Searching for a female partner for the world's 'loneliest' plant

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"Surely this is the most solitary organism in the world," wrote paleontologist Richard Fortey in his book about the evolution of life.

He was talking about Encephalartos woodii (E. woodii), a plant from South Africa. E. woodii is a member of the cycad family, heavy plants with thick trunks and large stiff leaves that form a majestic crown. These resilient survivors have outlasted dinosaurs and multiple mass extinctions. Once widespread, they are today one of the most threatened species on the planet.

The only known wild E. Woodii was discovered in 1895 by the botanist John Medley Wood while he was on a botanical expedition in the Ngoye Forest in South Africa. He searched the vicinity for others, but none could be found. Over the next couple of decades, botanists removed stems and offshoots and cultivated them in gardens.

Fearing that the final stem would be destroyed, the Forestry Department removed it from the wild in 1916 for safekeeping in a protective enclosure in Pretoria, South Africa, making it extinct in the wild. The plant has since been propagated worldwide. However, the E. woodii faces an existential crisis. All the plants are clones from the Ngoye specimen. They are all males, and without a female, natural reproduction is impossible. E. woodii's story is one of both survival and solitude.

My team's research was inspired by the dilemma of the lonely plant and the possibility that a female may still be out there. Our research involves using remote sensing technologies and artificial intelligence to assist in our search for a female in the Ngoye Forest.

The evolutionary journey of cycads

Cycads are the oldest surviving plant groups alive today and are often referred to as "living fossils" or "dinosaur plants" due to their evolutionary history dating back to the Carboniferous period, approximately 300 million years ago. During the Mesozoic era (250-66 million years ago), also known as the Age of Cycads, these plants were ubiquitous, thriving in the warm, humid climates that characterized the period.

Although they resemble ferns or palms, cycads are not related to either. Cycads are gymnosperms, a group that includes conifers and ginkgos. Unlike flowering plants (angiosperms), cycads reproduce using cones. It is impossible to tell male and female apart until they mature and produce their magnificent cones.

Female cones are typically wide and round, and male cones appear elongated and narrower. The male cones produce pollen, which is carried by insects (weevils) to the female cones. This ancient method of reproduction has remained largely unchanged for millions of years.

Despite their longevity, today's cycads are ranked as the most endangered living organisms on Earth, with the majority of the species considered threatened with extinction. This is because of their slow growth and reproductive cycles, typically taking ten to 20 years to mature, and habitat loss due to deforestation, grazing and over-collection. Cycads have become symbols of botanical rarity.

Their striking appearance and ancient lineage make them popular in exotic ornamental horticulture and that has led to illegal trade. Rare cycads can command exorbitant prices from US $620 (£495) per cm, with some specimens selling for millions of pounds each. The poaching of cycads is a threat to their survival.

Among the most valuable species is the E. woodii. It is protected in

botanical gardens with security measures such as alarmed cages designed to deter poachers.

AI in the sky

In our search to find a female E.woodii, we have used innovative technologies to explore areas of the forest from a vertical vantage point. In 2022 and 2024, our drone surveys covered an area of 195 acres or 148 football fields, creating detailed maps from thousands of photos taken by the drones. It's still a small portion of the Ngoye Forest, which covers 10,000 acres.

Our AI system enhanced the efficiency and accuracy of these searches. As E. woodii is considered extinct in the wild, synthetic images were used in the AI model's training to improve its ability, via an image recognition algorithm, to recognize cycads by shape in different ecological contexts.

Plant species globally are disappearing at an alarming rate. Since all existing E. woodii specimens are clones, their potential for genetic diversity in the face of environmental change and disease is limited.

Notable examples include the Great Famine in 1840s Ireland, where the uniformity of cloned potatoes worsened the crisis, and the vulnerability of clonal Cavendish bananas to Panama disease, which threatens their production as it did with the Gros Michel banana in the 1950s.

Finding a female would mean E. woodii is no longer at the brink of extinction and could revive the species. A female would allow for sexual reproduction, bring in genetic diversity, and signify a breakthrough in conservation efforts.

E. woodii is a sobering reminder of the fragility of life on Earth. But our

quest to discover a female E. woodii shows there is hope even for the most endangered species if we act fast enough.

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