Severe changes in world's leaf growth patterns over past several decades revealed

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Inspired by water transport in natural leaves (shown), researchers have created a synthetic, microfabricated "leaf" that can generate power from evaporative flow. Image credit: pdphoto.org

Extensive worldwide changes in the timing of leaf activity over the past few decades—which may have significant ecological and atmospheric consequences—have been revealed by a University of Otago, New Zealand research team analyzing satellite data from 1980 - 2012.

Their findings, newly published in the journal *Nature Climate Change*, provide the first global picture of change in the seasonal pattern of vegetation activity, known as leaf phenology.

Leaf phenology is the timing of leaf emergence, growth, and death of leaves and is influenced by environmental cues, such as temperature and rainfall, but also by atmospheric CO2 concentrations.

Research team leader Professor Steven Higgins says changes in these environmental cues have previously been shown to cause earlier leaf emergence in Europe and North America, but other parts of the world, especially in the Southern Hemisphere, have not been well-studied.

"For the first time, we have shown that equally severe changes have occurred over large regions of Africa, South America and Australia. Overall we found that the phenological signature of 95% of the Earth's land mass has altered with 54% changing substantially," Professor Higgins says.

This could lead to higher extinction risks for species that depend on the leaf phenological cycle, a process already underway in the Northern Hemisphere, he says.

"For example, several bird species have already experienced population losses due to the effective seasons moving out of synch with their life-cycles, and similar changes have been reported for insect pollinators and even large mammals such as deer," he says.

These changes are also likely to have significant impacts on ecosystem stability and functioning, carbon and energy exchange between the land surface and the atmosphere, and agricultural practices, he adds.

Professor Higgins says the techniques the team developed for the study provide a sensitive and direct way of measuring how the 'breathing' of our planet's land-surface is changing.

"We now have a tool that will be useful for both monitoring ongoing change and measuring the reliability of early warning indicators of catastrophic ecosystem state changes."

More information: Three decades of multi-dimensional change in global leaf phenology, DOI: 10.1038/nclimate2533

Provided by University of Otago