Sarah A. Batterman, Ecosystem Ecologist, Biogeochemist

Associate Scientist
PhD, Princeton University
battermans@caryinstitute.org

Research mission:

- Resolve how nutrients and plant strategies govern land carbon
- Determine the mechanisms critical to predicting the future of land carbon
- Guide reforestation and conservation of tropical forests as natural climate solutions

Summary:

One of the greatest challenges facing ecologists today is resolving the potential for terrestrial ecosystems to offset human carbon emissions and slow climate change. However, it is not yet clear how much carbon uptake in tropical forests depends on soil nutrients and plants' ability to overcome nutrient limitations. Sarah Batterman uses greenhouse and large-scale ecosystem experiments, field observations, and modeling to confront this challenge.

Contrary to what many ecologists previously thought, Batterman has found that nitrogen — not phosphorus — is the main nutrient limiting the growth of young tropical forests. This work led her to discover that symbiotic nitrogen fixation plays a key role in tropical forest recovery after disturbance. By naturally fertilizing forests with nitrogen, fixation enhances growth and increases the forest's capacity to trap carbon.

In addition to nitrogen fixation, Batterman is exploring other strategies that trees use to overcome nutrient deficiencies. These include utilizing mycorrhizal fungi, adjusting phosphatase enzyme activity levels, or changing how resources are allocated throughout the plant. Batterman seeks to understand the tradeoffs and limits of these strategies, and how they will affect the global carbon sink.

After finding that herbivores preferentially eat the leaves of nitrogen-fixing plants, Batterman is also working to understand herbivory's implications for tropical forest carbon absorption, and how forest managers can improve reforestation success based on this knowledge.

Batterman's research helps to improve predictions of the future land carbon sink, and guide policy makers and practitioners on best practices for conserving and restoring tropical forests to combat climate change.

Select publications:

Barker W, Comita LS, Wright SJ, Phillips OL, Sedio BE, and Batterman SA. 2022. **Widespread herbivory cost in tropical nitrogen-fixing tree species.** *Nature*, 612: 483–487.

Levy-Varon JH, Batterman SA, Medvigy D. et al. 2019. **Tropical carbon sink accelerated by symbiotic dinitrogen fixation**. *Nature Communications* 10(1):1-8.

Batterman SA, Hall JS, Turner B, Hedin LO, and van Breugel M. 2018. **Phosphatase activity and nitrogen fixation reflect species differences, not nutrient trading or nutrient balance, across tropical rainforest trees.** *Ecology Letters*. 21: 1486-1495.

Mills B, Batterman SA, and Field K. 2018. **Nutrient acquisition by symbiotic fungi governs Palaeozoic climate transition.** *Philosophical Transactions B*. 373. *All authors contributed equally.

Sheffer E, Batterman SA, Levin SA, and Hedin LO. 2015. **Biome-scale nitrogen fixation strategies selected by climatic constraints on nitrogen cycle**. *Nature Plants* 1, 15182.

Batterman SA, Hedin LO, van Breugel M, Ransijn J, Craven DJ, and Hall JS. 2013. **Key role of symbiotic dinitrogen fixation in tropical forest secondary succession.** *Nature* 502, 224–227.

P.O. Box AB, 2801 Sharon Turnpike
Millbrook, New York 12545
845 677-5343
www.caryinstitute.org

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