Leaves are nature's most sophisticated environment sensors

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New research confirms that leaves are nature's most sophisticated environment sensors. We can therefore use leaves to tell us about the

management of the land they are growing in.

Professor of Zoology, Yvonne Buckley at Trinity College Dublin is part of a global network of grassland ecologists who have found that critical plant nutrients such as nitrogen, phosphorus and potassium in leaves respond to fertilisation treatments as well as the climate and soils they are growing in. The discovery has just been published in *Nature Ecology & Evolution*.

While ecologists and agricultural scientists have known for some time that individual species at individual locations can vary in the amounts of these nutrients in their leaves in response to fertilisation, this is the first time that it has been confirmed across entire communities of plants in very different climates and soil conditions. The experiment was undertaken at 27 sites in four continents, from the semiarid grasslands and savannas of Australia to lush pastures in Europe and prairies in America.

When plants are fertilised they can use those extra nutrients to grow bigger and produce more flowers and seeds which can dilute the nutrients in their leaves, so a positive response of leaf nutrients to fertilisation is not guaranteed. A surprising result of this experiment was that Specific Leaf Area, a leaf trait that is commonly used to tell us about how plants defend themselves against herbivores and capture sunlight for growth, was unaffected by fertilisation. So this critical measure of leaf architecture is not changing in a consistent way in response to fertilisation. Leaf architecture is instead determined by climate and soil characteristics, so it may respond over a longer time frame than short-term fertilisation.

Commenting on the significance of the research, Professor Buckley said:

"As our environment changes more quickly due to climate change,

intensification of agriculture and [land use](), it is becoming more important to understand how grasslands all over the world are likely to respond. Grasslands are one of the most extensive habitats in the world, they provide us with food, carbon storage and habitat for pollinators. Using plants as sensors of environmental change gives us another important tool for understanding the consequences of these changes for our life support systems."

"There are two ways that leaf nutrients can change in grassland communities, either the existing species leaves change to store more nutrients or the kinds of species which can survive in these new conditions change to species that naturally have higher leaf nutrients. We found that for nitrogen and potassium both of these things were happening but for phosphorus the [species]() change pathway was not important."

Provided by Trinity College Dublin