

**COMPARISON BETWEEN TWO SURVEYS
OF *PHYSOSTEGIA CORRELLII* (LAMIACEAE)
IN TRAVIS COUNTY, TEXAS**

CASEY R. WILLIAMS
BIO-WEST

San Marcos, Texas 78666
cwilliams@bio-west.com

ASPEN MANNING

Department of Geography
Texas State University
San Marcos, Texas 78666

ABSTRACT

This study documents the results of distributional surveys conducted in 2014 and 2018 for the rare *Physostegia correllii* at Lady Bird Lake in Travis Co., Texas. Survey results showed that some *P. correllii* colonies were lost in between surveys but additional colonies were observed at new locations along deposited silt and sediment banks. Survey results indicate that the species is a stream bank specialist and disturbance fugitive preferring newly deposited and saturated sediment as well as sparse or low growing riparian vegetation to proliferate.

Physostegia correllii Lundell (Shinners), Correll's false dragonhead, is a rare, potentially threatened or endangered plant species found at scattered localities across southern and central Texas, coastal Louisiana, and northern Mexico (Cantino 1982). Plants are perennial, erect, horizontally rhizomatous herbs growing 1 meter or more tall. They have been observed growing along the edge of streams, ditches, and rivers (Poole et al. 2010) and the species perhaps had a more widespread distribution along springs and creeks of central Texas before urbanization.

The species is listed as critically imperiled in Louisiana (S1) and imperiled in Texas (S2). Historically *Physostegia correllii* has been noted or collected in 6 to 10 counties in Texas (Cantino 1982; Poole et al. 2010) and 4 parishes in Louisiana (Louisiana Natural Heritage Program 2010).

Figure 1 shows the distribution of *Physostegia correllii* in the USA (Kartesz 2015). The current status of *P. correllii* in many of these counties is unknown and the species is presumed to be extirpated from at least one Texas county (Poole et al. 2010). However *P. correllii* has continually been noted and observed in Travis County since it was first collected in 1952 along the Colorado River east of Austin. Over the last 10 years, observations have been made at sites along the shore of Lady Bird Lake just upstream of the original Travis County collection. Until 2014 no thorough surveys had been conducted at Lady Bird Lake to record localities other than the few previously known. We conducted a shoreline-based survey of the lake in order to document the number of *P. correllii* colonies and their growth habits.

Lady Bird Lake is a municipal reservoir located on the Colorado River as it passes through the city of Austin. The reservoir covers 190 hectares and is predominantly urban riverine habitat with multiple urban streams and storm water runoff channels flowing into it. Although Lady Bird Lake is highly modified aquatic habitat, it has a robust aquatic plant community and some areas of intact riparian communities. Water quality in Lady Bird Lake is generally good (City of Austin 2011).

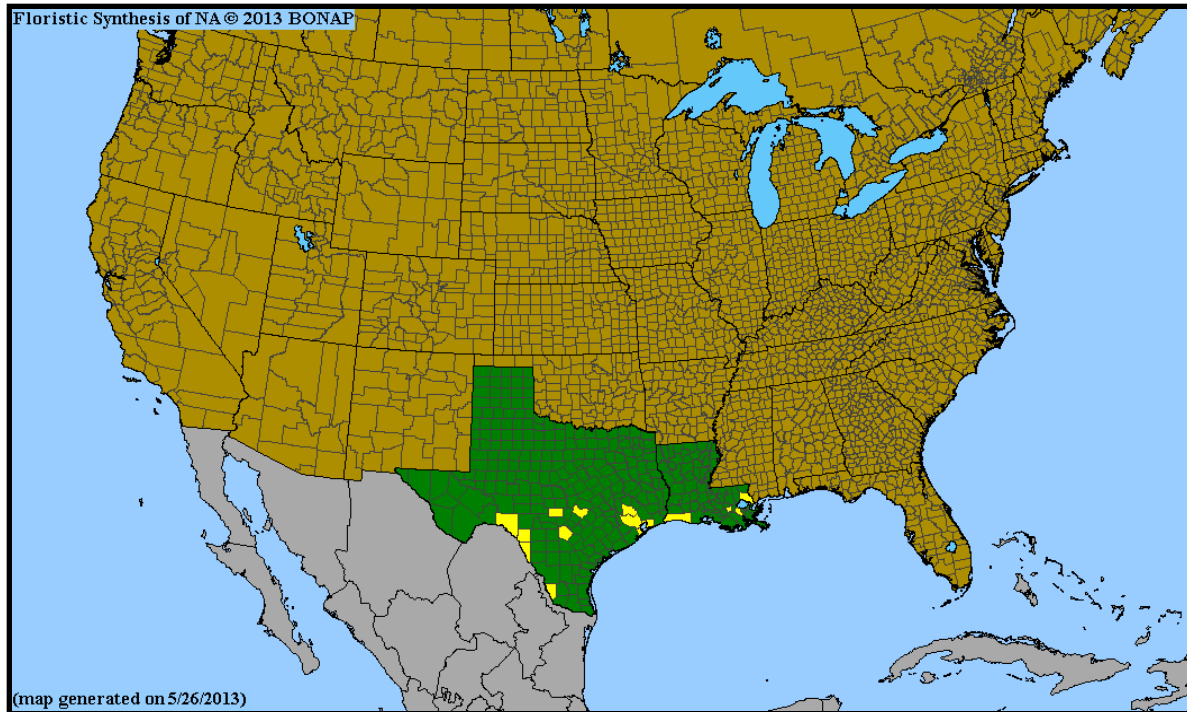


Figure 1. County distribution of *Physostegia correllii* in the USA (Kartesz 2015).

The reach of the Colorado River impounded to form Lady Bird Lake has historically been fed by several springs and spring fed tributaries. These include Barton Creek, which is fed by the fourth largest spring system in Texas. Barton Springs, Deep Eddy Springs, Bee Springs, Durham Springs and Seiders Springs all once provided perennial sources of water in the vicinity (Brune 1981). Many of these springs and tributaries are now surrounded by urban growth and have little to no intact riparian or aquatic habitat.

Methods

From April to September 2014 and April to August 2018 the survey team utilized kayaks to conduct this survey. Since *Physostegia correllii* typically grows along the edge of water, utilizing kayaks provided a clear line of site to colonies that would otherwise be hidden when viewing from the bank. A hand-held gps unit (Garmin or Trimble) or a cellular phone application (Polaris Navigator) was used to collect GPS coordinates. Latitude and longitude (D:M:S) were recorded and entered into a data sheet along with a point number. For data collected by cellular phone, GPS Earthpoint tools for Google Earth was used to convert these coordinates into a Google Earth layer. For Garmin or Trimble machines, collected data points were downloaded and converted into an ARC GIS shapefile. In addition to coordinates, other data such as soil type, colony length, colony width, maximum height of colony, stem counts, canopy density, and associated herbaceous and riparian species were also collected.

Results

During the 2014 survey 22 colonies of *Physostegia correllii* were found growing along the shoreline of Lady Bird Lake and one colony was located on an island situated in the Colorado River 70 meters below Longhorn dam. During the 2018 survey, 8 of the 2014 colonies were not relocated, including the Colorado River colony. However, 8 colonies were found at new locations, bringing the total number of colonies in 2018 back to 23. Figure 2 illustrates the difference in colony distribution between 2014 and 2018 surveys.

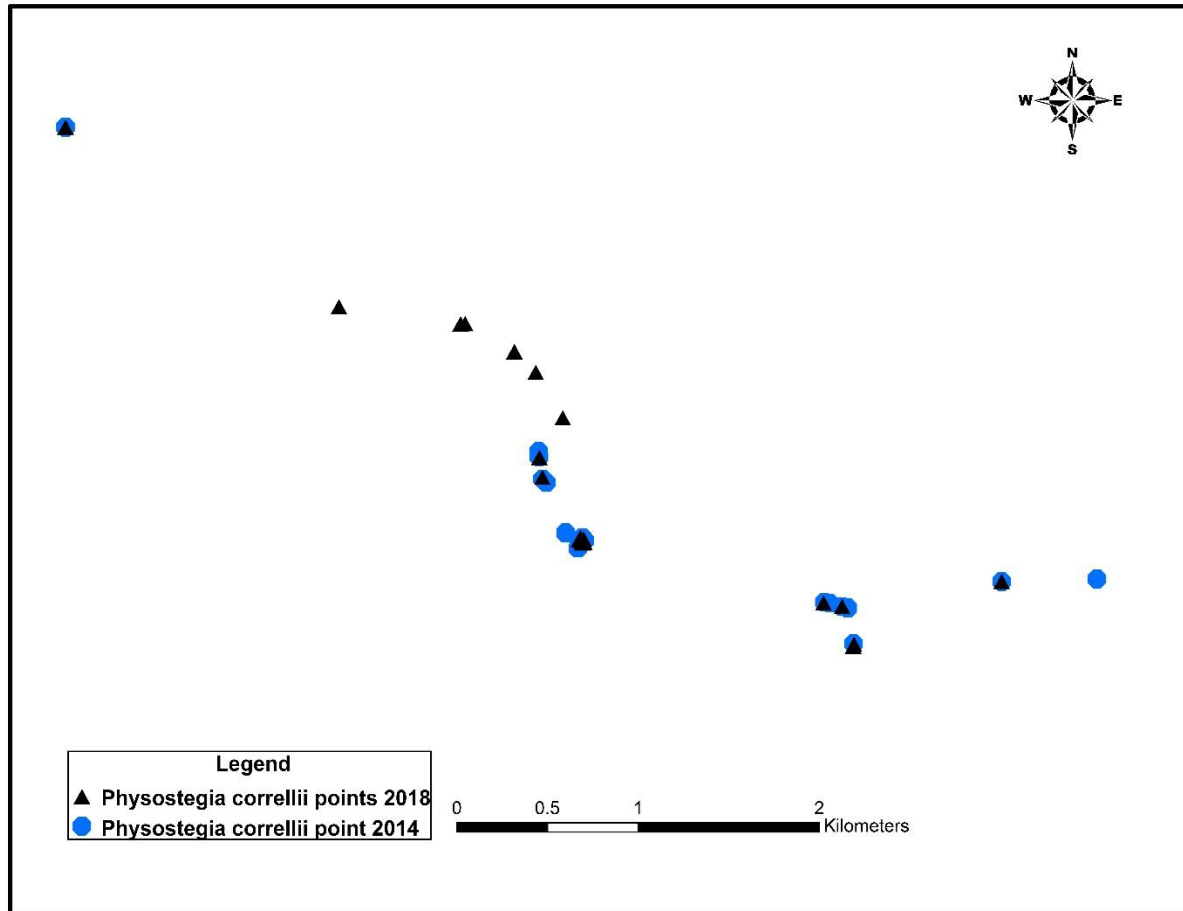


Figure 2. Distribution of *Physostegia correllii* colonies in 2014 and 2018. No specific geographic locations or topography are provided to protect the locations of this rare species

Colony size in 2014 ranged from 0.3 m² to 21 m², while in 2018 colony size ranged from 0.3 m² to 105 m². Between both surveys *Physostegia correllii* was most commonly associated with herbaceous species such as *Ambrosia.*, *Daucus*, and *Boehmeria* species. In both surveys about 40% of colonies were associated with non-native species. *Colocasia esculenta* was the most common non-native species associated with *P. correllii*, although *Iris pseudacorus*, *Arundo donax*, and *Alternanthera philoxeroides* were also noted.

Riparian canopy cover varied from no canopy cover to dense canopy cover, with *Taxodium distichum* and *Fraxinus pennsylvanica* being the most commonly associated riparian trees. Most colonies were found within light to moderate canopy cover. Soil tended to be silty sediment or organic detritus composed of broken down organic debris. Other soil types included gravel, bedrock, and sand. Two colonies were observed growing within cracked concrete.

Typically, *Physostegia correllii* colonies are composed of multiple stems united via an underground rhizome system. Colonies tend to grow parallel to the water's edge or along flat sediment banks with completely saturated soil. Plants rarely grow in the water but always grow in saturated soils in a "wet feet; dry ankle" situation.



Figure 3. Top. Two large *Physostegia correllii* colonies (indicated by black arrows) located in 2014. Bottom. In 2018 the colonies were missing presumably due to brush clearing along the bank.



Figure 4. A new colony location for 2018 that was not present during the 2014 survey. This colony was growing in saturated deposited sediment with no canopy cover, but associated with *Colocasia esculenta*

Table 1. Descriptive data for *Physostegia correllii* colonies.

	2014	2018
Colony Count	23	23 (8 colonies not relocated from 2014 survey but 8 new colonies were identified)
Colony stem count range	5 to 65	1 to 75
Soil type		
Organic/Detritus	20%	50%
Silt	60%	30%
Other	20%	20%
Riparian Cover		
None	8%	9%
Light	56%	45%
Medium	17%	27%
Dark	13%	18%
Associated species		
Native	57%	60%
Mixed Native/ non-native	43%	40%

Discussion

Physostegia correllii appears to be well established along the banks of Lady Bird Lake. Our surveys showed three distinct spots where colonies were aggregated in close proximity to one another. Six new colonies surveyed in 2018 were established along the northern edge of the lake where no colonies were observed four years prior. A few of these colonies may have been planted as part of habitat improvement projects along the Ann and Roy Butler trail, which is maintained by the non-profit Trail Foundation (Anna Strong, pers. comm.). Two new colonies were found on islands and were presumably naturally occurring. All new colonies were found growing on low lying sediment bars with less dense vegetation mostly dominated by quick-growing herbaceous species or very young *Salix* species. These sediment bars were likely deposited during the multiple significant flooding events that occurred at Lady Bird Lake since 2014. Conversely, the one colony located below Longhorn dam in the Colorado River was likely lost due to the same flooding events, as this area was completely scoured of all vegetation by 2018.

Based on our observations *Physostegia correllii* colonies at Lady Bird Lake seem to be somewhat site specific. Suitable habitat can be characterized by the following:

1. Saturated alluvial organic, silty soils.
2. Moderate canopy cover
3. Absent or sparse low growing associated vegetation

In our survey there was obvious differentiation in habitat between newer colonies and longer established colonies. The newest colonies were associated with sparse vegetation while older colonies were surrounded by more mature and denser vegetation and growing on more compacted soils. In several instances however, newer colonies, presumably planted or otherwise, were also becoming overshadowed by *Colocasia esculenta*.

Physostegia correllii health appears to decline in areas with dense riparian vegetation or canopy cover. Colonies that were located with dense riparian growth were notably less robust and exhibited leaf yellowing, insect damage, and decreased flower production. Some 2014 colonies in these growing situations were significantly reduced in size between the two surveys.

Physostegia correllii may be characterized as a stream edge specialist and disturbance fugitive that thrives on newly deposited sediment beds before more robust riparian and wetland vegetation takes hold. If this is the case, then the persistence of the species depends on the creation of new habitat or maintenance of existing habitat (scouring of dense riparian vegetation) by flooding events along streams and rivers. Dependence on fluvial disturbance is typical in riparian plant communities. Floodplain scouring and deposition of sediments creates new habitat (Bendix & Hupp 2000), can reduce non-native populations (Greet et al. 2015), and can increase biodiversity (Catford & Jansson 2014). Riparian plants such as *P. correllii* have several adaptive traits (i.e., rhizomes, flexible stems) that allow them to resist scouring and/or anoxic conditions associated with floods (Catford & Jansson 2014).

Management and conservation

Riparian areas in general are sites of high biodiversity because of their position at the transition zone between terrestrial and aquatic habitat, their role as linear connections among varied landscapes (Naiman et al. 1993), and their interactions with fluvial and geomorphic processes (Naiman & DéCamps 1997; Osterkamp & Hupp 2010). Changes in hydrologic processes as a result of dam operations can threaten riparian vegetation communities by altering moisture and sediment regimes (Poff et al. 1997) and impeding dispersal (Jansson et al. 2000). Because *Physostegia correllii* occurs along rivers that have multiple dams (i.e., Colorado River, Rio Grande), continued monitoring is necessary to conserve this rare species. In the present study, we observed that water levels in the Colorado River below Longhorn Dam vary widely throughout the day. More water is released from the dam at peak hours to meet hydropower needs, then the water level drops significantly in the evening as the demand for electricity decreases. The rapid changes in water levels and associated changes in soil moisture and sediment deposition may partially explain why we did not observe any populations near the Montopolis Bridge, where the species was known to occur in 1952. In contrast, still to slow-moving waters in Lady Bird Lake may somewhat benefit *P. correllii* by allowing deposition of fine sediments and organic debris after minor flood events. Lady Bird Lake is also a constant-level reservoir in which water levels fluctuate very little during operating times and average flows.

Noted threats to *Physostegia correllii* growing along Lady Bird Lake include stream bank erosion, competition from non-native species, and disturbances such as mowing, herbicide application, or construction in the riparian areas. *Physostegia correllii* would likely benefit from the control of *Colocasia esculenta* and other non-native species. Some non-native species are able to inhibit recruitment of associated natives by reducing the amount of light available to the soil surface (Maskell et al. 2006). *Colocasia esculenta* and *Arundo donax* grow in dense colonies and *P. correllii* seems sensitive to reduced light availability. Control of non-natives should be done with care, however, as *P. correllii* colonies do occur with colonies of non-natives (Figure 3). For example, three colonies located in 2014 were noted as extirpated due the removal of *Arundo donax*, general brush clearing, or mowing along the lake edges (Figure 4). Foot traffic along the stream edge can also have a negative impact on *P. correllii* when trampling compresses and hardens the substrate.

The ability for *Physostegia correllii* to reemerge after a period of disturbance or competition is unknown but possible if the rhizome mass stays viable and intact. Plants readily produce seed but no seedlings have been observed during our monitoring efforts. Viable fragments have been observed, including rooted stem fragments and broken rhizomes but it is not known which propagative method is most likely to produce the current colonies. Fragmentation is readily used as a colonization method in many aquatic and wetland plants, especially flood adapted species (Barrat-Segretain & Bornette 2000).

Although the Travis County populations of *Physostegia correllii* are located in a highly urbanized environment, restoration and/or protection of the riparian habitat is possible. Prevention of excessive mowing and trampling of the riverbank has been effective along urban streams in encouraging growth of native vegetation (Riley 2016). Though complete restoration of an urbanized and impounded riparian habitat to an unaltered state is not realistic (Wohl & Merritts 2007),

preservation of locations with extant *P. correllii* colonies is possible. Although *P. correllii* is occasionally planted along the Ann and Roy Butler Trail as part of beautification projects, further establishment into other sites along Lady Bird Lake and the implementation of an ecologically based conservation plan or refugium would be beneficial to this species.

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