

## Teaching Guide for: Consequences of Amazon Deforestation

Speaker: Christopher Neill

Video link: <https://youtu.be/eA1XcORWmpU>

### Major topic

- Ecology

### Overview

The Amazon rainforest is the largest tropical forest on earth. It absorbs vast amounts of CO<sub>2</sub>, and is large enough to impact local and global weather. Dr. Christopher Neill describes the dramatic changes in the Amazon ecosystem that have resulted from deforestation for agriculture. Forest fragmentation has caused more species extinction, more fires and increased concern about drought. Neill ends his talk on a brighter note, pointing out that government intervention and modified agricultural practices have decreased Amazon deforestation by 75% in the past 10 years.

### Sub topic

- Biogeochemical cycling

### Multiple-choice questions

1. The Amazon rainforest plays a major role in the global carbon cycle through storage of carbon in living trees. The Amazon rainforest holds approximately \_\_\_\_\_ metric tonnes of carbon.

- a. 86 million
- b. **86 billion**
- c. 850 billion
- d. 255 billion
- e. 270 billion

2. The Amazon rainforest also plays a major role in the global water cycle through transpiration of water from the soil into the atmosphere, through the body of the tree. Dr Neill estimates that \_\_\_\_\_% of the rainfall the Amazon rainforest experiences was transpired by the forest itself.

- a. 5%
- b. 20%
- c. 33%
- d. **50%**
- e. 75%

3. Historically, the Amazon rainforest has not experienced very much fire. Which of the following factors primarily contributed to the lack of fire in the Amazon?

- a. **Deep roots allow trees to remain moist and fire-resistant year round**
- b. There is no dry season in the Amazon rainforest

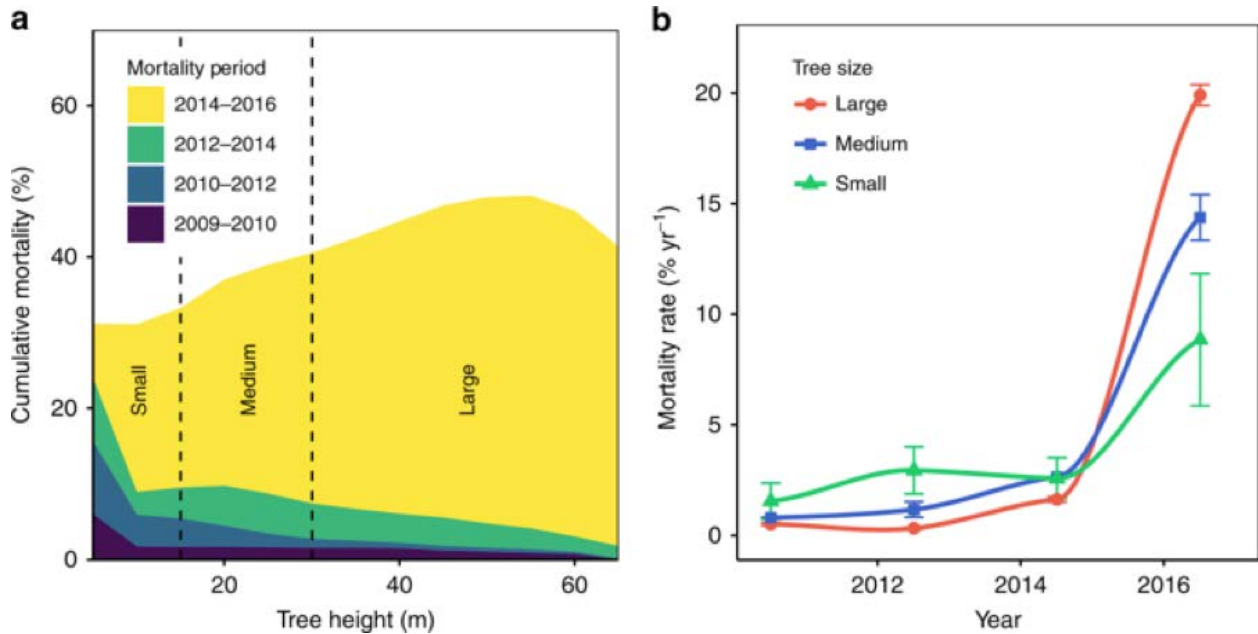
- c. Small fires are extinguished by flooding of the Amazon River
- d. The Mediterranean climate of the Amazon means that the dry season and the hot season occur at different times of year, reducing chances of fire
- e. All of the above contribute to minimal fire impacts in the Amazon rainforest

4. Which of the factors listed below does Dr. Neill argue has contributed to increasing fire prevalence in the Amazon?

- a. Decreased water supply from reduced flooding of the Amazon river
- b. Longer dry season, due to global warming
- c. Human introduction of fire-tolerant plant species into the Amazon rainforest
- d. Intentional setting of fires for large-scale land clearing projects
- e. Spread of fire from nearby pasture land into forest fragments
- f. Both C and D
- g. **Both B and E**
- h. All of the above

5. Dr. Neill discusses an experimental simulation of drought impacts performed in the Central Amazon. Note that the simulated drought significantly impacted some trees over others. Recently California experienced a natural drought that lasted 8 years and killed an estimated 2 million trees throughout the state. Earlier this year, scientists published the results of a study on the trees that were most affected by the drought (data shown in the figures below). Do the results of the natural drought in California match the results of the simulated experimental drought in the Central Amazon?

- a. **Yes, both droughts resulted in increased mortality in large trees**
- b. Yes, both droughts resulted in increased mortality in young trees
- c. No, the simulated drought affected all trees equally and the natural drought mostly affected large trees
- d. No, the simulated drought affected mostly deciduous trees and the natural drought affected mostly evergreen trees



Paper discussed in video is Nepstad et al 2007: <https://doi.org/10.1890/06-1046.1>  
 California study is Stovall et al 2019: <https://www.nature.com/articles/s41467-019-12380-6>

6. The video references a study on the interaction between drought and fire. The figure below is taken from the same study (but not shown in the video). In these figures, the x axis shows fire frequency and the y axis shows quantities of fast-burning fuels such as leaf litter (top row) and slow burning fuels like wood (bottom row). The left hand column of graphs are data from drought years and the right hand column of graphs are wet years. **Which of the statements below is supported by the data in the figures?**

- Wet years have higher slow burning fuel levels than drought years
- In all treatments, the forest contains more leaf litter than slow burning fuels**
- Less frequent fire increases fuel levels in all treatments
- The lowest fuel level measured occurred in wet years in forests experiencing fire every year
- All of the above are supported by the data

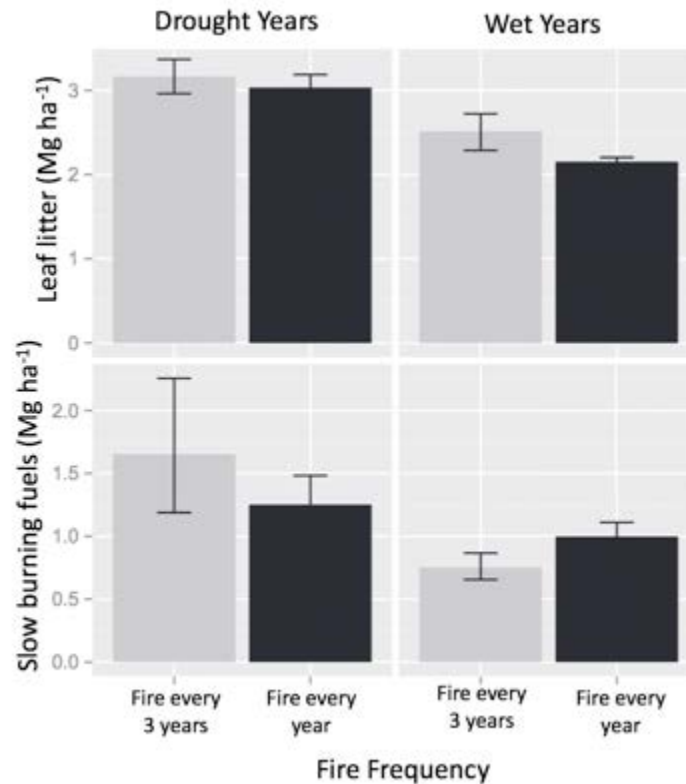


Figure from Brando et al 2014: <https://www.pnas.org/content/pnas/111/17/6347.full.pdf>

7. According to Dr. Neill, in the 2010's deforestation has slowed in the Amazon due to which factor(s)?

- Increased government protection of rainforest land
- Increased policing of illegal deforestation
- Pressure from environmental groups to increase sustainability
- Intensification of agriculture (higher production on less land)
- All of the above**

### Relevant literature

Stouffer, P. C., Bierregaard Jr, R. O., Strong, C., & Lovejoy, T. E. (2006). [Long-term landscape change and bird abundance in Amazonian rainforest fragments](#). *Conservation Biology*, 20(4), 1212-1223.

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Cochrane, M. A., & Schulze, M. D. (1999). [Fire as a Recurrent Event in Tropical Forests of the Eastern Amazon: Effects on Forest Structure, Biomass, and Species Composition 1](#). *Biotropica*, 31(1), 2-16.

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Nepstad, D. C., Tohver, I. M., Ray, D., Moutinho, P., & Cardinot, G. (2007). [Mortality of large trees and lianas following experimental drought in an Amazon forest](#). *Ecology*, 88(9), 2259-2269.

Nepstad, D., McGrath, D., Stickler, C., Alencar, A., Azevedo, A., Swette, B., ... & Hess, L. (2014). [Slowing Amazon deforestation through public policy and interventions in beef and soy supply chains](#). *science*, 344(6188), 1118-1123.

### **Acknowledgments**

We thank Dr. Laci Gerhart-Barley for sharing her multiple-choice questions for this video. For more information on how to implement this video in your teaching through homework assignments, check out Dr. Gehart Barley's [publication](#) and [webinar](#) with Dr. Brittany Anderton, Associate Director of iBiology.