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Nevada Native Plant Society

Primula cusickiana var *nevadensis* at the summit of Mt. Washington in Great Basin National Park.

Primrose Islands

Story and photographs by Austin Koontz

The *Primula cusickiana* species complex is a group of four primrose varieties: *cusickiana*, mainly in Idaho; *maguirei*, in the **Bear River Range** near Logan, Utah; *domensis*, in the **House Range** of Utah; and *nevadensis*, in the **Snake** and **Grant Ranges** of Nevada.

Taxonomically, each variety was originally classified as its own species, due to their distinct geographic distributions. A 2001 review by Noel Holmgren and Sylvia Kelso subsumed all four to being varieties of *Primula cusickiana* because of their almost identical morphologies, but there was no genetic data available to justify this shift. However, around that time, Paul was examining the population genetics of just the variety that grows right outside USU: *P. cusickiana* var. *maguirei*, or Maguire's primrose. And his research was generating some surprising findings.

Maguire's primrose grows exclusively in the corridor of Logan Canyon, with populations in both the lower and upper parts of the canyon. When Paul first studied var. *maguirei*, he found that the populations in the upper and lower part of the canyon were

This page: Variety *maguirei* growing in Logan Canyon.
Opposite page, left: Variety *cusickiana*, growing near Jarbidge, Nevada.
Opposite page, right: Overlooking the east fork of the Jarbidge River.

vastly different from one another genetically. It was almost as though the populations, although indistinguishable morphologically, were two entirely separate species, a phenomenon known as cryptic speciation.

I wanted to find out was how each var. *maguirei* population fit into the wider *P. cusickiana* complex. If either population was more closely related to a population outside of Logan Canyon than it was to its neighbor, that would imply that multiple varieties might be growing within the canyon, which would be especially important for conservation efforts. To answer that question, I had to collect material from var. *maguirei* individuals at both Logan Canyon populations, as well as from populations of all other varieties across the Great Basin, and then genetically sequence them to determine their relatedness.

Even though I was born the the Bay Area of California, I consider myself a native Nevadan. When I moved to Reno at age eleven I saw northern Nevada as a brown, seemingly lifeless desert. It wasn't until my undergraduate degree at the University of Nevada, Reno and I began to have more autonomy that my appreciation for the Great Basin began to grow. This partially occurred through the various trips I was able to make during those years to northern Nevada's gems: the Toiyabe and Toquima mountain ranges, the Black Rock Desert, Jarbidge, Lamoille Canyon and the Ruby Marshes, and the Snake Range in Great Basin National Park. I didn't realize it then, but my memories of these spots would help motivate my research years in the future.

I began my Master's degree at Utah State University (USU) in 2018, under the co-instruction of Dr. Paul Wolf and Dr. Will Pearse. It was Paul's research (which is focused on the systematics and genomics of ferns, but also examines the population genetics of species across the American West) which drew me to apply to USU and to focus on the *Primula cusickiana* species complex. By researching *Primula*, I've been able to harness my experience in genetics to research a threatened plant endemic to the Great Basin, a place I've come to love.

Using herbarium specimens available through the **Intermountain Regional Herbarium Network** (IRHN), I located populations of each variety and determined the blooming times of those groups. With this information and backed by funds that had been generously awarded to me by the Nevada Native Plant Society through the Magaret Wiliams Research Grant, I made my requests for collection permits and planned out my field season.

Primula cusickiana var. *cusickiana* is found at lower elevations compared to the other complex varieties, so my initial collections in April were in Idaho. On my very first trip,

I was put in contact with two extremely helpful sources: Dr. Barbara Ertter and Dr. Don Mansfield at the College of Idaho. In a crowded, noisy Basque bar in Boise on my first official night of fieldwork, I learned from Barbara that Don had found subtle but reliable morphological distinctions between the *P. cusckiana* populations in Idaho and those in southeast
Oregon. This news was both exciting and nerve-racking as I hadn't even begun collecting yet and my list of populations was already growing!

My trips to Idaho took me to several beautiful spots along the Snake River Plain, the most notable being **Craters of the Moon National Monument** (from where a New York Botanical Garden specimen from 1937 was sourced). There I looked for *P. cuscikiana* out on a ***kīpuka***: an island of undisturbed soil surrounded on all sides by a geologically younger lava flow. Clambering out to this site on the jagged ***ʻaʻā*** rock was hazardous (tearing several holes in my hiking boots) and yielded no primroses. Instead, they turned out to be in bloom at a spot right next to the highway that I drove in on, demonstrating to me that the inaccessible spots aren't always the promising ones!

Next, I made several trips to collect maguirei from its upper and lower Logan Canyon populations. These weren't without their hiccups. At one site, I got back down to the canyon floor via a carefully controlled slide down a scree pile.

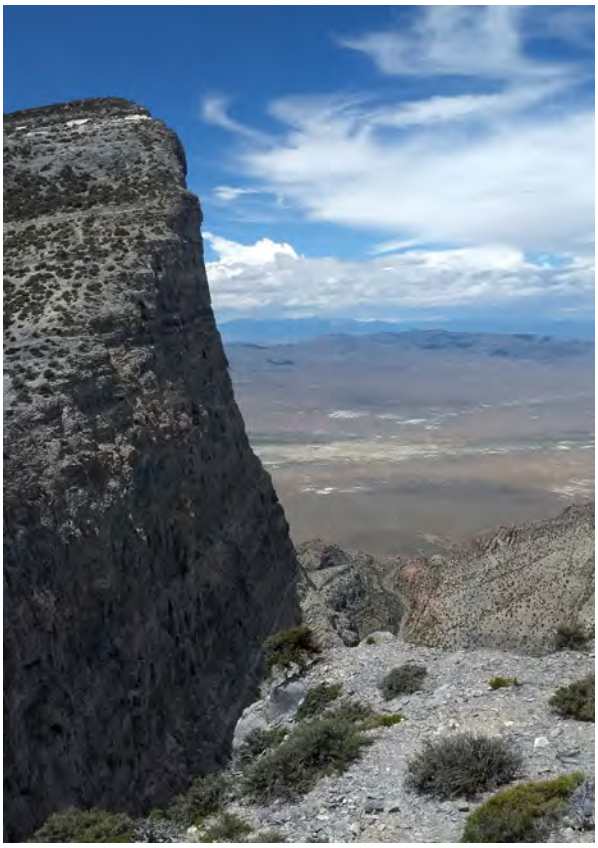
In late May, I made my trips to **Jarbidge**, Nevada, and the Owyhee High Desert Plain, in Oregon – two spots outside of Idaho where *P. cusickiana* had been found. My fieldwork in Jarbidge went without a hitch. Following the directions I had gotten from Jerry Tiehm at UNR (who I had met with earlier in the year), I found the *Primula* easily at a spot overlooking the east fork of the Jarbidge River. Afterwards, I got to spend some time in the town of Jarbidge and enjoyed a tasty adult beverage at the Red Dog Saloon.

Finding *P. cusickiana* on the Owyhee high desert plain proved more challenging. After unsuccessfully navigating washed out roads, a night in Winnemucca, and a hailstorm, I finally made it to the coordinates of a past collection spot of Don Mansfield, but saw no *Primula*. After receiving further guidance from Leila Shultz at USU, I returned to the site and realized that I had overlooked *Primula* in fruit.

After collecting from all of my *P. cusickiana* populations, I made a trip in early June to the House Range in central Utah to collect var. *domensis*, the most recently discovered variety in the complex (being first described in 1985). Along the beautiful hike I took to **Notch Peak** I found not only abundant *Primula*, but many other wildflowers.

In July, I set out on a collection trip through Nevada, making a loop starting in **Great Basin National Park**, traveling south to the Grant Range, and then heading back north to the Ruby Mountains

Collecting var. *nevadensis* in Great Basin National Park was difficult, but I ultimately

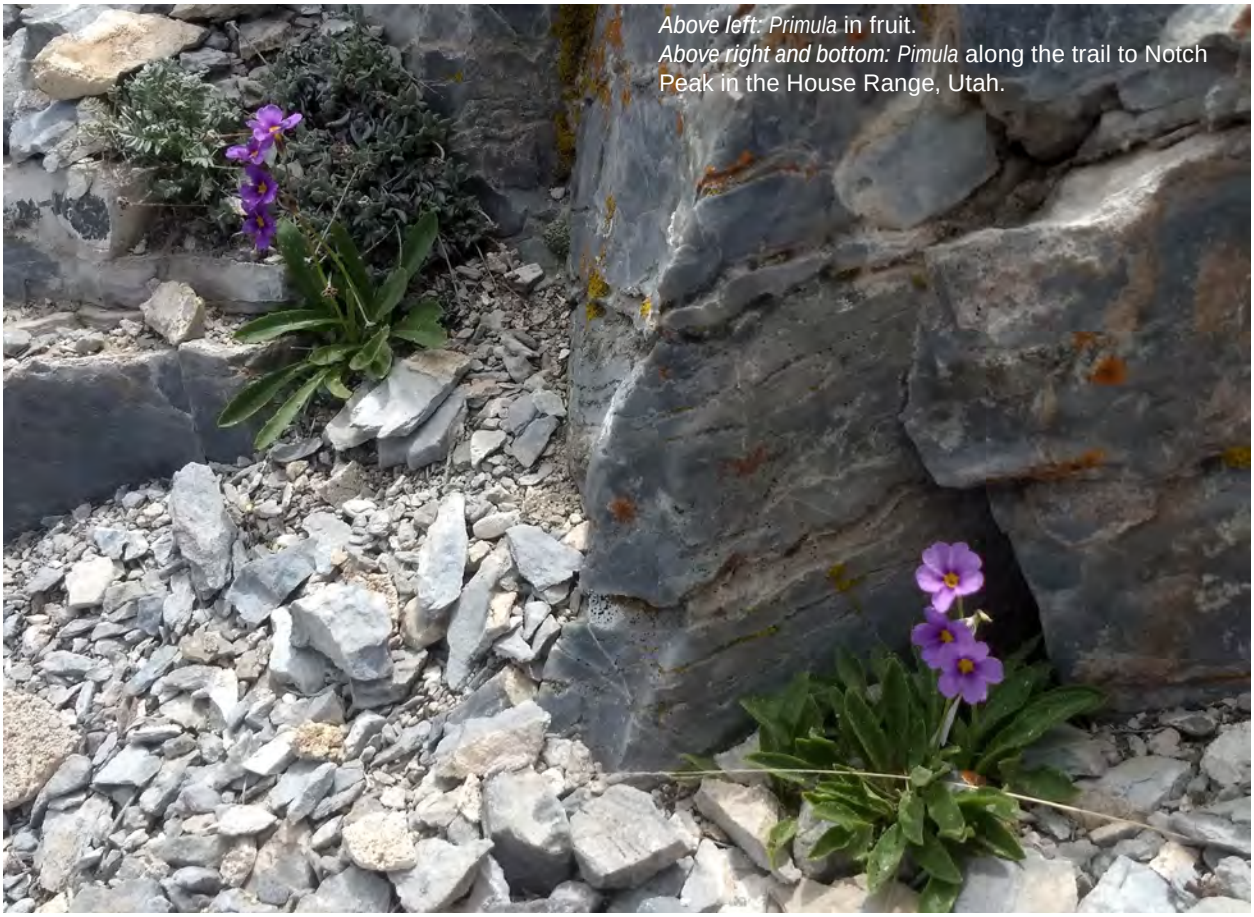


Above, left: Map of collection locations. *Above, right:* Notch Peak. *Below:* Caught in a hailstorm north of Owyhee.

found Primula bloom at the summit of **Mt. Washington**. I also managed to stop by Kerouac's in Baker and take a short backpacking trip in the park.

After Great Basin, I drove into Ely and then south to meet with Jeanne Sharp Howerton, her husband Charlie, and Noel and Pat Holmgren, who were also driving through Nevada at that time. Jeanne had just finished writing a history of the var. *nevadensis* population found in Troy Canyon of the Grant Range and had generously offered her ranch as a place to stay. We all met at Jeanne's ranch, where I spent the night before leaving the next morning to hike to Troy Peak. The trail up the peak was grueling, but I made it to the top to find a beautiful *Primula* population in peak bloom.

Once I'd collected all of the species complex varieties, my final task was to



Above left: Primula in fruit.
Above right and bottom: Pimula along the trail to Notch Peak in the House Range, Utah.

find the outgroup species I would use for genetic analysis. Past research had shown a close relationship between the species complex members and *Primula capillaris*, the Ruby Mountain primrose (described by Noel Holmgren).

My exploration in the **Rubies** began with a backpacking trip up **Lamoille Canyon** to Thomas Canyon where I looked for *P. capillaris* at the headwaters of Thomas Creek. At the coordinates where I expected to find *P. capillaris*, I instead found *Primula parryi* – a much larger and more abundant species found throughout the west. I searched again for *P. capillaris* on a subsequent trip out to the Rubies, but without luck. Given the nature of the plant as a rare endemic, I'm fearful that it has either gone extinct or been completely displaced by the *P. parryi* that I found growing in Thomas Canyon. If anyone ihappens to spot this rare species the next time they find themselves in the Ruby Mountains, I would be really grateful if they let me know!

Using a technique known as **restriction-site associated DNA sequencing**, or RADseq, we found that most populations were characterized by a pronounced isolation by distance. Genetically, varieties were massively distinct from one another, and even isolated populations within varieties came out as very unique. For instance, the Jarbidge and Owyhee populations of variety *cusickiana* were easily differentiated from the Idaho *cusickiana* populations. These findings provide an exciting starting point to further describe the genetics and biogeography of these two populations, and could potentially be used to justify classification of these populations as their own unique varieties or even species.

With regards to var. *maguirei*, I found that neither Logan Canyon population was more closely related to another population

Opposite: Thomas Canyon in the Ruby Mountains.
Above: P. parryi in bloom at the Thomas Cr. headwaters.

of another variety than it was to the neighboring population within the canyon. And in exception to the general trend of these results, var. *domensis* and var. *nevadensis* were shown to be closely related to one another, with *nevadensis* coming out as a hybrid of *domensis* populations to the east and *cusickiana* populations to the north. These results taken together demonstrate the strong vicariance of these populations and lays the groundwork for exciting future research into Nevada's islands of *Primula*!

Austin Koontz received a Nevada Native Plant Society Margaret Williams research grant in 2019 for his work on Primula. A detailed description of his findings is available on the Nevada Native Plant Society website at ***nvnps.org/sites/default/files/Primrose_Species_Genomic_Comparisons.pdf***

Society News

Southern & Northern Nevada Events

All meetings are currently canceled.
For all cancellations and postponements, NNPS will post updates on our website, **NVNPS.org** when we have more information.

On Saturday, October 24, 10 a.m.-12 p.m. PDT, the North American Native Plant Society (NANPS) will hold a ZOOM annual group meeting about native plants in your local region. Go to **nanps.org/events/agm-2020** for registration and more information.

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