

Lay summary of Mason *et al.* 2015:

- The **lakeside sunflower** (scientific name *Helianthus carnosus*) is a charismatic wild sunflower species native to only five counties in northeast Florida – Clay, Flagler, Putnam, St. Johns, and Volusia. It is listed by the state of Florida as “endangered”, primarily due to population destruction and long-term degradation of its native habitat in the region.
- The **pineland false sunflower** (scientific name *Phoebanthus tenuifolius*) is another charismatic wild sunflower species native to only five counties in the Apalachicola River Basin region of the Florida panhandle – Bay, Calhoun, Franklin, Gulf, and Wakulla. It is listed by the state of Florida as “threatened”, also due primarily to habitat degradation.
- Both of these species are considered “narrow endemics”, meaning they are species found in only a small geographic area and nowhere else in the world. What causes a species to only be found in one small area is poorly understood by biologists. One potential explanation is that such species have very specific habitat requirements, for instance only thriving under a certain combination of climate, soil, and vegetation conditions. Another potential explanation is that such species were historically widespread, and only today occupy small areas due to factors like habitat loss. In either case, being found in only a small geographic area is often associated with genetic problems, like inbreeding depression and low genetic diversity. Such factors can weaken an already at-risk species and increase the likelihood of extinction. The Florida panther is a good example of this phenomenon.
- Narrow endemic plant species are often of high conservation interest, as being found in only a small geographic area makes these species especially prone to extinction. Additionally, unlike most animals plants cannot easily move to new habitats if their current one becomes unsuitable. This is especially problematic in light of ongoing climate change, with many regions expected to experience changes in temperature and precipitation patterns. Understanding the causes of narrow endemism is key to informed management of threatened species.
- This new study, just published in the journal *Conservation Genetics* and funded in part by the Florida Native Plant Society, examines the potential causes of narrow endemism in both the lakeside sunflower and the pineland false sunflower. To accomplish this, these two species were compared to a very widespread and common close relative, the rayless sunflower (scientific name *Helianthus radula*), which is found throughout the southeastern United States from Louisiana to Florida to South Carolina. This species is similar in appearance, habitat usage, and overall biology to the two endemics, and thus makes for a good comparison.
- This study uses two main approaches: the evaluation of the “population genetics” of each species, and “environmental niche modeling”. The former approach involves the assessment of the genetic diversity within and among populations, the relative genetic connectivity among populations through seed or pollen dispersal, and the amount of inbreeding occurring. The

latter approach involves statistical assessment of the distribution of a species in relation to the geographic distribution of relevant environmental factors like temperature, rainfall, and soil type.

- The results of the “population genetics” component of this study show that both the **lakeside sunflower** and the **pineland false sunflower** are not much different from their widespread common relative the rayless sunflower in either genetic diversity or population connectivity. Neither endemic species showed evidence of inbreeding. This suggests that genetic factors are not a likely cause of narrow endemism in these species, and that these species are reasonably genetically “healthy”.
- The results of the “environmental niche modeling” component of this study show that the distributions of both endemic species are strongly determined by temperature and rainfall patterns. In particular, in the **lakeside sunflower** the inland boundary of the distribution of the species strongly aligns with a climatic boundary defining the driest quarter of the year. In the coastal counties where this species is found, the driest quarter of the year is November-January, while farther inland the driest quarter of the year is October-December. Given that the **lakeside sunflower** flowers in the late summer and sets seed throughout the fall, inland locations may experience too much autumn drought for optimal reproduction. For the **pineland false sunflower**, the species distribution aligns strongly with the amount of precipitation in the wettest month of the year, which for this species is June, when most populations flower. Locations to the east, west, and north of the Apalachicola River Basin receive much less rainfall during this critical period of the life cycle, which may make these areas unsuitable for the **pineland false sunflower**.
- Given the importance of climate characteristics to the distribution of both endemic species, this study also performed modeling analyses predicting the amount of suitable habitat under conservative estimates of climate change in Florida. These analyses were surprising in that they predicted a strong reduction in habitat suitability for both species over the next few decades. This decline in habitat suitability appears to be driven by the prediction that the timing and amount of precipitation will change for both species. For the **pineland false sunflower**, precipitation during the peak flowering period is predicted to be sharply reduced, and this coupled with higher predicted summer temperatures may result in conditions too dry for optimal reproduction, especially in drought years. For the **lakeside sunflower**, a similar scenario is predicted, with increased temperatures during reproduction combined with the dry season shifting earlier in the year. While these models predict reduced habitat suitability, it is important to note that this does not necessarily mean that these species will go extinct, though the likelihood of this occurring will be increased. Improved conservation efforts for both of these species are needed to ensure their continued existence, particularly careful monitoring and management of populations.

- The lead author of this study, Dr. Chase Mason, is originally from Palatka, FL. He received his B.S. in Zoology from the University of Florida in 2009 and his PhD in Plant Biology from the University of Georgia in 2015. He is currently a Katherine H. Putnam Fellow in Plant Science at the Arnold Arboretum of Harvard University.

Contact Info:

Chase Mason, PhD
Arnold Arboretum
1300 Centre Street
Roslindale, MA 02131

(386)-916-6578
chasemason.evolution@gmail.com