**Title:** (Understanding the decoupling of CO2 uptake and woody production) *(many commentaries have clever, catchy, somewhat informal titles)*

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**keywords:** *(5-8)*

**quote:** *(A brief quote extracted from the Commentary should be included after the article title.)*

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|  | count |
| words | *(1500 max)* |
| figures | *(1-2 encouraged)* |
| tables | 0 |
| references | *(15 max)* |

As the climate changes and scientists seek to project its future course, an important uncertainty lies in the response of forests. Will rising atmospheric carbon dioxide (CO2) and lengthening growing seasons relieve limitations to tree growth, allowing increased carbon (C) sequestration in long-lived woody tissues and providing a negative feedback to climate change? Or will increasing heat and drought stress reduce growth and increase mortality, resulting in a positive feedback to climate change? To answer this question, global C cycle models simulate photosynthesis under future conditions, using simple plant C allocation schemes to determine the amount of C sequestered in woody growth versus that allocated to short-lived pools and rapidly respired back to the atmosphere as CO2 (**ref?**). Yet, there is growing evidence that these schemes are too simplistic, as wood production is in fact decoupled from photosynthesis (**refs?**), being itself directly influenced by climatic drivers (**refs?**). Needed, then, is an understanding of how woody growth is jointly shaped by photosynthesis and climate variables under a range of conditions. In this issue of *New Phytologist*, Martinez-Sancho *et al.* (pp. 000-000) use an innovative approach to describe the seasonal course of carbon sequestration in tree stem growth and how this is affected by drought. This study exemplifies the type of research needed to improve our ability to predict forest C sequestration under climate change.

*(1-2 paragraphs summarizing/ explaining Martinez-Sancho study)*

*(describe typical seasonal patterns, including what was known and what Martinez-Sancho contributed.)*

*(talk about drought impacts)*

The Martínez-Sancho *et al.* (2022) study adds to growing evidence that CO2 uptake and woody production are decoupled. …(Jiang *et al.*, 2020) …(Dow *et al.*, in press) …(Cabon *et al.*, 2022) …. (Kannenberg *et al.*, 2022) Of course, these observations of decoupling do not imply that *ANPPwoody* is completely decoupled from *GPP*; rather, the two show some level of correlation both in relation to interannual climatic variation at a single site (Cabon *et al.*, 2022) and across broad climatic gradients (Banbury Morgan *et al.*, 2021). However, we now have clear evidence that it is not realistic to expect that a constant allocation of photosynthate will be allocated to woody growth on either intraanuual or interannual time scales.

*(one paragraph discussing models)* C allocation to woody growth is an important parameter in models, yet models get it wrong. Therefore, this is an important uncertainty.  
To get models right, we need to understand seasonal patterns of C allocation to woody growth and how they are influenced by climate variation (and change)

We need more studies like Martínez-Sancho *et al.* (2022) – bonus if they also get GPP – to broaden our understanding of how *ANPPwoody* is jointly shaped by climate– both directly and indirectly (through GPP).

# References

**Banbury Morgan R, Herrmann V, Kunert N, Bond-Lamberty B, Muller-Landau HC, Anderson-Teixeira KJ**. **2021**. Global patterns of forest autotrophic carbon fluxes. *Global Change Biology* **27**: 2840–2855.

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**Dow C, Kim A, Loïc D’Orangeville, Gonzalez-Akre E, Helcoski R, Herrmann V, Harley G, Maxwell J, McGregor I, McShea W, *et al.*** **in press**. Warm springs alter timing but not total growth of temperate deciduous trees. *Nature*.

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