LATEST NEWS ARTICLES

- Will warm springs compensate for summer drought?
- Adding CCS to power plants could cause river problems
- Trees share their survival skills
- European air clean-up saved lives but warmed climate
- Designing for older concrete could cut carbon emissions

RELATED STORIES

- Insight: drought 'turns off' carbon sequestration in forests
- Heat and drought extremes likely to stress ecosystem productivity equally or more in a warmer, CO2 rich future
- Insight: spring droughts could reduce plant growth and carbon uptake

RELATED LINKS

- Sebastian Wolf, ETH Zurich
- **PNAS**

SHARE THIS

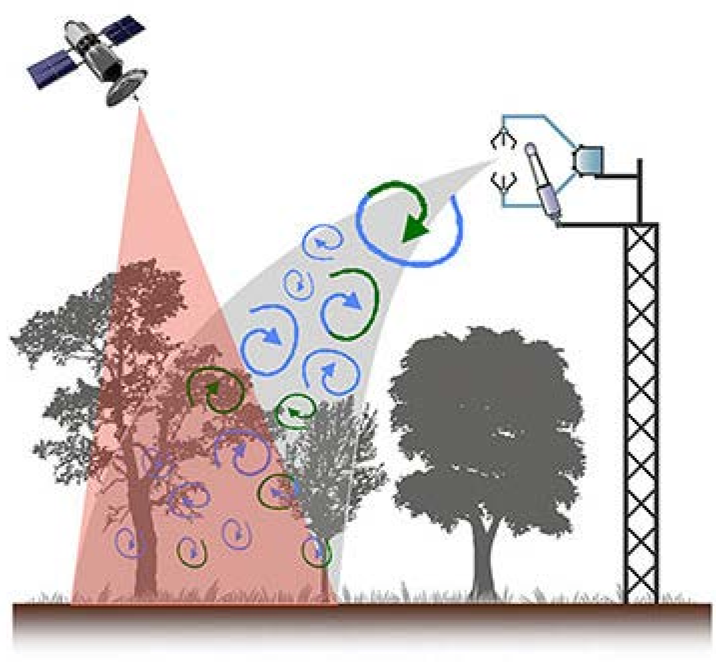
E-mail to a friend
StumbleUpon
Twitter
Facebook
CiteUlike

NEWS

Apr 29, 2016

Will warm springs compensate for summer drought?

The terrestrial carbon sink absorbs around one-third of global fossil-fuel emissions each year. But its strength depends on extreme climate events.



Breathing of the biosphere

In 2012 the US experienced warm temperatures and a severe summer drought, conditions that are likely to become more frequent as climate changes. Now a team has discovered that the carbon uptake by early vegetation growth in the warm spring of 2012 compensated for the reduced carbon uptake caused by the summer drought.

"The year 2012 was special across the US…it was the warmest spring ever recorded, followed by one of the most severe summer droughts since the Dust Bowl in the 1930s," Sebastian Wolf of ETH Zurich, Switzerland, told **environmentalresearchweb**. "Both warmer spring temperatures and drier summers are projected with climate change for the US, though less severe drought conditions then experienced during 2012. It is thus important to understand the impact of these seasonal anomalies on the carbon uptake of the terrestrial biosphere."

This is the first confirmation with direct measurements of a spring–summer compensation for a specific climate anomaly, according to Wolf. The phenomenon had previously been indicated by large-scale top-down approaches.

Since the increased carbon uptake during the warmer spring balanced out the reduced uptake during the summer drought, the contiguous US remained a carbon sink during the year 2012. In contrast, a drought in 2003 turned Europe into a carbon source.

But there was a downside. "We also found that the positive carbon cycle effect of a warmer spring came at a cost: the earlier vegetation activity caused soils to dry out earlier and thus further contributed to water limitations during summer," said Wolf. "This likely enhanced summer heating through reduced evaporative cooling and biosphere–atmosphere feedbacks."

The Eastern Temperate Forest played an important role in the increased spring uptake, the team found, emphasizing its ecosystem service value.

Wolf and colleagues combined direct measurements, satellite observations and mathematical modeling to assess the impact of the 2012 climate at scales from site-level to continental.

"While continuous and direct measurements of such biosphere–atmosphere exchange are done at the ecosystem scale (covering an area of several hundred metres around the measurement tower), remote sensing and modeling techniques are required to quantify such exchange and carbon uptake at a larger scale, e.g. across the US," said Wolf. "While these satellite and modeling methods cover a larger area, these are not continuous (only every couple days or weeks) and based on assumptions."

Combining these bottom-up – from the biosphere – and top-down – from the atmosphere – techniques gave an independent assessment. "The outcome from these different approaches agreed quite well in our study, giving confidence to our estimates of the carbon cycle impact of the 2012 drought," said Wolf.

The carbon cycle compensation in the US in 2012 is a case study for this one anomalous event, and can’t be extrapolated to future climate conditions, the researchers say. "Further work with process-based models and climate projections would be needed to estimate the effect of such seasonal climate anomalies on the carbon cycle in a changing climate," said Wolf. "As our results only give indications of the earlier waterdepletion/heating feedback of a warm spring for a limited number of sites in the centre of the drought, the next step would be to systematically investigate this at larger scales (e.g. across the US or Europe) and varying climate conditions over longer periods (past and future) to understand the potential effect on summer temperatures."

The team reported their results in **PNAS**.

Related links

- **PNAS**
- Sebastian Wolf, ETH Zurich

Related stories

- Insight: spring droughts could reduce plant growth and carbon uptake
- Heat and drought extremes likely to stress ecosystem productivity equally or more in a warmer, CO_2 rich future
- Insight: drought 'turns off' carbon sequestration in forests

About the author
Liz Kalaugher is editor of **environmentalresearchweb**

Be the first person to comment on this article