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How Much of the Amazon Would it Take to Print the Internet?

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Abstract

This paper explores the idea of printing every page of the internet onto a standard A4 piece of paper, and how many trees, in terms of a percentage of the Amazon rainforest, would be required in the process. By making some assumptions about the size of the Internet, and the type of tree available in the Amazon, it is found that $2.1 \times 10^{-6}\%$ would be required in order to print Wikipedia alone, 0.002% to encompass the entire non-explicit internet and 2% including the 'Dark web'.

Introduction

Despite only being 25 years old, the Internet has grown so that in 2014, 40% of people in the world were using it [1]. Its growth has been not only in the number of people utilising it, but also the amount of information contained in pages within it. What if these pages, instead of being beyond a computer screen, were printed onto actual paper pages? To illustrate how much paper, and consequently how many trees would be needed in this endeavour, the Amazon rainforest has been chosen as a theoretical source for the 'real pages' of the web.

The Amazon rainforest, situated in South America, is the largest rainforest on Earth, despite having lost at least 20% due to deforestation [2], it still spans an impressive 5.5 million square kilometres, and is home to approximately 400 billion trees [3].

How many pages?

To solve this problem the first thing to consider is how many web pages the internet consists of. English Wikipedia, a substantial website, contains 4723991 pages alone [4]. By considering ten of these pages randomly, an estimate of the average number of paper pages they would each require is estimated as 15, therefore:

$$4723991 \times 15 = 70859865 \text{ paper pages} \quad (1)$$

If this is applied to the Internet as a whole, its 4.54 billion pages [5] corresponds to a staggering 6.81×10^{10} paper pages.

However, this is a very conservative assumption, as many web pages could require a conservative estimate of as many as 100 paper pages. Therefore an estimate of average paper pages per web pages of the Internet is estimated as at least 30:

$$4.54 \times 10^9 \times 30 = 1.36 \times 10^{11} \text{ paper pages} \quad (2)$$

It is approximately this many pages required to print the Internet.

Paper from Trees

To establish how many trees would be needed to print the required number of paper pages, the principle of obtaining paper from trees must be discussed. The pulp used to produce paper can be made from many softwood trees including Birch and Oak, and hardwood trees such as Fir and Pine [6]. Whilst these trees are contained within the 16000 species in the Amazon, for the purposes of this model, it will be assumed that all 3.9×10^{11} trees can be used to make paper [7]. A reasonable assumption considering the wide variety of trees that are available for this purpose.

If it were also assumed that the trees of the Amazon are equally distributed across its entire area, then there would be 70909 trees per km^2 . It is possible to obtain approximately 17 reams of paper per usable tree. There are 500 sheets of individual paper in each ream. This results in a total of 8500 sheets of paper obtainable per tree [8].

Results

As aforementioned, 70859865 sheets of paper are required to print English Wikipedia. In reams of paper this would result in:

$$\frac{70859865}{500} = 141720 \text{ reams of paper} \quad (3)$$

With 17 reams of paper per tree, this results in a total of 8337 trees required to print this one website. In terms of the Amazon rainforest, with 70909 trees per km², English Wikipedia would only consume 12% of a single km², (assuming every tree can be used for paper.)

For the entirety of the Internet however, more of the Amazon would be consumed. With the estimated 6.81×10^{10} paper pages required to print the Internet, this corresponds to:

$$\frac{6.61 \times 10^{10}}{500} = 13.62 \times 10^7 \text{ reams of paper} \quad (4)$$

Continuing the assumption of 17 reams of paper per tree, this would require 8011765 trees. This results in 113 km² of the Amazon rainforest.

However striking these numbers may appear, what percentage of the Amazon rainforest would actually be destroyed if one were to print the Internet? With a total of 5.5 million km², the 113 km² equals only 0.002% of the total rainforest; a minute amount to print the entire Internet.

Conclusion

By making some assumptions about the size of the Internet, how much paper can be gained per tree, and that all trees within the amazon can be utilized for paper, it has been possible to determine that the printing of the non-explicit Internet would require 0.002% of this rainforest. Whilst this is a very small percentage, combined with the numerous other uses for trees i.e. as a source of material for construction, the rate of deforestation in the Amazon is hardly surprising.

Also, it is thought the non-explicit web is only a mere 0.2% of the total internet, the rest encompassing the Dark Web [9]. This would mean that printing the entire internet including Dark web would use 2% of the rainforest.

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