New satellite tools give scientists fresh insights into evergreens on Earth

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Using sensor data collected by satellites, scientists have developed an index to track photosynthesis in evergreens, giving them insight into seasonal cycles that signal how these trees adapt to climate change.

Environmental scientists have new tools for monitoring the health of northern forests — and they're orbiting many miles above Earth.

Using sensor data collected by satellites, scientists have developed an index to track photosynthesis in evergreens, revealing subtle natural rhythms and seasonal cycles that signal how these trees adapt to climate change.

"Past satellite studies have focused primarily on using 'greenness' indices … as indicators of seasonally photosynthetic activity," project lead Dr. John Gamon told Digital Trends. "While these approaches work well for some types of vegetation, they work poorly in evergreens that lack large seasonal changes in green leaf display — after all, they are 'evergreen!'"

To see these hidden rhythms on a large scale, Gamon and his team used new combinations of satellite frequency bands, including one that NASA uses to study oceans and one that tracks what Gamon calls the "invisible glow" of chlorophyll. They then developed an index to analyze the changes.

"Satellites are now starting to have the right tools for the job," Gamon said. "This understanding of how these things are connected in a coherent way depends not only on new satellite data but on a network of collaborating scientists and field sites … and involves a lot of on-the-ground validation."

Virtually all life on Earth depends on photosynthesis in some way so it is a vital sign of the planet's overall health.

"Besides releasing oxygen," Gamon said, "photosynthesis helps regulate our atmosphere by absorbing carbon dioxide … which helps regulate our climate and slow down climate change." The process also helps humidify Earth by releasing water vapor. "In a warming world, active photosynthesis means a productive world and a more stable climate, which are all indicators of planetary health," he added.

Slowing photosynthesis, meanwhile, indicates something in the system is failing, Gamon said. It is important then to keep track of even the subtle pigment changes in evergreens, which are particularly telling because they occupy 14 percent of all land on Earth and significantly impact environmental productivity.

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"As an example of 'ill health' conveyed by evergreen photosynthesis, the recent declines of evergreen forests in much of the western U.S. and Canada due to warming, drought, insects, and wildfire are all indicators of severe stress and can be seen as a decline in planetary health in the face of changing climate," Gamon said. "In this way, forest activity is a key indicator of planetary health."

Gamon is now focused on analyzing these changes in photosynthesis detected with the new tools and index in an effort to determine how these vital systems will respond to a changing climate. His study appeared in the journal Proceedings of the National Academy of Sciences this week.

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