Plant Niches of a Lithium Claim in Oregon and a Story of Ancestral Climate Adaptations by Nikki Hill

Table of Contents

Project Summary

In spring of 2023, Groundwork sponsored the Lithium Lands Fellowship, a month-long immersion field study to document the flora within Jindalee Resources of Australia's proposed McDermitt Lithium Project site, with a focus on culturally important plants (CIP). CIP are plants traditionally used for food and crafts by Indigenous people. The relative density of these plants in a landscape often point towards ancestral human kinship, as well as current use and significance for local tribes. The fellowship project was motivated by threats to the site from a large-scale, proposed lithium mine and the resulting necessity of ascertaining what is at risk within the potential sacrifice zone.

Groundwork is a 501(c)3 that provides educational programs and publications which present a lens on how environmental issues are tied to cultural perspectives and values. Groundwork aims to shift the foundations of the ways we understand ourselves and our place in the world, to work towards more just and sustainable shared futures.

Goals and Objectives: Plants, People & Data

The goal of the fellowship was to help provide baseline floristic data for the site and to inspire collaboration that supports further research and consideration of the living story of the place, all as part of a larger effort to support advocacy for the site protection by people in local communities and elsewhere. In short, to root observations in connection, by following the roots.

1. **Plants:** to understand the presence and patterns of plants and their niches.
2. **People:** to mentor young ecologists, and to make connections with local people and environmental advocates.
3. **Data:** to collect quantitative and qualitative data on plants and their niches in this remote, under documented region.

We set out with 5 objectives:

1. To **survey** all encountered plants within the proposed project boundaries.
2. To **map and describe** the patterns of CIP including species of the *Lomatium, Calochortus, Allium, Fritillaria, Lewisia, Perideridia,* and *Cymopterus* genera. Indicator species commonly associated with CIP, such as *Artemisia arbuscula, Phlox caespitosa, Townsendia scapigera* and *Viola beckwithii* would also be recorded.
3. To **identify and document** any potential rare plants encountered during the survey.
4. To **collect** voucher specimens for submission as a representative collection to a regional herbarium.
5. To **make data available** to tribal and conservation advocacy groups.

Scope and Demographics

The McDermitt Caldera is a closed basin that is possibly the oldest caldera formed by the Yellowstone hotspot. The caldera is a crater formed by volcanic eruptions 16.4 million years ago that contained alkaline magma rich in sodium, potassium and lithium. A lake persisted in the caldera for hundreds of thousands of years, which deposited lithium into clay bed soils before drying out. Spanning 28 miles long from Oregon into Nevada and 22 miles wide, the caldera is described as likely containing the world's largest lithium deposit, with most of the area staked out by various mining claims, of which Jindalee Resource's McDermitt Lithium Project is one. (See map in **Attachment 3**.)

The northern region of the McDermitt Caldera is bound by the rim of the Oregon Canyon Mountains to the North and the Trout Creek Mountains to the West. McDermitt Creek nurtures a verdant green riparian belt that straddles the Oregon Nevada border and provides critical Lahontan cutthroat trout (*Oncorhynchus clarkii henshawi)* rearing habitat. Within this mountainous rim is a large bowl-like sea of rolling sagebrush hills accentuated by three perennial creeks and various other seasonal spring fed drainages. This Northern Caldera is a land rich with headwaters that originate in wilderness study zones along the mountain uplands. It is considered essential habitat for Greater Sage-grouse (*Centrocercus urophasianus)* survival and serves as a connectivity corridor between populations.

Our project area was defined by Jindalee's proposed McDermitt Lithium Project (MLP). Located just below the northern rim of the McDermitt Caldera, the MLP is the largest proposed lithium project in the United States, encompassing 7,200 acres in this remote high desert sagebrush basin. Its stated mineral extraction potential exceeds that of Thacker Pass, a sacred site known as *Peehee mu'huh*, just over the border to the south, which is now in the early stages of full-scale mine development. Jindalee has already been conducting exploratory drilling, with around 70 drill sites and associated access spurs cleared of vegetation. A Bureau of Land Management environmental assessment concerning Jindalee's

plans for 267 new drill hole and sump sites, 30 new miles of roads and 100 acres of anticipated disturbance is set to be released in the spring of 2024.

I spearheaded and organized the 2023 Lithium Lands Fellowship in the field. The fellowship consisted of young adults in their twenties, three of whom were present at camp full time: Maeve Moynihan, Shiobhan Moynihan and Lauren Stazinski. A fourth, Logan Bates, joined us for a weekend and a fifth, Molly Willoughby, could not be physically present but assisted by providing plant checklists and assisting with collections in the field on a later visit, after the month-long project. All the fellows were individuals who have been involved in conservation work, either by volunteering and working in the field or focusing on academic studies.

Figure 1: Shiobhan Moynihan, Maeve Moynihan, Nikki Hill and Lauren Stazinski

This remote reach of the "sagebrush sea" has a long history of ancestral importance and connection to various Indigenous People of the region. The town of McDermitt, Nevada, is an unincorporated community that includes the Fort McDermitt Indian Reservation. Located on the Oregon/Nevada border, the community consists of around 513 people, 75% of whom are Northern Paiute and Shoshone.

Methodologies, Results and Impact

The field camp took place from April 4 to May 8, 2023, with additional visits by members of the fellowship in May and June. Fellowship participants met up in Winnemucca, Nevada. Travel was made

challenging by blizzard conditions during an extremely cold, wet and delayed spring transition. Once in McDermitt, just south of the Oregon border, we heard news that the sole access road into the site had been washed out due to all the precipitation. We had contacted the Oregon Department of Fish and Wildlife to conduct Sage-grouse lek surveys in the area in addition to our plant surveys, so we bided our time hiking on the other side of the mountains until the washout was repaired. We made it to our camp in the project area a week later and walked belt-transects as a group, recording plants and outlining plant niches.

Plants

Once on site, we realized the immensity of the proposed project area. We decided to downsize our primary survey focus within the Indicated Resource Zone (IRZ) as outlined in a Jindalee Resources stakeholder presentation found online. (See red zone in Location of McDermitt Resource image, **Attachment 3**). Mainly we walked transects on the rolling hills between and around Payne and Mine Creeks at the heart of the IRZ. Our walks also took us to the edges of the Jindalee claim, where the rolling sagebrush begins to climb into the uplands. Our transects were delineated by topography, where we walked a riparian area, a drainage, a hill slope, or a hilltop, as one section or track. For each new plant we observed, we recorded them in our plant list, took pictures and added a GPS point for a reference.

Figure 2: Disaster Peak (Kootsoo na'a) with IRZ in foreground and middle ground

We focused on the relative distribution and densities of our focus plants, mostly geophytes that are CIPs, tended and harvested for their starchy roots and tasty greens. These included: Biscuitroots (*Lomatium* and *Cymopterus* spp.), Bitterroot (*Lewisia redviva*), Wild Onions (*Allium* spp.), Yellow Bells (*Fritillaria pudica*), Mariposa Lilies (*Calochortus* spp.), Spring Beauty (*Claytonia umbellata*), and Yampa (*Perideridia* spp.). We spread out to walk transects and we marked GPS way points at the beginning and end of prominent patches and zones of our focus plants, using codes and symbols to describe some characteristics of their occurrence. We took notes of what type of niches they were found using simple observations such as location within local topography, aspect and relationship to other niches.

Figure 3: Biscuitroot (Cymopterus longipes)

Patches were areas with a relative density of focus plants within a well-defined outline of occurrence. Qualifying codes included “scattered” or “dense” within the patch area.

Zones were areas lacking a clear beginning and end but expressing a repeating pattern of focus plant occurrence in a particular niche. Qualifying codes for the type of zone included: Rock Flow Zones, Clay Flat Zones, Adobe Clay Zones, Talus Zones, Micro terrace Zones and Drainage Zones.

Additional descriptive codes included soil color and texture (soft, clay or rocky), and slope grade (gentle to steep and shallow to deep), especially for drainages.

To describe the distribution patterns of the various plant species, it seems most accurate to describe the different types of niches they are fond of. Mapping the mosaic of patterns was tricky, due to the blending occurrence of these niches within the rolling topography. What did become apparent was the repetition of these patterns within the seemingly uniform rolling sagebrush hills.

The **coarse anatomy** of the rolling hills is of gentle slopes rising from the flat, wide floodplains of the perennial creeks, with their deep soils and few rocks. Adobe clay zones alternate with fine soft soil zones on the slopes, seeming to occur primarily on the south and east sides of the steeper and taller hills.

On gentler slopes, **rock flow zones** appear as runs of either tan- to orange-colored, flat metamorphic rocks or dark volcanic surface rocks smaller than a cupped hand, the latter becoming more prominent on terraced shelves and along hilltops.

Clay flat zones are areas of smooth, exposed clay from seasonal water collection, rimmed by dark rocks and often linked together by rock flow zones. These flats are found on hilltops and slope terraces, observed mostly on west facing hill slopes.

The wide hilltops consist of the weaving of soft rock free deep soils and shallow lithosoils with small rocks and **dark rock flow zones**. Dark rocky zones become more prominent near hilltop to slope transitions and where drainage creases begin.

The smaller rolling mounds with subtle inclines have micro terraces with pebble sized rocks and cryptobiotic crusts. Above the steeper creek canyons and running down from the mountain rim are prominent talus zones, appearing like giant scratches on the landscape. Each of these areas define a niche where certain CIPs can reliably be found. Pictures of each niche referenced below can be found in **Attachment 2: Photos of Niche Anatomy Types**.

Figure 4: Rolling Hill Anatomy: SW Adobe exposures like wave crests in the sea.

Adobe Zones: Areas of deep light-colored clay soils with sparse surface rocks that can be deeply cracked from previous moisture. Found especially on south and east sides of larger rolling hills, larger drainages. These soils actually hold moisture fairly well in deeper clay layers, providing a niche for long taproot and bulb bearing species to survive hot and dry summer climates. These zones hold Longstalk and Ibapah Springparsely (*Cymopterus longipes* and *C. longipes* var *ibapensis*), Bruneau Mariposa Lily (*Calochortus bruneaunis*), and Yellow Fritillary (*Fritillaria pudica*) **[see Figures 7 and 8]**. Spineless Horsebrush (*Tetradymia canescens*) is a common shrub. Along the shadier east-facing adobe zones, Sand rice grass (*Eriocoma hymenoides*) appears along runoff crevasses, Giant Blazing Star (*Mentzelia laevicaulis*) makes an appearance, and patches of Utah Serviceberry (*Amelanchier utahensis*) occasionally present up above just below hilltops where adobe transitions into rocky footholds.

Clay Flat zones (CFZ): Pebble to fist sized rock zones with various cleared clay flat depressions that hold spring moisture. Twinleaf onion (*Allium anceps*) especially fond of the cleared clay spaces, while Bitterroots (*Lewisia rediviva*) are around rocky edges. Found on hill tops, gentle terraces, and shelf contours of gentle slopes **[see Figure 9]**.

Rock Flow Zones (RFZ): Areas with surface rocks arranged in a sinuous to linear run on a slope or flat area. Typically overlaying lithosols, which are thin, rocky soils.

Dark Volcanic Rock RFZ: This is the prominent niche for Bitterroot (*Lewisia rediviva*) and the associated patches of Twinleaf Onion (*Allium anceps*) at transitions that fade into clay flats. A pattern of these Bitterroot zones appears to occur more on the western hilltop to slope margins in addition to being common on hilltops. Porous volcanic type rock colors range from black to burnt red **[see Figure10]**.

Light Slate Rock RFZ: Found mostly on side slopes of rolling hills. Nevada onion (*Allium nevadense*), scattered Nevada Biscuitroot (*Lomatium nevadense*) and Bitterroot (*Lewisia rediviva*). Fine grained, flattish, angular metamorphic rock colors range from white to orange **[see Figure 11]**.

Rolling Hilltops: Low Sagebrush (*Artemisia arbuscula*, possibly var. *nova*) common in lithosol zones with Spiny Phlox (*Phlox hoodia*) in rocky runs between. Other regular appearances include sparse Hopsage (*Grayia spinosa*), scattered *Astragalus* species including Woollypod Milkvetch (*Astragalus purshii*), and Desert Prince's Plume (*Stanleya pinnata*). CIPs include Flat-leaf Onion (shelf terrace just below hilltops) **[see Figure 12]**, scattered Nevada Biscuitroot (*Lomatium nevadense*) in cracked fine soils between and nestled in sagebrush (*Artemisia spp.*), and Bitterroot (*Lewisia rediviva*) in rocky zones, especially near hilltop edge transition zones to slopes. Narrower hills often had adobe zones that reached up from the slopes, containing Humboldt Mountains Milkvetch (*Asclepias cryptoceras*) and the occasional Gooseberry Globemallow (*Sphaeralcea grossularifolia*).

Micro Terraces: Located on gentle sloping inclines especially near roads, seasonal runoff and drainage channels. Made up of small round stones in tan clay that create micro ridges, with sparse Low Sagebrush (*Artemisia arbuscula*), Hermit Milkvetch (*Astragalus eremiticus*), Nevada Onion (*Allium nevadense*) and a scattering of Bitterroot (*Lewisia rediviva*) and *Lomatium* species. They are commonly associated with clay flat zones where wider terraces intersect this zone **[see Figure 13]**.

Riparian: Narrowleaf willow (*Salix exigua*) and two other unidentified willows form dense, decadent thickets along much of Mine and Payne Creeks. Intermingling at the sagebrush edge is Wood's Rose (*Rosa woodsia*) in some places especially near a hard edge, such as the dirt roads near creek crossings. The deeper soft soils of the floodplain support stately Tall Sagebrush (*Artemisia tridentata)*, Yellow Rabbitbrush (*Chrysothamnus viscidiflorus*), Rubber Rabbitbrush (*Ericameria nauseosa*). Stepping out further from the shore *Allium nevadensis* is scattered in shallower pebble pockets, Upland Larkspur (*Delphinium nuttallianum*) speckles about with scattered Longleaf Phlox (*Phlox longifolia*). Along creeks under the dappled shade of sparser willow are Golden Currant (*Ribes aureum*) and vibrant white Meadow Stars (*Hesperochiron nanus*) that grow in patches along the banks. On collapsed, wide bars, Baltic Rush (*Juncus balticus*) appears with Oregon Checker-mallow (*Sidalcea oregana*). Slow, trapped pools contain smattering of Duckweed (*Lemna* spp.)

Seeps: Along the slopes of areas of the riparian zone, often in relation to a rocky ledge above, Sagebrush Buttercup (*Ranunculus glaberrimus*) is a familiar cohort with Yellow Prairie Violet (*Viola nuttalii*). Spring-held moisture seeps from the soil here, creating wet zones on otherwise dry hillsides.

Spring Fed Water channels: There are two springs near the North border of the Lithium claim, Rose Spring 1 and Rose Spring 2. The spring is impounded by a cattle tank, with the overflow supporting a verdant patch of grass and Musk Mustard (*Chorispora tenella*) along tank edges. This area lies just below the ascent up into the foothills of the caldera rim. The springs are separated by a tall, rounded hill of light-colored soft soils **[see Figure 14]**. We walked a small creek running down from Rose Spring 2 in a wide spreading shallow channel of patchy verdant green sedges including sage-colored Nebraska Sedge (*Carex nebrascensis*) and Baltic Rush (*Juncus balticus*). These spread out banks held Sagebrush Buttercup (*Ranunculus glaberrimus*) and mats of yellow Yellow Prairie Violets (*Viola nuttalii*) under the shade of Tall Sagebrush further down the waterways. Prairie Star Flowers (*Lithophragma parviflorum* and *L. glabrum*), American Brookline (*Veronica americana*) and scattered Golden Currant (*Ribes aureum*) shrubs appear. On the rockier hill transition from the floodplain, a few Broadsheath Desert Parsley (*Lomatium vaginatum*) were present. The western banks of the seasonal creek showed signs of being burned at some point, with mostly Rabbitbrush and grasses. *Allium acuminatum* were a prominent presence on the east bank. The flowing channel is gravelly, with *Perideridia bolanderii*

growing in the flowing water. No plants were found outside of the active water channel, but Yampa was quite dense in some areas and continuous throughout the whole channel reach.

Rose Spring 1, on the other side of the rounded hill, is encrusted in alkaline salts, with dense yampa growing right in the water with salt crusted leaves. Lots of Yellow Prairie Violets (*Viola nuttalii*) on banks with Bitterbrush (*Purshia tridentata*) appearing here on the western banks and found nowhere else during our survey. *Lomatium nevadense* and *Lomatium macrocarpum* formed sporadic yet dense patches along a flat, on benches directly above the channel. Between the two springs, clumps of *Allium acuminatum* run up the slopes between scattered *Lomatium nevadense* to a pebble studded hilltop.

Soft-Soiled Seasonal Water Drainages: Hooker's Balsamroot (*Balsamorhiza hookeri*) is fond of shallowly defined runoff channels that have some rocks in fine textured deep soils. These zones also contain heightened densities of Mariposa (*Calochortus* spp.).

Rocky Seasonal Water drainages: We walked an unnamed seasonal water tributary to Cherokee Creek that entered the Eastern boundary of the project area. It is a rocky bottomed drainage that contains large, petrified wood chunks with aggregates of hand sized to coarse gravel in the mix. Bolander's Yampa (*Perideridia bolanderi*) grows thickly in these coarse soils and along bigger boulder edges. In the channel where finer sediments collect and especially in the shadow of north facing rock walls, Hooker's Onion (*Allium acuminatum*) grows in lush bunches. Yampa (*Perideridia spp*.) grows consistently dense higher up in the drainage and peters out as it descends towards Cherokee Creek. For context as a niche indicator plant, Yampa requires a relatively moister niche in the arid desert, one that holds onto water a little longer than the surrounding landscape. Continuing up into deep talus pockets, Yampa is present all the way up to the canyon wall tops, well above the channel, where clay flat zones run between them **[see Figure 15]**.

Figure 5: Talus Zones showing moist niche ringed with blooming Yampah flowers (white rings around dark areas)

Angular Scree or Talus Formations: These prominent and fascinating round to long and linear formations are thought to be erosional or rockfall remnants that essentially act as rain or melt water collection sites. The geometry of the underlying slope is thought to influence a "rill" like flow under the

scree. They appear as giant long, linear scratch marks, ovals, and an assortment of other interesting shapes littered across the uplands. Very common on steeper hill slopes running from rocky topped highlands, but also found on gently rolling slopes in linear arrangements **[see Figure 16]**. These scree zones, and the moister bands of land surrounding them, are key niches for various food and medicine plants, such as Yampa (*Perideridia* spp.), Great Basin Spring beauty (*Claytonia umbellata*), Ball head Phacelia (*Hydrophyllum capitatum*), Hooker's Onion (*Allium acuminatum*), Narrowleaf Skullcap (*Scutellaria angustifolia*), and White Pasqueflower. (*Pulsatilla occidentalis*). The white rims around these formations in the picture above are dense Yampa in bloom last spring. These talus areas hold onto snow cover longer than the surrounding landscape. The layering of these larger rocks serves to capture moisture and provide shade, creating a unique desert micro niche for tender seedlings and sprouts. Beckwith's Violet (*Viola beckwithii*) is a charming indicator of more shallow talus zones containing *Lomatium nevadense*.

Between these formations, the plants grow lusher and appear a more verdant green than the surrounding topography **[see Figure 17]**. Here we found larger clumping grasses such as Great Basin Rye (*Leymus cinereus*), Ballhead Waterleaf (*Hydrophyllum capitatum*), Arrowleaf Balsamroot (*Balsamorhiza sagittata*) and Narrowleaf Skullcap (*Scutellaria angustifolia*) during our surveys. When I inquired about them at Thacker Pass a Paiute elder said that "people used to plant in there."

People

Our goal of making connections in the area included communicating about our project to people we met in McDermitt and inviting them out to our camp. Also, due to the vast openness of the topography, we could see the few vehicles that entered the bowl, and we made an effort to introduce ourselves and find out what brought others out here. The connections we made fostered awareness of the cultural traditions in the area and the caldera's importance as critical habitat for wildlife who depend on the ecosystem in an intact state.

While waiting for site access (due to the washout of the access road), we conducted Sage-grouse lek surveys. The three leks we visited were within clay flat zones containing short sage (*Artemisia arbuscula* and other low species*)* and Twinleaf Onion (*Allium anceps*), a CIP. The area is known as critical habitat for Greater Sage-grouse, so we added recording points for Sage-grouse scat within our study area, due to significance of their presence here.

By chance, we met Katie Fite, Director of Public Lands for Wildlands Defense, who is a well-known advocate for high desert ecosystems and their associated habitats. We met up with her multiple times, shared observations, and learned about the area and the projects that threaten it.

We were pleased to meet the tribal librarian, Martica Crutcher, who took an interest in our project and shared her enthusiasm for the plants. She introduced us to Thierry Veyrié, the tribal Language Program Director, who has been supporting the continuation of traditional wild food gathering by leading group outings of youth, elders and adults in the field. He came out to our camp, and we showed him where we were finding the CIP and what we had observed about their patterns. A week later, we brought roots and seeds to make a presentation on the plants and swap stories.

Later, Veyrié brought out a group of children, adults and an elder to dig roots with us in areas of abundance. We talked about how there is a reciprocal relationship between small scale human disturbance—the digging of these roots—and their continued abundance on the landscape. We examined the bulbs of Yellow Fritillary (*Fritillaria pundica)*, a squat shaped starchy corm with a detachable root bearing disc, that tastes like sticky rice. Commonly known as a type of "riceroot", I pointed out the tiny rice-like cormlets that grow whole new plants once separated from the main corm and left like seeds to propagate in the soil. We hope such experiences will benefit both plants and people by helping to keep alive a cultural tending heritage that has existed for thousands of years. These plants need their people, and the people their plants.

We also visited with Raphael Bell, a tribal elder I had met harvesting pine nuts in central Nevada years before. We met with him on a few occasions, sharing news of our project and learning Paiute words. We were honored to hear stories and receive language lessons on our visits to town, and to have our new friends visit us at camp. These experiences served to enrich our understanding of the stories of connection, and reconnection, to CIP in the area.

Figure 6: Fritillary pudica corm and ricelike cormlets left

Veyrié connected us with Erick Robinson, an archaeologist he believed might be interested in our project. I ended up meeting with Erick twice, June 18-24 and July 7-10, to follow the CIP densities we had observed during the fellowship, and to point out a few obsidian point locations we had recorded. As we looked for "lithic diagnostics"—which are stone tool bases whose unique shape have been established to a certain time period—we traded stories of tracking plants and shards of obsidian or chert. Lithic diagnostics can be used to piece together a history of previous habitation and lifeways of a place and support existing hypotheses. I took him to visit three drainages where Yampa (*Perideridia bolanderi*) grew: one a dry yet deep and rocky channel on the Eastern project boundary, where Yampa was thick in the channel but also found in the deep talus terraces above the steep channel walls; and the other two intermittent streams that bubbled up from the

“Rose 1” and “Rose 2” springs within the project boundary. The first drainage presented a puzzle of determining if a human fingerprint existed in the presence of Yampa on the upper talus terraces. Rocks erode, but Erick expressed some question about their arrangement. The second two spring streams were separated by a rolling hill, and it was here that we found six lithic diagnostics pointing towards long-term human habitation going back 8,000 years.

This span of time demonstrated by the lithic diagnostics we found point towards a period of historic climactic changes and subsequent adaptation of lifeways within the Great Basin. The Great Basin once had a cooler and wetter climate during the last glacial period. During the Archaic period (around 10,000-3,000 years ago), the climate began to shift, becoming hotter and drier. Humans had been living close to the big lakes of the basin. During the middle archaic, (in the realm of 8,500-5,000 years ago), various studies depict signs of people adapting to this climate change by becoming more nomadic and spending more time in the uplands above the desiccating basins. This is referred to as the “Desert Culture” which is highlighted by the transition to greater mobility across the landscape to follow seasonal foods in a wide variety of niches. By following the persisting niche holdouts of some of these plants, we came across a potential upland village site, and a story of migration and adaptation to climate change that has already been told before.

Another walk took us up on the higher foothills just below the caldera’s upland rim where the Oregon Canyon and Trout Creek mountains meet. I took Erick to see the extensive rock flow areas and long straight talus zones that run down the expansive gentle slopes. Here is where some of the rock flows mixed with circular talus patterns, and where Spring Beauty (*Claytonia umbellata*) lives. In the center of this zone, there is a short stack of rocks. Down the valley from here, where the talus runs in long linear lines towards a soft soiled drainage, is another similar rock stack. Walking to both and viewing the other, we notice how they line up pointing east. Erick mentions how some of these stacks may have been hunting blinds, and we mused on how they also would have offered a compass between plant niches from across the vast sagebrush sea.

On the edges of the hills here, near clay flat zones containing Nevada Onions (*Allium nevadense),* Ball head Phacelia (*Hydrophyllum capitatum*) appears scattered in the shade made by Saskatoon (*Amelanchier utahensis*). *H. capitatum* is a floral-flavored green with succulent rhizomes that have been horticulturally tended in areas of the West for food. Nearby the Great Basin Spring Beauty (*Claytonia umbellata*) grow in curiously aligned talus flow zones, with a few starchy biscuitroots in the surrounding rocky soils: Broadshealth Desert Parsley (*Lomatium vaginatum*), Bigseed Biscuitroot (*Lomatium macrocarpum*) and Nevada Biscuitroot (*Lomatium nevadense*). Sitting in this place, with a breathtakingly full view of the Caldera bowl, I could feel the comfort and wisdom of this spot, surrounded by food and medicines.

This outings with Erick were about pairing botany with archaeology to track the persistence of culturally important plant niches and thereby reveal the signs of previous climate change migrations, lifeway adaptations and the utilization of upland plant niches. These fingerprints of living archaeology and human relationship show a persistence of relationship through changing use.

Data

During our belt-transect surveys, we recorded 527 total waypoints into our GPS unit. These included new plants, specimen collections, non-plant points of interest (such as Sage-grouse scat, lithic tool shards and mineral survey poles), and rough boundaries of plant niches, zones, and patches of CIP. This data will be used to generate maps of the CIP we observed, which will be offered to various tribal members and advocates in McDermitt.

We recorded each survey walk as a track, resulting in a total of 69 tracks over the course of our initial five-week study and three short visits later in the season. We collected 42 plant specimens, most of which were collected by my students, Maeve and Molly, on a later visit in late May when many more plants were in bloom. We are still pondering the best place to submit our collection, and have some communications, notes organization and decisions to make. One possibility is to help start a collection at the McDermitt tribal library, which is a potential way to contribute to the local community.

Spring was slow to unfurl during our initial five-week field study from April 4-May 8. Many deciduous shrubs were still in budding mode, and many herbaceous plants were only showing only their first true leaves. The Biscuitroots and Fritillaries came into bloom a week or so into our stay, and many of our other focus plants, (Wild Onions, Bitterroots and Mariposa Lilies), were first observed by their leaves alone. It was an interesting challenge to do some beginning botany lessons for sure! We documented all the species we were sure of and took pictures and notes of others with as much info as we could. By the time our field stay ended, herbaceous plants had flower buds and we were able to catch some plants in flower.

Our subsequent visits were relatively brief, done independently and did not involve walking transects. I communicated with the fellows about checking in on some patches of plants we had seen to attempt final identification and we took as many photos as possible of plants in their blooming and seeding stages. To help solidify our list, we communicated and sought corroboration with others who had been out there looking at plants and solicited confirmations on iNaturalist. Our complete observations to are uploaded and listed under our project page on iNaturalist, under the project title “First Foods Survey of McDermitt Lithium Site”. There are still some plant identifications to sort out, such as the various Biscuitroots of the area, that may be added to the plant list in time. The project page is set up to also include other people’s observations within the defined area, to aid in generating plant checklists for further research and advocacy. This was done due to the lack of overall documentation for the area and due to a timing imperative of documentation before further drilling and disturbance from the McDermitt Lithium Project exploration.

Link to project: First Food Surveys of McDermitt Lithium Site · iNaturalist
https://www.inaturalist.org/projects/first-food-surveys-of-mcdermitt-lithium-site

There is still much to do in the way of floristically documenting this area, but we were able to confidently compile a list of 128 plants **[see Attachment 1]**. Paiute names for some plants are included, which were shared during in-person communication and sourced from the Northern Paiute Language Project website: Northern Paiute Language Project https://paiute.ucsc.edu/dictionary.php

I do not recommend relying on this list as representing anything like a complete picture, but it’s a good start. There might be specific varieties of some plants listed that we were unable to decipher further due to the seasonality of our visit and limited time later. With further research and communication, I have been making lists of particular species and varieties to look for in future visits, and I have also been inviting other botanists to check out this area.

Financial details

Total expenses for the project came to $6206.81. This included gear, food, water, lodging and entire fuel costs for one vehicle. Due to lack of funds raised, the group agreed to cover their own fuel costs to travel to the site, except for my personal vehicle, which was the 4wd vehicle used for group travel at the site. We were able to raise $3848 in project funds from personal donations and two online fundraisers (set up by Groundwork and the Groundshots Podcast), plus the first grant installment of $750 awarded by the Native Plant Society of Oregon (NPSO). I personally covered the remaining costs of $2358.81

out of pocket to support supply needs in the field. The NPSO will issue the second $750 grant installment after receiving this report.

Conclusion

The extremely late spring during our project meant that we did not have the opportunity to observe and record many of the plants, because they had simply not emerged or flowered yet. Because of this, we understand that our floristic survey is not nearly complete, even for the topography we were able to survey. In the future, planning and finding resources for multiple field trips to the site throughout the entire growing season would be helpful to catch more of the plants present.

Sinking into the area by spending an extended time out there worked well for getting a read on the overall patterns of plants on the landscape. We were able to share this plant-tracking pattern with others who visited, including a visiting archaeologist and the cultural program participants from the McDermitt reservation tribal group. Outlining the niches for CIP and their orientation on the site landscape seems highly valuable for relating patterns to other people and groups. The niche descriptions can also serve as a narrative of persistent kinship with the land, offering a written map for continued traditional gathering and tending practices in this area.

Tracking these patterns has proven useful for finding sites of interest in the realm of archaeology and cultural heritage. Our study was able to illustrate a rich diversity of plant niches that hold CIPs and likely evidence supporting long-term human habitation. For advocacy purposes, we hope that our findings highlight the need for in-depth inquiry into possible justification for historic and cultural preservation.

This project was intended as an introductory survey of the site and an opportunity to spend time here. Our findings show that there is the need to further understand the significance of this place, which would entail listening to what local tribal communities have to say and centering their inclusion in future site assessments and decisions.

Surveying the plant niches with a human cultural lens has so many layers of potential for understanding. It has been a deeply nourishing endeavor for me the past ten years. I am very curious to see how the stories as told by plants in the rock talus scree of this area relate to other regions and their history of human relationship. For example, in Nez Perce territory of far northeast Oregon, I was shown intentional landscape modification that enhanced the moderating influence of rock layering to capture water in order to create sites for planting and reliable generational harvesting. These modifications resemble rock flow areas described previously, but where surface rocks appear more cleanly puzzled together in runs. It is not dissimilar to the documented use of lithic mulch on hill terraces in the southwest of northern New Mexico, where a solid boundary of rocks lined up around a shallow pit of layered rocks slows and spreads seasonal precipitation for reliable sustenance-providing grounds. That is, the elements of plant niches for arid desert survival translate across ecoregions: rocks, directional aspect and intermittent water availability. It is the carefully curated lithic arrangement and use of these elements, in relation to the varied topographies and seasonal patterns of human habitation (from settled to nomadic), that result in unique anthropogenic characteristics in different regions. My hypothesis is that these talus zones, so prominent from far southeastern Oregon down into the Reno area and across northern Nevada, are not only the result of natural erosion processes, but that the influence of human niche use and expansion can be tracked here as well.

The importance of this inquiry is in understanding how to ensure the continued survival of these plant species—including where rare, relict species might be holding out—and in recognizing the importance of traditional Indigenous interactions that have been fundamental in the creation these ecologies. There is also a poetic suggestion, illuminated from various exchanges and observations during this fellowship, that the desert has stories to tell us about adapting to climate changes.

Recommendations

The site is extremely large. To properly survey the entire proposed Jindalee McDermitt Lithium Project claim would require additional years of surveying with sufficient support to accurately record the diversity of plant species and to properly conduct archaeological surveys, and the remnant plant populations that identify them. In lieu of being granted that time and resources, I recommend bringing attention to this area by inviting others to consider survey and advocacy projects here.

A future project I would really enjoy would be to help facilitate a camp out with the tribal cultural group and other youth and elders from McDermitt. A major focus of ours was the thread of human connection with plants, which links together so many aspects of how we make decisions about use of the land. We had such an amazing time with the group and recognized that there are some logistical challenges for some community members to access such experiences.

Acknowledgments

I would like to give my deepest heartfelt thanks to the various people who enriched the experience of this endeavor and offered financial support.

- The Native Plant Society of Oregon: for the much needed and appreciated grant, and for supporting floral inquiry of the more remote and unknown places.
- GoFundMe campaign donors: for your financial support and interest in this type of endeavor It is greatly appreciated and motivating.
- Kelly Moody of Groundshots Podcast: for bringing me an audience and support to get us on our way.
- Jeff Wagner of Groundwork: for supporting and holding space for such interesting immersion programs.
- Nancy Gadkey: for your generous spirit in supporting this project at the very beginning. It was a huge vote of confidence.
- Raphael Bell: for your language lessons and stories. What a life you have lived!
- Martica Crutcher: for your welcoming kindness and enthusiasm when we came to town, and for inviting us to share plant kinship.
- Thierry Vieyrié: for being a cultural plant ally, taking the time to see what we were looking at out there and for facilitating our group field walk. This was a highlight of our trip.
- Erick Robinson: for your wealth of curiosity and professional inquiry into human lifeways, easy spirit of sharing lithic tracking stories and lively discussions at camp.
- Mark Darrach and Michelle Cloud-Hughes for taking the time to offer me direction when planning the project and for providing pointers for conducting the survey.
- Katie Fite: for being a wealth of information on the happenings in the caldera, unrelenting advocacy for protection, swapping plant info and for a lovely spring bloom walk.
- Kollibri terre Sonnenblume: for always being there to help with my digital frustrations, being my editing helper extraordinaire, and for all the support in all the ways when I needed it most.

Attachment 1: List of Plants

Species Name	Common Name	Family	Paiute Name	CIP
Achillea millefolium	Common Yarrow	Asteraceae		X
Agoseris parviflora	Intermountain Dandelion	Asteraceae		
Agropyron cristatum	Crested Wheatgrass	Poaceae		
Allium acuminatum	Hooker's Onion	Amaryllidaceae	*Seta* or *See*	X
Allium anceps	Twinleaf Onion	Amaryllidaceae	*Paduse*	X
Allium nevadense	Nevada Onion	Amaryllidaceae	*Uudzee*	X
Amelanchier utahensis	Utah Serviceberry	Rosaceae		X
Amsinckia tessellata	Bristly Fiddleneck	Boraginaceae		
Antennaria dimorpha	Low Pussytoes	Asteraceae		
Artemisia arbuscula	Low Sagebrush	Asteraceae	*Sawabe*	X
Artemisia arbuscula var. nova		Asteraceae		
Artemisia spinescens	Bud Sagebrush	Asteraceae		
Artemisia tridentata	Big Sagebrush	Asteraceae	*Paba'yoo sawabe*	X
Asclepias cryptoceras	Humboldt Mountains Milkweed	Apocynaceae		
Astragalus beckwithii	Beckwith's Milkvetch	Fabaceae		
Astragalus calycousus	Torrey's Milkvetch	Fabaceae		
Astragalus eremiticus	Hermit Milkvetch	Fabaceae		
Astragalus filipes	Basalt Milkvetch/Narrowpod Locoweed	Fabaceae		
Astragalus iodanthus	Humboldt River Milkvetch	Fabaceae		
Astragalus malacus	Shaggy Milkvetch	Fabaceae		
Astragalus newberryi	Newberry's Milkvetch	Fabaceae		
Astragalus obscurus	Arcane Milkvetch	Fabaceae		
Astragalus purshii	Woollypod Milkvetch	Fabaceae		
Atriplex confertifolia	Shadscale Saltbush	Amaranthaceae		
Balsamorhiza hookeri	Hooker's Balsamroot	Asteraceae	*Todza'a*	X
Balsamorhiza sagittata	Arrowleaf Balsamroot	Asteraceae	*Todza'a*	X
Blepharipappus scaber	Rough Eyelashweed	Asteraceae		
Boechera ssp.	Rockcress	Brassicaceae		
Calochortus bruneaunis	Bruneau Mariposa Lily	Liliaceae		X
Carex nebrascensis	Nebraska Sedge	Cyperaceae		
Castilleja chromosa	Desert Paintbrush	Orobancaceae	*Tutayganna*	X
Castilleja pallescens var. *inverta*	Pallid Indian-Paintbrush	Orobancaceae		
Ceratocephala testiculata	Curveseed Butterwort	Ranunculaceae		
Cercocarpus ledifolius	Curlleaf Mountain Mahogany	Roseaceae		
Chaenactis douglasii	Hoary Pincushion	Asteraceae		
Chorispora tenella	Crossflower/Musk Mustard	Brassicaceae		
Chrysothamnus viscidiflorus	Yellow Rabbitbrush	Asteraceae		
Claytonia umbellata	Great Basin Springbeauty	Portulaceae		X

Species Name	Common Name	Family	Paiute Name	CIP
Collinsia parviflora	Small flowered Blue-eyed Mary	Plantaginaceae		
Cordylanthus ramosus	Bushy Bird's Beak	Orobanchaceae		
Crepis occidentalis	Western Hawksbeard	Asteraceae		
Cryptantha pterocarya	Wingnut Cryptantha	Boraginaceae		
Cusickiella douglasii	Alkali Cusickiella	Brassicaceae		
Cymopterus foeniculaceum	Carrotleaf Desert-Parsley	Apiaceae		X
Cymopterus foeniculaceum var. *macdougalii*	Macdougal's Lomatium	Apiaceae		X
Cymopterus longipes	Longstalk Springparsley	Apiaceae		X
Cymopterus longipes var. *ibapensis*	Ibapah Springparsley	Apiaceae		X
Cymopterus terebinthinus	Northern Indian Parsnip	Apiaceae		X
Delphinium andersonii	Anderson's Larkspur	Ranunculaceae		
Delphinium nuttallianum	Upland Larkspur	Ranunculaceae		
Diplacus nanus	Dwarf Purple Monkeyflower	Phrymaceae		
Eremogone kingii	King's Sandwort	Caryophyllaceae		
Eremothera boothii	Booth's Evening Primrose	Onagraceae		
Eriastrum signatum	Maroon-spotted Woollystar	Asteraceae		
Ericameria nauseosa	Rubber Rabbitbrush	Asteraceae	*Segoope*	
Erigeron bloomeri var. *bloomeri*	Bloomer's Fleabane	Asteraceae		
Erigeron compositus	Cut-leaf Fleabane	Asteraceae		
Erigeron linearis	Desert Yellow Fleabane	Asteraceae		
Eriocoma hymenoides	Sand Ricegrass	Poaceae		X
Eriogonum caespitosum	Matted Wild Buckwheat	Polygonaceae		
Eriogonum ovalifolium	Cushion Bickwheat	Polygonaceae		
Eriogonum sphaerocephalum	Rock Buckwheat	Polygonaceae		
Eriogonum umbellatum	Sulfur Buckwheat	Polygonaceae		
Eriophyllum lanatum	Common Woolly Sunflower	Asteraceae		
Erodium cicutarium	Redstem Stork's-Bill	Geraniaceae		
Fritillaria pudica	Yellow Fritillary	Liliaceae		X
Grayia spinosa	Hopsage	Amaranthaceae		
Hesperochiron nanus	Meadow Stars	Hydrophyllaceae		
Hydrophyllum capitatum	Ballhead Waterleaf	Boraginaceae		
Ionactis alpina	Lava Aster	Asteraceae		
Iris missouriensis	Western Blue Flag Iris	Iridaceae		
Juncus balticus	Baltic Rush	Juncaceae		
Krascheninnikovia lanata	Winterfat	Amaranthaceae		
Layia glandulosa	Whitedaisy Tidytips	Asteraceae		
Lemna ssp.	Duckweed Species	Lemnoideae		
Lepidium perfoliatum	Clasping Pepperweed	Brassicaceae		
Lewisia rediviva	Bitterroot	Montiaceae	*Kaneddu*	X
Leymus cinereus	Great Basin Wild Rye	Poacaea	*Way*	X
Linanthus pungens	Granite Prickly Phlox	Polemoniaceae		

Species Name	Common Name	Family	Paiute Name	CIP
Lithophragma glabrum	Bulbous Woodland Star	Saxifragaceae		
Lithophragma parviflorum	Smallflower Woodland Star	Saxifragaceae		
Lithospermum ruderale	Western Stoneseed	Boraginaceae		
Lomatium macrocarpum	Bigseed Biscuitroot	Apiaceae	*Tuzga*	X
Lomatium nevadense	Neavad Biscuitroot	Apiaceae	*Tuzga*	X
Lomatium vaginatum	Broadsheath Desert Parsley	Apiaceae		X
Lupinus brevicaulis	Shortstem Lupine	Fabaceae		
Lupinus uncialis	Liliput Lupine	Fabaceae		
Mentzelia laevicaulis	Giant Blazingstar	Loasaceae		
Mentzelia spp.	Blazingstarts	Loasaceae		
Microsteris gracilis	Slender Phlox	Polemoniaceae		
Nicotiana attenuata	Coyote Tobacco	Solanaceae	*Pooe bbahmoo*	X
Nothocalais troximoides	Sagebrush False-Dandelion	Asteraceae		
Oenothera cespitosa	Fragrant Evening Primrose	Onagraceae		
Oreocarya glomerata	Cockscomb Oreocarya	Boraginaceae		
Penstemon roezlii	Roezl's Penstemon	Plantaginaceae		
Penstemon spp.	Penstemon species, white flowered	Plantaginaceae		
Perideridia bolanderi	Bolander's Yampah	Apiaceae		X
Perideridia spp.	Likely P. gardineri	Apiaceae		X
Phlox hoodii	Spiny Phlox	Polemoniaceae		
Phlox longifolia	Longleaf Phlox	Polemoniaceae		
Phlox stansburyi	Cold Desert Phlox	Polemoniaceae		
Phoenicaulis cheiranthoides	Daggerpod	Brassicaceae		X
Physaria spp.	Bladderpods	Brassicaceae		
Plectritis macrocera	Longhorn Seablush	Caprifoliaceae		
Poa secunda	Pine Bluegrass	Poaceae		
Primula conjugens	Bonneville Shooting Star	Primulaceae		
Purshia tridentata	Bitterbrush	Roseaceae	*Hunube*	X
Ranunculus andersonii	Anderson's Buttercup	Ranunculaceae		
Ranunculus glaberrimus	Sagebrush Buttercup	Ranunculaceae		
Ribes aureum	Golden Currant	Grossulariaceae	*Mababooe*	X
Rosa woodsii	Wood's Rose	Rosaceae	*Tseabe or aa'a sawabe*	X
Rumex spp.	Dock	Polygonaceae		
Salix exigua	Narrowleaf Willow	Salicaceae	*Suube*	X
Sarcobatus vermiculatus	Greasewood	Sarcobataceae		
Scutellaria angustifolia	Narrow Leaf Skullcap	Lamiaceae		
Scutellaria nana	Dwarf Skullcap	Lamiaceae		
Senecioneae	Groundsels and allies	Asteraceae		
Sidalcea oregana	Oregon Checker-mallow	Malvaceae		
Sphaeralcea grossularifolia	Gooseberry Globemallow	Malvaceae		
Stanleya pinnata	Desert Prince's Plume	Brassicaceae		X

Species Name	Common Name	Family	Paiute Name	CIP
Tetradymia canescens	Spineless Horsebrush	Asteraceae		
Tetradymia spinosa	Shortspine Horsebush	Asteraceae		
Townsendia scapigera	Nevada Grounddaisy	Asteraceae		
Toxicoscordion paniculatum	Foothill Deathcamas	Melanthiaceae		
Tragopogon porrifolius	Purple Salsify	Asteraceae		
Veronica americana	American Brookline	Plantaginaceae		
Viola beckwithii	Beckwith's Violet	Violaceae		
Viola nuttalii	Nuttall's Violet	Violaceae		X

Attachment 2: Photos of Niche Anatomy Types

Figure 8: Adobe Zone with Fritillary pudica

Figure 9: Clay Flat Zones with Allium anceps

Figure 10: Dark Rock Flow Zone with Lewisia rediviva

Figure 11: Orange slate rock flow zone with Allium nevadense

Figure 12: Rocky terrace niche on gentle slopes with Lewisia rediviva and Allium anceps

Figure 13: Astragalus eremiticus and Phlox hoodii on gentle microterrace slopes

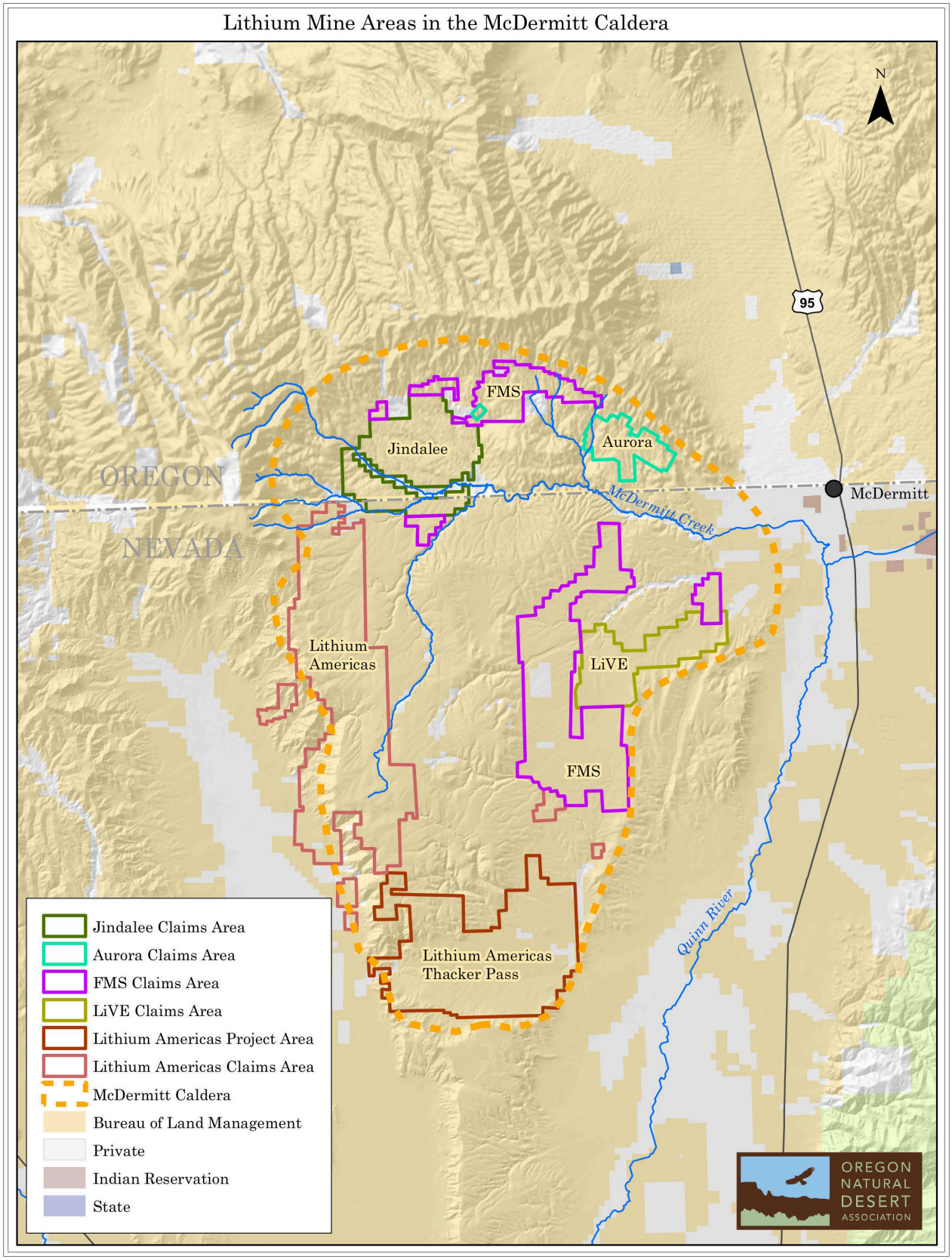
Figure 16: Rose Spring 2 zone with Perideridia bolanderi in water channels. Rose Spring 1 on other side of low hill in back right

Figure 17: Perideridia spp. emerging in Talus Zones above dry drainage

Figure 18: Perideridia bolanderi in talus niche with McDermitt Creek below

Figure 19: Talus niche influences spreading water

Attachment 3: Maps



Location of McDermitt Resource, Exploration Target Areas, Drilling and New Claims

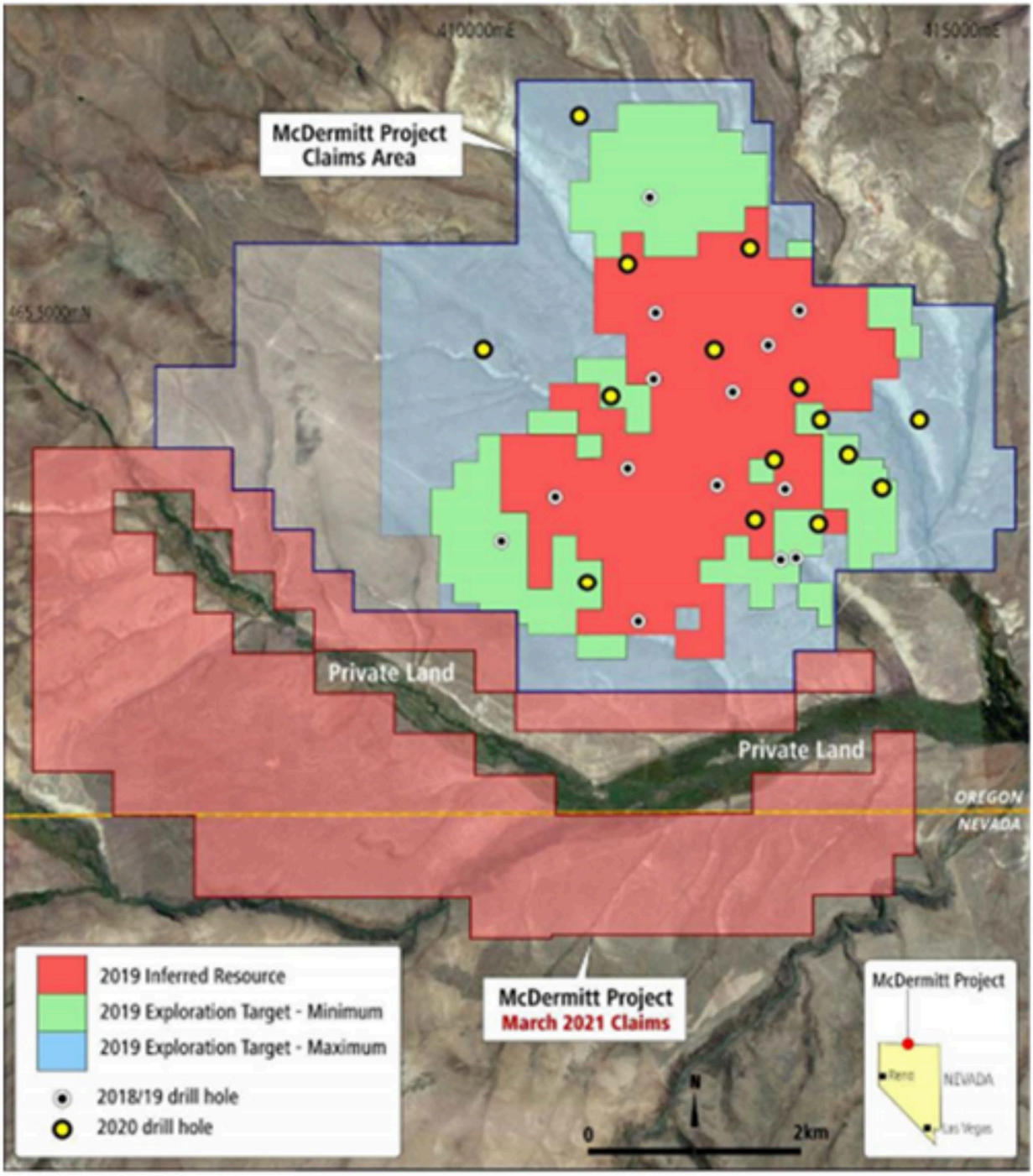


Image Source: Company Announcement (31 March 2021)