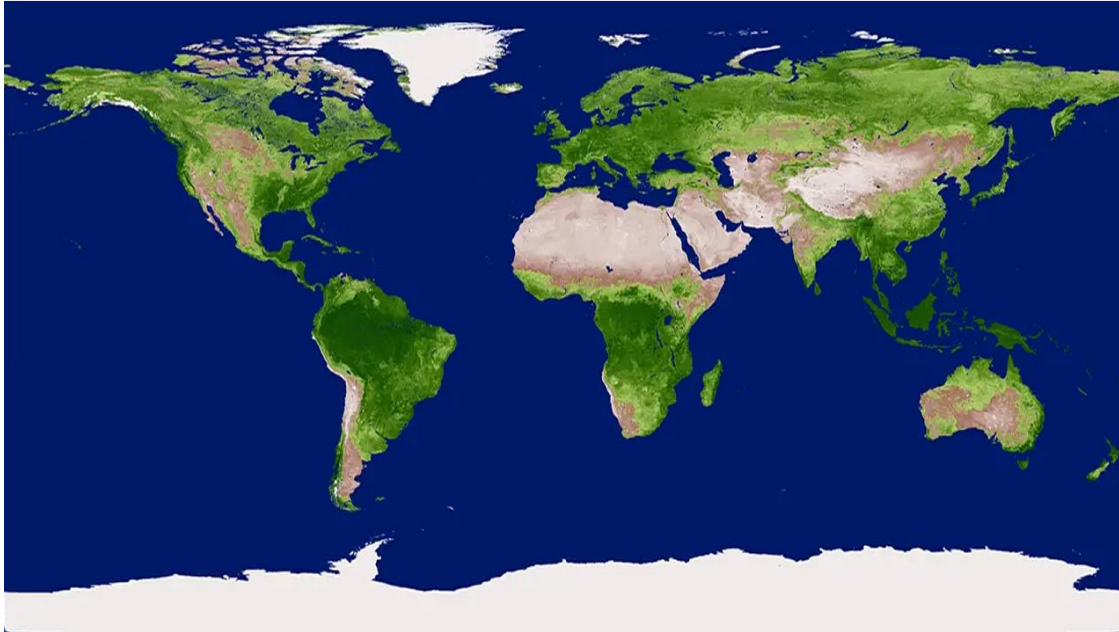


Climate at a Glance: Global Greening



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Key Takeaways:

- NASA satellite imagery analysis shows significant plant growth globally over the past 35 years.
- Research from NASA as well as multiple other studies conclude that the increased plant growth is a response to rising carbon dioxide in Earth's atmosphere creating better growing conditions.
- The increased plant coverage mitigates surface warming due to increased efficiency of heat and water vapor transfer to the atmosphere.

Short Summary:

Plant life is integral to the [biosphere](#).¹ Plants take CO₂ in, and in the process of photosynthesis, turn it into oxygen and water vapor which is released into the atmosphere. During [photosynthesis](#) plants combine water, CO₂, nutrients, and energy (light), to grow.²

[Liebig's Law of the Minimum](#), which defines the most limiting resource in photosynthesis, says that if one of those elements increases, all other elements remaining equal, growth will occur.³ Carbon dioxide concentration [has increased in Earth's atmosphere](#) over the last century, and plants have benefitted from the extra CO₂, producing a general greening of the earth.⁴

NASA satellite imagery has recorded this greening which is reflected in the [Normalized Difference Vegetation Index](#) (NDVI), created to measure the vegetative cover on the land surface.⁵ NDVI also identifies water, deserts, and ice.

In [2016](#), NASA reported that up to half of Earth's vegetated lands have shown significant greening during the preceding 35 years, largely due to rising levels of atmospheric carbon dioxide. NASA measured a 10 percent greening of the earth between 2000 and 2020, alone. The greening represents a net increase in leaves on plants and trees equivalent in area to two times the size of the continental United States.⁶ (See Figure 1 below)

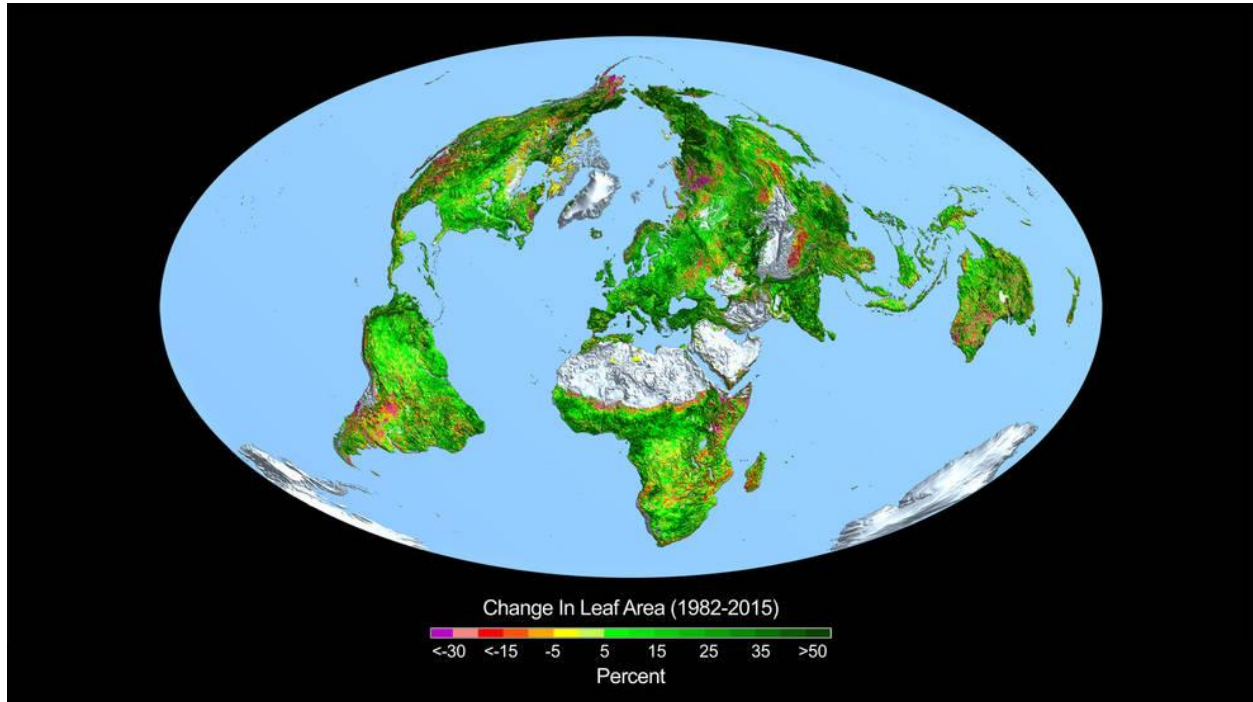


Figure 1. This image shows the change in leaf area across the globe from 1982-2015 detected by satellite. Credits: Boston University/R. Myneni. Image source: NASA

NASA's results confirm earlier research which found that the 14 percent increase in atmospheric CO₂ between 1982 and 2010 resulted in a 5-to-10 percent increase in green foliage cover in warm, arid environments.⁷

Plant life is not just expanding in temperate regions. A 2018 study found the Sahara Desert had shrunk in area by 8 percent over the previous three decades, due a CO₂ fertilization induced expansion of plant coverage.⁸

[Follow-up studies in 2018 and 2020](#), showed that on a global scale: greening can be attributed to the increase of carbon dioxide in the atmosphere; it has produced a beneficial cooling effect; and the increased plant growth is acting as a significant carbon sink.^{9 10}

The 2018 study noted, “. . . global greening since the early 1980s may have reduced global warming by as much as 0.2° to 0.25° Celsius (0.36° to 0.45° Fahrenheit).”

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Climate At A Glance is a Project of [The Heartland Institute](#)

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