Live 'it up or long' to prosper? Ecologists probe plant lifestyles

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Utah State University ecologist Peter Adler and colleagues say simple morphological measurements can predict where a species falls within the global range of life histories. Credit: Utah State University

Consider the dandelion and the bristlecone pine, says Utah State University ecologist Peter Adler.

The former grows 'like a weed,' issues copious amounts of fluffy seeds (which provide entertainment for kids and less amusement for lawn owners trying to maintain pristine turf), but dies within a few weeks. In contrast, the brawny bristlecone pine matures at a glacial pace, is rather stingy with seeds; yet lives for hundreds, sometimes thousands, of years.

"How can you explain such variation?" asks Adler, associate professor in USU's Department of Wildland Resources and the USU Ecology Center. "Is it enough to know the size of a species' seeds or the thickness of its leaves?"

With USU graduate student and Quinney Fellow Aldo Compagnoni, along with colleagues Roberto Salguero-Gómez of Australia's University of Queensland and Germany's Max Planck Institute; USU alums Joanna Hsu of the University of California, Berkeley and Jayanti Ray-Mukherjee of South Africa's University of Kwa Zulu-Natal, and Cyril Mbeau-Ache and Miguel Franco of Britain's Plymouth University, Adler published a paper showing that simple morphological traits can, in fact, explain variation in the life histories of plants. The research, supported by the National Science Foundation, appears in the Dec. 30, 2013, online *Early Edition of the Proceedings of the National Academy of Sciences.*

"There's traditionally been a disciplinary divide in ecology between the physiology of organisms versus population biology," says Adler, a 2011 recipient of the NSF's Faculty Early Career Development "CAREER" Award. "Trait-based approaches assume that simple functional traits influence fitness and life history evolution, but these assumptions have not been rigorously tested."

To remedy this, Adler and his team linked a global traits database with empirical population models for more than 200 species.

"We found strong relationships between functional traits and plant life

histories," he says. "We show that simple morphological measurements can predict where a species falls within the global range of life histories."

Essentially, species with large seeds, long-lived leaves and dense wood have population growth rates influenced primarily by survival. (Live long and prosper.) In contrast, species with small seeds, short-lived leaves or soft wood, depend on fecundity—having lots of babies—for population growth and persistence.

"These results increase our ability to explain complex population processes with a few easily measured character traits," Adler says. "If we can refine this approach, it could have important applications in conservation and natural resource management."

Having these tools, he says, could help managers determine the most cost-effective ways of controlling invasive species or protecting threatened species without spending years collecting demographic data.

"We're confirming that trait-based ecology is built on a solid foundation, and that the field is moving in the right direction," Adler says.

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