Scientists move a step closer to understanding species distributions in the face of climate change

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A team of international researchers, led by the University of Sheffield, has moved one step closer to discovering how physiological attributes allow some plants to thrive in a variety of conditions - something that could be the key to future food sustainability.

Climate change strongly impacts on biodiversity, putting some species at risk of extinction. However, some plant species adapt to their new conditions, and go on to thrive and invade areas where they have never grown before - something that largely remains a mystery to scientists.

Until now, little research has been done to understand the link between species' characters and ecological preferences.

Dr Marjorie Lundgren, a postdoctorate researcher from the University of Sheffield's Department of Animal and Plant Sciences, led an international team of scientists from France, South Africa, the United States, Uganda, and Tanzania, to look in detail at the species *Alloteropsis semialata*, a grass that prospers in a variety of habitats, from South African grasslands to the wooded savannahs of Tanzania.

Alloteropsis semialata is the only species known to have plants with and without C4 photosynthesis, which is a complex assemblage of leaf anatomical characters and enzymatic reactions that together increase productivity in warm and dry environments.

The syndrome is present in just three percent of all plant species yet accounts for one quarter of terrestrial primary production. This impressive productivity is due to C4 grasses, which dominate most open areas of the tropics and subtropics and especially savannahs.

Through genomic analyses, Dr Lundgren and her team found that *Alloteropsis semialata* originated in Central Africa during the Pliocene - the period of geologic time that extends from 5.3 to 2.6 million years ago.

Using novel approaches the scientists were able to understand the ecological changes that happened during the dispersal of this species, first in Africa and then in Asia and Australia. The team found that while the non-C4 plants remained confined to a small range of ecological conditions in Central Africa, the evolution of C4 photosynthesis immediately broadened the ecological conditions where the species could grow.

The pioneering research, published in *Ecology Letters*, discovered that C4 plants can disperse broadly across environmental and geographical space, while still surviving in the same habitats occupied by the non-C4 ancestors, showing that this physiological novelty increases the variety of habitats available, which allowed the rapid colonization of three distinct continents by this unique grass.

Dr Lundgren said: "In a world rapidly affected by climate changes and other anthropogenic alterations of natural systems, understanding how physiological attributes allow some plants to thrive in a variety of conditions might hold the key to the management of more resilient ecosystems. In addition, understanding what allows some plants to be productive in a variety of environments could help direct future crop improvement projects."

More information: Photosynthetic innovation broadens the niche within a single species, published in *Ecology Letters*, doi:10.111/ele.12484

Provided by University of Sheffield

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