gut-Feeling plot to the right of Point 1. However, population grows as the Actuality plot. So, at Point 2 in the future, the population growth will be significantly larger than expected, and at Point 3, twice as far into the future as Point 2, the growth will be even more significantly larger than expected. We stand to be very surprised that the amount that we underestimate the population growth grows faster and faster with each unit of time.

Thus, the situation is a lot worse than we realize, and limiting population growth gets more and more essential, if not critical, with each passing day.

## 11. Conclusions

To conclude, in the past, it may have been reasonable to ignore "and fill the earth and subdue it" in favor of "Be fruitful and multiply";

Where  
is the  
Figure?



there was no chance that the earth would be filled or subdued any time soon. However, today, there is growing evidence that the earth is rapidly approaching being filled and subdued, if it is not already so, perhaps irreparably so. Hence, it may be time to regard TC, “Be fruitful and multiply, and fill the earth and subdue it” as commanding an earth-sustaining balance of procreation and birth control.



## Notes

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1. Some take Genesis 1:28 not as a commandment, but as a blessing, if for no other reason than that Genesis 1:28 begins with “And God blessed them,” referring to Adam and Eve. However, a glance at the commentaries of Section 3 shows that most in the Jewish tradition consider Genesis 1:28 to be a commandment.
2. Wikipedia, “Human Overpopulation,” [http://en.wikipedia.org/wiki/Human\\_overpopulation](http://en.wikipedia.org/wiki/Human_overpopulation) (viewed 14 April 14, 2014), and I. Sample, “Global Food Crisis Looms as Climate Change and Population Growth Strip Fertile Land,” *The Guardian*, August 31, 2007, <http://www.theguardian.com/environment/2007/aug/31/climatechange.food>.
3. M. B. Greenspan, “Be Fruitful and Multiply: Limits and Challenges, Parshat Bereshit Genesis 1:1-6:8,” *Rabbi Greenspan’s Torah Table Talk*, [http://www.oceansidejewishcenter.org/table-talk/5767/1\\_01\\_Bereshit.htm](http://www.oceansidejewishcenter.org/table-talk/5767/1_01_Bereshit.htm).
4. Certainly, the notion of an unlimited command to “be fruitful and multiply” is as outdated as the notion that the command applies to only men! The male-gender-centric interpretation of many of the commentaries on the command is a topic for a whole other article.
5. H. Freedman and M. Simon, *Midrash Rabbah*, Translated into English with Notes, Glossary, and Indices, third impression (London: Soncino Press, 1961), 62-63.
6. Chabad.org, *Bereishit Torah Reading—Parshah with Rashi*, “Torah Reading for Bereishit, Genesis 1:1-6:8,” <http://www.chabad.org/parshah/torahreading.asp?aid=7781&p=1&showrashi=true>.
7. D. R. Blumenthal, *Ramban’s Genesis*, <http://www.js.emory.edu/BLUMENTHAL/GenRamban.html#fn47>.
8. I. Hershon, *The Pentateuch according to the Talmud. Genesis: With a Talmudical Commentary* (London: Samuel Bagster and Sons, 1883), 67-68.
9. D. S. Shapiro, *Studies in Jewish Thought* (New York: Yeshiva University Press, 1975), <http://traditionarchive.org/news/article.cfm?id=103967>.

10. E. Schweid, *The Philosophy of the Bible as Foundation of Jewish Culture: Philosophy of Biblical Narrative*, trans. L. Levin, Reference Library of Jewish Intellectual History (Boston: Academic Studies Press, 2009), 67.
11. A. Cohen, "Be Fruitful and Multiply, Parshat Bereishit," [http://www.chabad.org/library/article\\_cdo/aid/1005203/jewish/Be-Fruitful-and-Multiply.htm](http://www.chabad.org/library/article_cdo/aid/1005203/jewish/Be-Fruitful-and-Multiply.htm).
12. Strictly speaking, also abstinence, especially in married couples, should be prohibited, simply because it goes against being fruitful and multiplying.
13. Interestingly, a Google search of the phrase "Be fruitful, and multiply, and replenish the earth" the King James's translation of the original Hebrew, yielded 135,000 hits, about 1.7 times the number of hits for the more direct, more popular of the Jewish translations of the original Hebrew with "fill the earth." The King James's translation is more widely quoted than the more popular Jewish translation.
14. T. C. Eskenazi and A. L. Weiss, eds., *The Torah: A Women's Commentary* (New York: URJ Press, 2007).
15. Recall the tradition that the Torah is the word of God:  
וַיֹּאמֶר ה' אֶל מֹשֶׁה וְאֶל אֶלְיָאֵשׁ בְּנֵי יִשְׂרָאֵל, עַל פִּי אֲדֹנָי בֵּד מִשָּׁה.  
This is the Torah that Moshe put before the Children of Israel, according to the word of God, by the hand of Moshe.
16. See, e.g. Choon-Leong See, **A Grammar of Biblical Hebrew** (Nashville: Abingdon Press, 1995). For a more extensive explanation see [http://cs.uwaterloo.ca/~dberry/FTP\\_SITE/tech.reports/BerryFeuerhermPaperOnLineAppendix.pdf](http://cs.uwaterloo.ca/~dberry/FTP_SITE/tech.reports/BerryFeuerhermPaperOnLineAppendix.pdf)
17. Each author's personal opinion is that the answers to Questions 1 and 2 are "Yes" and that the answer to Question 3 is "We are very close!"
18. Wikipedia, "Ecological Footprint," [http://en.wikipedia.org/wiki/Ecological\\_footprint](http://en.wikipedia.org/wiki/Ecological_footprint) (viewed April 14, 2014), and B. Ewing, A. Reed, A. Galli, J. Kitzes, and M. Wackernagel. "Calculation Methodology for the National Footprint Accounts 2010 Edition," Global Footprint Network, [http://www.footprintnetwork.org/images/uploads/National\\_Footprint\\_Accounts\\_Method\\_Paper\\_2010.pdf](http://www.footprintnetwork.org/images/uploads/National_Footprint_Accounts_Method_Paper_2010.pdf) (viewed April 14, 2014)
19. Anonymous, "World Footprint: Do We Fit on the Planet?" Global Footprint Network, [http://www.footprintnetwork.org/en/index.php/GFN/page/world\\_footprint/](http://www.footprintnetwork.org/en/index.php/GFN/page/world_footprint/), (viewed April 14, 2014).