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A VASCULAR FLORA OF THE SOUTH FORK TULE RIVER, SOUTHERN SIERRA NEVADA, TULARE COUNTY, CALIFORNIA

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ABSTRACT

I conducted a floristic study of the South Fork Tule River watershed, located in the southern Sierra Nevada in Tulare County, California. The primary objectives of this floristic study were to document and catalogue all vascular plant taxa that occur in the watershed, describe the plant communities, analyze the flora and its affinities with other areas, and establish a herbarium for the Tule River Indian Reservation. The upper reaches of the South Fork Tule River originate on the western slope of Slate Mountain in the Sequoia National Forest and drain west through the Tule River Indian Reservation into the Lake Success reservoir. The highest elevation in the watershed is Slate Mountain Peak at 2790 m and the lowest is at Lake Success reservoir, at 162 m. Prior to my study there were only 176 plant collections from the watershed, representing 159 taxa. I spent a total of 64 days over three field seasons (2013–2015) in the study area and made 1356 collections, bringing the total number of minimum-rank taxa to 562, representing 271 genera and 80 plant families. Seven rare taxa were documented during the course of my study, including the federally endangered Clarkia springvillensis. I documented and described 12 plant communities, including giant sequoia (Sequoiadendron giganteum) forests. Several species find their southern extent in the watershed, including the paleoendemic Torreya californica, which occurs on the Tule River Indian Reservation. Floristic affinities analyses revealed that locally, the South Fork of the Tule River does not have many species in common with the North or Middle forks, but this could be a result of collector bias. Statewide, the South Fork has its greatest affinities with the Sierra Nevada Foothills and the Sierra Nevada High eco-geographic subdivisions of California and the least affinity with the desert regions. Poorly documented plant diversity on tribal trust lands speaks to the need for more collaboration with tribal communities, and this flora is a contribution to that effort.

Key words: floristics, plant collections, rare plants, tribal trust lands.

INTRODUCTION

The Sierra Nevada mountain range is part of the California Floristic Province, which is characterized by great plant diversity (Raven and Axelrod 1978; Shevock 1996). The southern part of the range is known for its plant endemism as well as rare species (Shevock 1996). While the southern Sierra Nevada is biologically diverse, it is relatively understudied and represents a botanical “black hole” (CCH 2016). Continued progress in the study of the California flora will depend on floristic inventories and systematic sampling of poorly known geographic areas (Wilken 1995). To contribute to this effort, I conducted a floristic study of the South Fork Tule River watershed located within the southern Sierra Nevada in Tulare County, California (Fig. 1). The purposes of this study were to: 1) document and catalogue all the vascular plant taxa that occur in the watershed, 2) describe the plant communities, 3) analyze the flora and its affinities with other areas, and 4) establish a herbarium for the Tule River Indian Reservation.

The South Fork Tule River watershed is located ca. 20 miles east of Porterville, off Hwy 190 (Fig. 1). The South Fork originates on the western slope of Slate Mountain in the Giant Sequoia National Monument and drains west through the Tule River Indian Reservation into the Lake Success reservoir (Fig. 1–2). The watershed encompasses 76,372 acres (30,549 ha). By far the largest portion of the watershed (55,356 acres [22,142 ha]; 72%) is occupied by the Tule River Indian Reservation, while the two remaining, smaller portions (each 14%) fall within the Giant Sequoia National Monument (Sequoiadendron giganteum) groves (Fig. 2). Some land immediately west of the Tule River Indian Reservation boundary is also managed by the Tule River Tribe and was included in the study. Other private land west of the reservation boundary was not included (Fig. 1).

Established in 1873, Tule River Indian Reservation is one of the largest reservations in California (Frank and Goldberg 2010). The Tule River Tribe is the federally recognized tribe that manages the reservation. The Tule River Tribe is composed of several closely related but politically distinct Southern Valley and Foothill Yokuts, as well as some members of the neighboring Western Mono tribes (Frank and Goldberg 2010). Federally recognized tribes have status as sovereign nations within the United States (Henson 2008). Reservation lands are held in trust by the U.S. federal government for federally recognized tribes. What this means is that the federal government ultimately holds legal title to the land, which is subject to federal regulations such as the Endangered Species Act and the National Environmental Policy Act. While tribes...
do not pay taxes on the land, any beneficial interest generated from the land remains with the tribe (Henson 2008).

The paternalistic history of federal control and mishandling of tribes and their resources have given rise to general feelings of apprehension within tribal communities to allow access to their land for any reason, including scientific study (Henson 2008). As a result, tribal trust lands are often underrepresented in herbaria (CCH 2016). Poorly documented plant diversity on tribal trust lands speaks to the need for more collaboration with tribal communities as we work towards a greater understanding of the California flora. As both a researcher and a guest of the Tule River Tribe, I was grateful for the opportunity to work with the Tribal Forestry and Environmental Departments to carry out a study that would generate information beneficial to the tribe as well as contribute to our understanding of the Sierra Nevada flora as a whole.

**Physical Setting**

**Physiography.**—The Sierra Nevada is ca. 640 km long and 64–128 km wide, extending from the Mojave Desert in the south to the Modoc Plateau in the north (Bergquist et al. 1978; Moore 2000). The Tule River watershed is a fan-shaped area of 393 square miles, above Lake Success on the western slope of the Sierra Nevada (Stephens 1982). Three main forks form the Tule River: the North, Middle, and South forks, which are fed by numerous small tributaries. The South Fork descends from Slate Mountain (Fig. 2), the highest elevation in the watershed at 2790 m, and empties into Lake Success reservoir, at 162 m. The lowest elevation in the study area is ca. 270 m, where the river crosses the western boundary of the reservation. Throughout the watershed, water runoff has deeply incised the terrain, forming steep-sided, narrow canyons and prominent ridges in the higher elevations, contrasting with the gently rolling foothills of the lower elevations, which are broken by granite outcrops. In addition to Slate Mountain, prominent peaks include Cow Mountain (1132 m), Solo Peak (2227 m), Black Mountain (1980 m), and Mule Peak (2443 m) (Fig. 2).

**Geology.**—The study area is underlain by metamorphic and igneous rocks of the Sierra Nevada batholith that rose along a series of faults, known as the Sierran Frontal Faults, on its eastern side and which tilted the range westward (Bergquist et al. 1978; Moore 2000). The western slope of the Sierra Nevada is gentler in contrast to the precipitous eastern slope,
which is the result of the westward tilt of the faults responsible for its continued uplift today (Moore 2000).

The study area contains physiographic components from both the Central Valley and Sierra Nevada provinces, as well as the foothill transition area between these provinces (Stephens 1982). The foothill area contains alluvial soils consisting of eroded parent material from the Sierra Nevada. A complex of igneous and metamorphic rocks exposed in the foothills is the result of the uplift of the Sierra Nevada mountain range. In the higher elevations large exposed granite outcrops are common, such as on Mule and Slate Mountain peaks. Decomposing granitic soil derived from Mesozoic granitic rock is common throughout the watershed. In the lower elevations of the watershed there are many well-rounded cobbles and boulders, which suggests that the Tule River Valley may have been filled with gravel prior to its current stream course (BIA 2014).

In cooperation with the USDA Soil Conservation Service, the Tule River Tribe had a geological soil survey completed in the late 1970s (Stephens 1982). The soil survey, as well as other geologic maps, describe the geology of the reservation as consisting mainly of pre-Cretaceous metasediments intruded by Jurassic-Cretaceous granitic rocks and metamorphosed limestones and dolomites (Smith 1964; Stephens 1982; Ross 1995). The metasedimentary rocks consist of schist, metachert, phyllite, quartzite, hornfels, tactite, slate, and marble (Stephens 1982). There is a limestone and dolomite deposit on the Tule River Indian Reservation at NW1/4 NW1/4 sec. 11, T22S, R30 E (36.062067°, -118.653010°), near the Tule River Indian Reservation tungsten mine that is now inactive and unmaintained and has been for several decades (Bergquist et al. 1978).

Climate

Many factors contribute to climate, including elevation and topography. With an elevational gradient from ca. 162 to 2790 m, the climate in the South Fork Tule River watershed is diverse. Like most of California, the climate is Mediterranean, with cool moist winters and warm dry summers. Long-term climate records do not exist for the study area proper. I used climate data from the past 20 years from two weather stations, Lemon Cove located in the neighboring Kaweah River watershed (36.38333°, -119.03333°; elevation 156 m) and Grant Grove located at the Sequoia-Kings Canyon Forest visitor center (36.73333°, -118.96667°; 2011 m) (NOAA 2016). Temperatures...
at lower elevations in the summer often exceed 100°F (37.8°C), while at upper elevations the temperatures rarely exceed 85°F (29.4°C) (Fig. 3). Minimum temperatures differ more between the low and high elevations, with those at lower elevations rarely going below 40°F, while those at higher elevations dip below 20°F (Fig. 3). This affects plant community composition at higher elevations because cold intolerant species are excluded.

Precipitation amounts can vary tremendously in the study area. Rains begin in October and steadily increase until January, with levels tapering off February–May, and summers have little to no precipitation (Fig. 4). The South Fork Tule River is known to stop running mid–late summer and to start again with the fall rains (J. Stewart, pers. comm. 3 Feb 2013).

During the three years of my study, California was experiencing exceptional drought, causing severe tree mortality in the southern Sierra Nevada (Fig. 4; Moore 2015). Comparison of the monthly historic precipitation averages over the past 20 years with the three years of the study show great disparity (Fig. 4). Dry summers are part of the climate dynamic, but the
multi-year drought that coincided with the study without question negatively impacted flowering.

**Human Impacts**

**Indigenous Peoples.**—There is evidence that people have inhabited the Sierra Nevada area for at least 13,000 years (Keintz 2002). These “Paleo-Indians” were in the area prior to the arrival of the Yokuts. The Yokuts people live in the South Fork Tule River watershed today, as they did prior to European contact. The Yokuts people of central California were once the largest indigenous group in California, holding one-ninth of the overall territory at the time of contact (Kroeber 1976). According to anthropologist A.L. Kroeber (1976), the Yokuts people of California were egalitarian and unique in being divided into “true tribes”—each with their own name, dialect, and territory. Kroeber identified 40 of these tribes, but suggests that there may have been as many as 50. The people occupied villages within different territories partitioned based on geography, along the shores of Tulare Lake, as well as the rivers and creeks of the western slope of the Sierra Nevada, including the Tule River. The Yokuts are divided into three geographical divisions: Northern, Southern Valley, and Foothill. The South Fork Tule River watershed was part of the Southern Valley Yokuts territory and is the ancestral home of the Bokninuwad. Not much is known about the Bokninuwad except that they were similar to but smaller in population size than the neighboring Yaudanchi that occupied the foothills of the North and Middle forks of the Tule River (Kroeber 1976; BIA 2014).

In California, it is well known that the indigenous peoples manipulated the landscape for the purposes of hunting and gathering, and the effects of these land management techniques impacted California’s landscape (Kroeber 1976; Blackburn and Anderson 1993; Keeley 2002; Anderson 2006; Lightfoot and Parrish 2009). Fire is a land management tool employed by hunter-gatherer communities (including the Yokuts) to enhance and diversify wild food crops, medicines and raw materials while also enhancing ecosystem services (Blackburn and Anderson 1993; Anderson 2006; Lightfoot and Parrish 2009). For example, it has been shown that fires set by humans are responsible for the type conversion of shrubland to grassland in the coastal ranges in California based on the frequency of lightning fires that would have been required to maintain the grasslands (Keeley 2002). While the Tule River Tribe is not necessarily dependent on the land for subsistence today as they once were, as mentioned above the tribe conducts prescribed burns, sometimes as a management technique to tend and gather plants to be used for medicines and basket weaving (J. Orozco, pers. observ.). Although many of the Yokuts names for the plants have been lost due to colonization, there is a language revitalization program on the reservation and it is my hope to work with the Tule River Tribe in the future to create new Yokuts names for the plants based on their uses and characteristics. With the introduction of non-native plant species, native people began to use them for various medicines as well. For example, mullein (*Verbascum thapsus*) is an introduced plant of European origin, but is used by the Yokuts for poultices and teas and highly regarded as a medicine (Lightfoot and Parrish 2009). Having worked with the tribal Forestry and Environmental departments during my study, I was asked by members of the Tule River Tribe to be on the lookout for mullein and to collect what I can for use by tribal members for medicine. The ability and willingness of native people to incorporate beneficial introduced plants into their culture speaks to their ingenuity.

**European Exploration, Miners and Homesteaders.**—The first recorded European contact with the Southern Valley Yokuts was in 1772 when a band of Spanish soldiers explored Tejon Pass on their way into the San Joaquin Valley. Then, in 1776, the explorer and missionary, Francisco Garcés, came to the valley (Keintz 2002; BIA 2014). The Catholic Church made an attempt to establish missions in the region, but failed due to the topography and climate of the interior of California, which was harsher than that of the coast (Anderson 2006). As a result, the southern Valley became a haven for the runaways of the missions, and the infiltration of different customs led to the breakdown and evolution of local cultural patterns. When California was ceded to the United States by Mexico in 1848 with the treaty of Guadalupe Hidalgo, the United States agreed to recognize “Indians” as citizens and as such recognize aboriginal land title, but the influx of settlers due to the gold rush changed that policy and many miners and homesteaders overrun native peoples’ homelands (Sutton 1975; Anderson 2006). The ecological changes to the landscape included agriculture, logging, and the pollution from mining (Anderson 2006). No direct reports of gold mining from the South Fork could be found, although the area on the northeast slopes of Cow Mountain just north of the reservation, known as the Globe mining district, was prospected in the early 1900s (Bergquist et al. 1978). Tungsten was mined on the reservation in the early 1900s but diminished as demand for the ore tapered off and the mine has been inactive and unmaintained. According to the minerals report, the mine was accessed by a road that is now washed out, overgrown, and impassable to vehicle traffic (Bergquist et al. 1978). The mine is on the south slope of a ridge ca. 90 m upslope from the main reservation road (Bergquist et al. 1978; BIA 2014). During the course of my fieldwork I was not able to locate the tungsten mine and nearby dolomite deposit.

In 1884, the northeastern portion of the watershed, including the Black Mountain sequoia grove and portions of the Tule River Indian Reservation, passed into private ownership after the United States General Land Office approved an erroneous resurveying of the reservation (Frank and Goldberg 2010). The area was heavily logged until the Tule River Tribe’s persistence and legal actions resulted in the restoration of the contested area albeit a hundred years later in 1984 (Frank and Goldberg 2010). While this and the surrounding areas of the Sequoia National Forest were logged, the mature sequoias were not cut (B. Rueger 14 Jul 2014, pers. comm.). The sale of commercial timber was once a major source of revenue for the Tule River Tribe but a sustainable timber management program has been in place for several decades now (Frank and Goldberg 2010).

**Current Land Uses.**—The Sequoia National Forest, established in 1893, manages the upper portion of the South Fork Tule River watershed. National Forests fall under the jurisdiction of the U.S. Department of Agriculture (USDA) and are managed under the 1960 multiple use policy to provide services and
commodities to the public including lumber, cattle grazing, minerals and recreation (USDA 2016). In 2000, President Clinton established the Giant Sequoia National Monument from a portion of the Sequoia National Forest that contains old-growth giant sequoia groves. Establishment of this monument allowed for permanent protection of the giant sequoia groves, as well as provided protection for all the land and resources contained within the monument. At higher elevations of the watershed in the Giant Sequoia National Monument there are several trails and Forest Service roads that are used for forest maintenance as well as for recreation by the public. Off-road vehicles are prohibited in the monument, as well as hunting and grazing. According to the Giant Sequoia National Monument Hydrology report (Kaplan-Henry and Courter 2010) there are currently no cattle grazing allotments in the Sequoia National Monument. However I vividly remember seeing a cow and thinking it was a bear at Round Meadow in the Sequoia National Monument in July 2013. The impacts of grazing are most evident in meadows, including those near Rodger’s Camp and Round Meadow, where they show signs of trampling. Based on this I believe there is little to no regulation of grazing in the National Monument.

Major land impacts on the Tule River Reservation portion of the watershed include cattle grazing, forest maintenance roads, outdoor recreation for a small community of about 900 people, and the Eagle Mountain Casino. The main reservation road is paved and runs through the reservation at lower elevations, but the paved portion terminates near the old sawmill site at ca. 550 m. The road then becomes gravel that goes through the high country and is at times only accessible using a 4 x 4 vehicle. There are other abandoned mining and logging roads that connect to the main road in the higher elevations that are used mainly by the Tribal Forestry Department for forest maintenance. The other roads are unpaved in the community area and restricted to lower elevations, leaving the majority of the land undeveloped.

Raising cattle is a major source of revenue for many of the tribal members on the Tule River Reservation. The cows are considered free range and all areas of the reservation are used for grazing. Grazing has had adverse effects on riparian zones, especially montane meadows due to trampling. The Tribal Forest Department’s management of reservation forests emphasizes enhancement of overall forest health and productivity by actively monitoring the water quality of the South Fork Tule River and its tributaries, reducing fuel loads, and targeting invasive weeds for eradication. Tribal timber sales are currently geared towards removing dead, dying, and insect-infested conifers both within and outside giant sequoia groves for the purpose of fuel reduction (Rueger 1994). Fuel reduction is generally accomplished by using mechanical and manual methods (lop-and-scatter). Prescribed burning has been used sparingly primarily because of the narrow burn window, high cost and risk. Land management also includes restoration of the giant sequoia groves within the reservation boundaries (Rueger 1994; pers. observ. 2013).

Fire History.—According to Brian Rueger, the tribal forest manager, the foothill woodland and grassland communities in the lower elevations of the reservation have burned more frequently than communities at higher elevations. Areas immediately upslope from the main community area have burned every 5–15 years on average, with moderate intensity. The mid-elevation chaparral, Sierran mixed hardwood forest and mixed coniferous forest have burned less frequently, often having gone more than 50 years between burns. The tribe conducts periodic prescribed burns generally less than 50 acres (20 ha) in size. The prescribed burning is site specific and includes giant sequoia groves. Prescribed burns have been used sparingly to date and are of low intensity (Rueger 1994). Prescribed burn limitations include high liability, insufficient resources, air quality regulations and a narrow burn window opportunity. The Tule River Tribe has its own fire department that administers the burns.

Collaboration

U.S-Tribal Relations and How it Affects Land Access.—The Tule River Tribe has expressed their inherent sovereignty by maintaining control of their ancestral land and culture (Frank and Goldberg 2010). As a domestic sovereign, the Tule River Tribe has an inherent responsibility to protect and preserve the reservation as well as provide for the cultural, economic, and self-determination needs of its members in a manner consistent with tribal practices (BIA 2014). This responsibility includes establishment of governmental jurisdiction over tribal land. Although the U.S. federal government has long recognized the sovereignty of Native Nations in law, its historical treatment of tribes can be characterized as paternalistic (Henson 2008). And while federal and tribal relations are improving, historically there has been much conflict over jurisdiction of natural resources. The history of federal control and mismanagement of tribal resources has also given rise to general feelings of apprehension within tribal communities to allow access to their land for any reason, including scientific study (Henson 2008).

Corresponding to tribal control of economic development efforts as well as self-governance, many tribes are taking a more proactive role in their natural resource management (Henson 2008). The Tule River Tribe is part of the greater community of California concerned with the quality of our environment, and partners with a number of agencies and organizations including the Natural Resources Conservation Service, Sequoia National Forest, Society of American Foresters, Tulare County Resource Conservation District and Yosemite-Sequoia Resource Conservation & Development Council. This presents an opportunity for botanists to collaborate with tribes to assist with the documentation and categorization of the flora on tribal trust lands. By reclaiming that basic knowledge of what plants and other natural resources are on the reservation, tribal communities such as the Tule River Tribe can continue to assert their autonomy and sovereignty over their ancestral land.

Building a Trust-Relationship with the Tule River Tribe.—In order to augment our knowledge of the California flora, we must collaborate ethically and effectively with groups and agencies such as tribal communities, which have a claim and interest in the plant diversity of California. It is important to remember when working with tribal communities that all federally recognized tribes are independent, sovereign entities, with autonomous
rights they exercise according to their different community needs. Corresponding to the diversity of community concerns, each tribal government has a different process for obtaining collecting permits. The request to obtain a collection permit for the Tule River Indian Reservation was a first for the Tule River Tribe and required much deliberation. I contacted the tribal forest manager with my proposal several times prior to meeting with him in person about my proposed project. I listened to the concerns of the tribe, which mainly had to do with privacy. The tribe did not want the precise (GIS) localities of the plant collections to be made public. I addressed this concern by suppressing the data in the public databases, but making the information available on the physical specimen deposited at RSA, where their use can be monitored. In this way the information is still collected and available to researchers, but not to the general public. Other concerns had to do with community member privacy (i.e., not collecting plants in someone’s yard). I planned my fieldwork according to their suggestions and specifications and avoided the community areas and other restricted sites.

I wanted to establish relational accountability with this project and build a work relationship with the Tule River Tribe that was cooperative and respectful of the tribe’s autonomy. Following indigenous research paradigm guidelines, relational accountability required that I form a reciprocal relationship with the tribal community (Wilson 2008). To do this I needed to relate how a floristic study would be beneficial to the tribe. A floristic study is beneficial because the central product is an inventory of the plant diversity on the reservation. This information serves as baseline data for future studies. The current management emphasis of the Tule River Tribal Forestry Department is on improved forest health, and information generated from this study will inform current and future land management practices.

Persistence and follow-through are important in building relational accountability. I was able to build relational accountability by respecting the Tule River Tribe’s autonomy by changing my proposal to match community concerns. Acknowledging the tribe’s concerns and being willing to compromise and modify my proposal to include the suppression of data to the general public was important in building a trusting relationship with the tribe. I was able to identify an advocate in the tribe’s Environmental and Forestry departments who understood the importance of a floristic study and the foundational information that results from it. With their help and advocacy, the tribal council approved my proposal and a collecting permit was issued.

### Historic Plant Documentation

I used the Consortium of California Herbaria database (CCH 2016) to find previous plant collections from the study area. The CCH database contains over 2 million searchable plant specimen records from 35 herbaria and is the most complete record of the plant collections in California. I downloaded from the CCH database all collections made from Tulare County and then used ArcGIS to extract all collections made within each watershed (ESRI 2011). After removing duplicate collections, these searches yielded a total of 176 collections from five herbaria (RSA, CAS, UC, SJSU, and JEPS) representing 159 taxa. Only 57 of these collections came from the reservation, which occupies most of the watershed, indicating how poorly documented the area was prior to my study (Fig. 5). I examined and annotated all of these specimens and updated them as needed with current nomenclature.

Collection history of the South Fork Tule River watershed is summarized in Table 1. George B. Grant made the first plant collections in 1903 in the upper reaches of the watershed in Round Meadow, Sequoia National Forest. With the exception of E. K. Balls and L. W. Lenz, E. C. Twisselmann, P. Leski- nen, J. R. Shevock, and J. Stewart, each person made fewer than 10 collections. Ernest Twisselmann, a well-known rancher/botanist and author of *A Flora of Kern County* (1967), explored the upper reaches of the watershed in 1959 and 1968 and collected the most specimens (91) prior to my study. Following his lead was Jim Shevock (77 specimens), who discovered numerous rare species in the southern Sierra Nevada, including the South Fork Tule River watershed, and collected here early in his botanical career during 1977–1982. Joan Stewart, a local botanist from the Springville area, made the most recent collections from the watershed: her collections from Slate Mountain date from 1996–2004.

### Fieldwork

I spent a total of 64 days over three seasons (2013–2015) in the study area and made 1356 collections. Plant samples were made from a variety of locations, elevations, and habitats (Fig. 5). However, much of the watershed of the South Fork Tule River is rugged and steep, and there is a limited network of roads and trails, which made access to many areas difficult. As a result, many collections were made along roads (in service and abandoned), trails, ridgelines, and waterways that provided greater accessibility for day-long collecting trips. The largest sampling gap was the Bear Creek watershed, located in the south-central part of the study area (Fig. 5). I was warned not to enter this area because of reports of illegal marijuana growers from off the reservation. Another sampling gap included the Solo Peak ridgeline in the north. Here the Tribal Forestry Department was selectively removing trees that had fallen victim to drought. For liability reasons, I was told not to collect in areas where crews were actively working. Also, as noted above, fieldwork coincided with an exceptional drought in California. Therefore, although this study provides a vastly improved understanding of the plant diversity in the South Fork Tule watershed, the area certainly harbors additional, undocumented taxa.

Each collection involved taking only enough plant material to create one or two herbarium sheets. Accompanying data included the standard categories: precise location using GPS, habitat, substrate, slope, aspect, associated species, etc. A complete set of specimens was deposited at RSA, and a duplicate set is destined for the Tule River Tribe’s Forestry and Environmental departments. *The Jepson Manual: Vascular Flora of California* (Baldwin et al. 2012) was used for identification and nomenclature, including previously collected, accessioned specimens, except in the case of the genus *Erythranthe*, which followed the nomenclature of Barker et al. (2012). Plant rarity and special status taxa were determined using the guidelines put forth by the California Native Plant Society’s Inventory of Rare and Endangered Plants (CNPS 2016). For federally designated endangered species that were found in the study area, California Native Species Field...
Survey forms were filled out and submitted to the California Natural Diversity Database.

**Collection Bias.**—The North, Middle and South forks together form the Tule River watershed. Plant species have been documented in the North and Middle fork watersheds since the late 1800s, but the South Fork watershed has had comparably little documentation prior to this study (CCH 2016). As pointed out above, the lack of documentation can be explained by collecting restrictions imposed by the Tule River Tribe. Any concentrated plant collecting effort of an area should yield more taxa than collections that accumulate for an area from taxon-focused studies or occasional collecting forays. Collection bias can occur from a lack of systematic plant surveys. To investigate this collection bias, I compared the total historic collections made in the Tule River watershed as a whole. I used the CCH database to compare the historic collections from the North and Middle forks with the historic (pre-study) collections of the South Fork (Fig. 5–6). Comparing the collection densities made in the North, Middle, and South Forks of the Tule River (Fig. 6), we can see that most of the 4-km grid squares of the North and Middle Forks are not colored blue, indicating that collections exist for most of these areas. In contrast, prior to my study, the South Fork had many more blue squares indicating undocumented areas (Fig. 5.). These uncollected areas potentially harbored plant taxa that were undocumented for the South Fork watershed.

Post study, the South Fork watershed has the most collections of all three forks, but the Middle Fork has the most taxa (Table 2). The Middle Fork is completely within the boundaries of the Sequoia National Forest and has many more roads and trails. As a result, collectors have been able to access more remote, diverse and relatively undisturbed places. The majority of the South Fork collections were collected during the past three years, which coincided with a drought. I have no doubt this affected the breadth of diversity that was found in the South Fork compared with the other forks, in which collections were made throughout the past century. This emphasizes the need to continue fieldwork in the South Fork watershed to get a more fine-scale picture of the diversity that exists there.
Table 1. Person who previously made plant collections from the South Fork Tule River watershed, based on herbarium specimens at CAS, RSA-POM, SJSU and UC/JEPS.

<table>
<thead>
<tr>
<th>Collector</th>
<th>Year</th>
<th>Collections</th>
</tr>
</thead>
<tbody>
<tr>
<td>G.B. Grant</td>
<td>1902</td>
<td>5</td>
</tr>
<tr>
<td>F.W. Peirson</td>
<td>1908</td>
<td>1</td>
</tr>
<tr>
<td>Y.W. Winblad</td>
<td>1933</td>
<td>1</td>
</tr>
<tr>
<td>D.D. Keck</td>
<td>1935</td>
<td>2</td>
</tr>
<tr>
<td>J. Clausen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R.F. Hoover</td>
<td>1936</td>
<td>1</td>
</tr>
<tr>
<td>P.A. Munz</td>
<td>1948</td>
<td>3</td>
</tr>
<tr>
<td>E.K. Balls</td>
<td>1952</td>
<td>20</td>
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<tr>
<td>L.W. Lenz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.R. Kruckeberg</td>
<td>1954</td>
<td>1</td>
</tr>
<tr>
<td>E.C. Twisselmann</td>
<td>1959, 1968</td>
<td>65</td>
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<td>C.N. Smith</td>
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<td>P. Leskinen</td>
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<td>R.D. Goeden</td>
<td>1990</td>
<td>2</td>
</tr>
</tbody>
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VOLUME 41(1–2) Vascular Flora of the South Fork Tule River

**Plant Communities**

A plant community is an assemblage of plants that interact with each other and their environment within a space-time boundary (Holland and Keil 1995). Following this definition we can classify these assemblages based on habitat characteristics, physiognomy and composition of species. These communities may vary from site to site in species composition, but are characterized by the dominant species found there. There are several classification schemes for California plant communities that vary in their level of detail (e.g., Holland and Keil 1995; Rowlands 1995; Sawyer et al. 2009). Although these are general descriptions, they are useful in conveying information about habitat and environment. I chose to use the classification of Holland and Keil (1995) because it best fit the level of detail I used in my field notes. Based on this, the following plant communities occur in the study area: valley grassland, mixed chaparral, foothill woodland, Sierran mixed hardwood forest, mixed coniferous forest, ponderosa pine forest, giant sequoia forest, redwood forest, mixed coniferous forest, ponderosa pine forest, mixed chaparral, and mixed nature of the community is evident.

**Valley Grassland.**—Valley grassland is dominated by non-native annual grasses that have replaced the native grasslands. These areas are fragmented and occur in the lower elevations (150–500 m) where the majority of the tribal community resides. A combination of low/irregular precipitation, high summer temperatures and annual summer drought create conditions unsuitable for most woody species (Holland and Keil 1995). Historically, the Yokuts used fire in this community to increase the abundance and density of edible geophytes such as *Dichelostemma capitatum*, *Triteleia* spp. and *Calochortus* spp. by decreasing plant competition and promoting growth through recycling of nutrients (Anderson 2006). In the absence of fire, valley grassland becomes encroached by woody species. It merges with other communities in the foothills and broad drainages, where *Quercus douglasii* and *Q. lobata* are present and grassland species form the understory. These species include the grasses *Avena fatua*, *Bromus diandrus*, *B. hordeaceus*, *B. madritensis* subsp. *rubens*, *B. tectorum*, *Festuca microstachys*, and *F. myuros*. Valley grasslands may also contain native forb species such as *Amsinckia* spp., *Plagiobothrys* spp., *Lupinus bicolor*, *L. benthamii*, *Eschscholzia californica*, *Trifolium* spp., *Lasthenia deblis*, *L. minor*, *Claytonia* spp., and *Castilleja* spp.

**Mixed Chaparral.**—Chaparral dominates the mid-elevation slopes (500–750 m), but patches are also found in higher elevations on steep, dry, south- and southwest-facing slopes. Interestingly, *Eriodictyon californicum* and *Keckelia breviflora* are dominants in this vegetation type. *Penstemon laetus* was always present and often growing intermixed in patches of *E. californicum*. The absence of *Adenostoma fasciculatum* was surprising, as it occurs in the neighboring Middle Fork watershed and is so often a dominant in chaparral. Other common constituents include *Arctostaphylos patula*, *Ceanothus* spp., *Cercocarpus betuloides*, *Fremontodendron californicum*, *Garrya flavescens*, and *Toxicodendron diversilobum*. Not all of these species occur together in a given stand, and other taxa may be locally present based on elevation, so the mixed nature of this community is evident.

**Foothill Woodland.**—Foothill woodland covers the reservation at low- to mid-elevations (250–1400 m) with fragments of valley grassland and chaparral interspersed. Foothill woodland varies from open to dense canopies. There are a number of annuals that make up the understory including *Poa* spp., *Hordeum* spp., *Avena barbata*, *A. fatua*, *Erodium* spp., *Plagiobothrys* spp., *Nemophila* spp., *Amsinckia* spp., *Lepidium nitidum*, and *Lupinus bicolor*. The main tree species are *Quercus wislizeni*, *Q. douglasii*, *Q. lobata*, *Aesculus californica*, *Umbellularia californica*, and *Cercis occidentalis*. *Pinus sabini ana* was found in small patches in steep canyons, but was not very common in the lower elevations. Many shrubs that are dominant in chaparral can also occur in the understorey including *Ceanothus cuneatus*, *Ribes quercetorum*, and *Arctostaphylos* spp. There are many granitic outcrops that contribute to the overall diversity. Species associated with these outcrops include *Phacelia cicutaria*, *Toxicodendron diversilobum*, *Pentagramma triangularis* subsp. *triangularis*, *Erythranthe floribunda*, and *Claytonia* spp.

**Sierran Mixed Hardwood Forest.**—In the study area, Sierran mixed hardwood forest usually occupies a zone between foothill woodland and mixed coniferous forest, as is often the case on the western slope of the Sierra Nevada (Holland and Keil 1995), but it may also grade into chaparral or riparian communities. This plant community is found at 1200–2400 m elevation. Because it covers such a wide elevational gradient, it picks up different herbaceous species locally. Dominant trees include *Quercus kelloggii*, *Q. chrysolepis*, *Calocedrus decurrens*, and *Pinus ponderosa*. *Arctostaphylos viscida* is also common and *Chamaebatia foliolosa* is often present as a ground cover. Compared to other tree species in the study area, *C. decurrens* seemed to be most affected by the drought that coincided with the study, with hundreds of standing dead individuals observed. Undoubtedly, reduction of the overstory will affect community dynamics. Annuals were not common in the understorey. Other perennials include *Sanicula* spp., *Boechera* spp., *Symphoricarpos* spp., *Toxicodendron diversilobum*, *Ranunculus occidentalis*, *Silene laciniata* subsp. *californica*, and *Calystegia malocophylla*. 
Montane Mixed Coniferous Forest. — Montane mixed coniferous forest communities are scattered in the study area at 1600–2400 m. These forests are variable in composition and habitat. Because of this variation, they are categorized into several communities that differ in dominant species and habitat: mixed conifer forest, ponderosa pine forest, and giant sequoia forest. These forests were logged historically in the study area and as a result the landscape is a mosaic of forest communities in various stages of succession.

Mixed Conifer Forest. — Mixed coniferous forest is often composed of 4–6 conifer species. Calocedrus decurrens, Pinus lambertiana, and Quercus kelloggii are dominant tree species in most stands. At higher elevations, white fir, Abies concolor, joins this community type and is sometimes dominant. Quercus sempervirens is another hardwood that can sometimes grow in thick continuous stands where there are openings in the taller conifer canopy. Pinus ponderosa is found in the warmer, dryer areas, while Abies concolor is found in the cooler, more mesic, higher elevations. Most hardwood trees within mixed coniferous forests are associated with riparian habitats and include Alnus rhombifolia, Acer macrophyllum, Cornus nuttallii, and Salix spp. Understory shrubs and herbs are extremely diverse and include Chamaebatia foliolosa, Prunus emarginata, Ribes roezlii, and Ceanothus spp.

Ponderosa Pine Forest. — Pinus ponderosa forest is common in the lower and middle elevations up 2400 m. Like other areas of the western slope of the Sierra Nevada, P. ponderosa

Table 2. Comparison of the number of plant collections and minimum-rank taxa found in the North, Middle and South forks of the Tule River based on CCH records and collections made for this study.

<table>
<thead>
<tr>
<th>Area</th>
<th>Collections</th>
<th>Taxa</th>
</tr>
</thead>
<tbody>
<tr>
<td>North</td>
<td>25366</td>
<td>542</td>
</tr>
<tr>
<td>Middle</td>
<td>28432</td>
<td>1325</td>
</tr>
<tr>
<td>South</td>
<td>30907</td>
<td>1597</td>
</tr>
</tbody>
</table>
dominates warm xeric sites, just above foothill woodland and
chaparral (Holland and Keil 1995). Common associates of *P.
ponderosa* forests at lower elevations include *Quercus kelloggii* and *Calocedrus decurrens*. *Pinus ponderosa* often grows in
almost pure stands, but chaparral shrubs can be interspersed
and may form well-developed chaparral on adjacent slopes.

**Giant Sequoia Forest.**—*Sequoiadendron giganteum* is endemic
to California and restricted to ca. 80 groves along the western
slope of the Sierra Nevada (Holland and Keil 1995). It is
considered a relict species, meaning its range was once wide-
spread in the Tertiary period, when California was more
mesic, but its range has greatly contracted due to increased
aridity (Holland and Keil 1995). All giant sequoia groves
occur on mesic, unglaciated ridges at 1370–2560 m and are often
associated with red fir and mixed conifer forests (Rueger 1994).

There are five giant sequoia groves within the watershed:
Redhill, Peyrone, South Peyrone, Black Mountain, and Parker
Peak. The Tule River Tribe manages the Parker Peak Grove,
as well as portions of Black Mountain and Peyrone groves.
The tribe has grove-specific inventory and map data for each of
these groves (Rueger 1994). This data is for use in long-
term forest management planning and decision-making. The
Tribal Council considers the data sensitive and does not
release this information to the public. Current grove manage-
ment strategies emphasize protecting old-growth sequoias,
promoting growth of replacements, reducing fuel loads, and
maintaining esthetic and cultural values (Rueger 1994). The
tribe has also been actively banking giant sequoia seeds from
the trees on the reservation to preserve germplasm (B. Rueger,

Fire is essential for the reproduction of giant sequoia
because heat is required to open the closed cones to release
the seeds. Fire also burns up leaf litter and exposes bare miner-
al soil, which is needed for seedling recruitment (Rueger
1994). In the absence of fire the shade-tolerant *Abies con-
color* becomes progressively denser (Holland and Keil
1995). The giant sequoia groves are often mixed with *A.
concolor* and other conifers such as *Pinus ponderosa* and
*Calocedrus decurrens*. Common shrub species in the groves
include *Sambucus nigra* subsp. *caerulea*, *Ribes roezlii*, and
*Ceanothus* spp. Most of the understory herbaceous plants in
the groves are perennials and include *Acmispon* spp., *Drapa-
ria* syltyla, and *Chamaebatia* foliolarosa.

**Red Fir Forest.**—*Abies magnifica* (red fir) forest is largely re-
stricted to higher elevations at 2300–2800 m. *Abies concolor*
(white fir) is a dominant species in mixed conifer forest and is
often found interspersed with *A. magnifica* at lower elevations.
At higher elevations, red fir forest often forms a dense canopy
in which no other conifers can successfully compete (Holland
and Keil 1995). Some *Ceanothus* spp. and other conifers
including *P. lambertiana* and *P. contorta* may occur in areas
that have been opened up by fire or other disturbance such as
logging. Herbaceous vegetation is very sparse, but some taxa
common in the litter of red fir forest are *Pyrola picta*, *Corallo-
rhiza maculata*, *Chimaphila menziesii*, *Monardella odoratis-
sina*, *Hackelia* spp., and *Phacelia* spp.

**Riparian Communities.**—The plant communities associated
with streams, lakes, springs and other waterways are distinct
and not restricted to specific climatic or edaphic conditions in
the same manner as other communities (Holland and Keil
1995). Stream flow is not uniform from season to season and
during periods of low precipitation, the exposed stream chan-
cel can be colonized by a mixture of native and non-native
species (Holland and Keil 1995). Cattle grazing and trampling
primarily impact riparian communities introducing many non-
native species such as *Taraxacum officinale*, *Avena fatua*, and
*Bromus* spp. Waterways also pass through every plant com-
munity and some of the species of these local communities
become part of the riparian community. It is difficult to clas-
sify riparian communities because of the diversity and ever-
changing nature of water flow, but I recognize three riparian
communities in the watershed: valley and foothill riparian,
montane riparian and montane meadows (Holland and Keil
1995). For simplicity, I chose to include montane meadows
within riparian communities, departing from Holland and Keil
(1995) who classified them under freshwater wetlands.

**Valley and Foothill Riparian.**—This community occurs along
waterways from lower elevations in valley grassland, chapar-
ral, and foothill woodland to the margins of the montane
mixed coniferous forests. These areas are often targeted by
cattle and therefore disturbed. The summers are long and dry
and water flow often ceases but subsurface moisture remains
available. The dominant tree species are mostly deciduous and
include *Acer macrophyllum*, *Alnus rhombifolia*, *Platanus racemosa*, *Salix lasiolepis*, *S. gooddingii*, and *S. lasiandra var.
lasiandra*. Common shrubs include *Cercis occidentalis*, *Bac-
charis salicifolia*, *Cornus sericea* subsp. *sericea*, *C. naltii* and
*Toxicodendron diversilobum*. Common herbs include *Carex* spp., *Juncus* spp., *Erythranthe floribunda*, *E. guttata*, *E.
moschata*, *E. nasuta* and *Urtica dioica*.

**Montane Riparian.**—Riparian communities in the higher
mountainous areas differ from lower elevation riparian zones
because of lower temperatures. Montane and valley and foot-
hill riparian communities have many species in common
including *Alnus rhombifolia*, *Acer macrophyllum*, and *Fraxi-
nus latifolia*. Tree species such as *Platanus racemosa*, present
along watercourses at lower elevations, are absent due to intol-
erance to colder temperatures. Common shrubs are *Cornus sericea* var. *sericea*, *C. naltii*, *Holodiscus discolor* var.
*microphyllus* and *Salix* spp. Herbaceous species include *Carex* spp., *Juncus* spp., *Erythranthe cardinals*, *E. floribunda*, *E.
guttata*, *E. moschata*, *E. nasuta* and *E. tilingii*.

**Montane Meadows.**—Montane meadows occur in the upper
reaches of the watershed in montane mixed coniferous forests
and red fir forest. Most meadows occupy areas where the water
table is close to the surface and drainage is relatively slow. The
shallow water table inhibits tree growth, and the ecotone
between the forest and meadow is abrupt in some areas and in
others a zone of moisture-tolerant trees, such as *Salix* spp., bor-
der the meadow (Holland and Keil 1995). Many meadows are
moist only during the spring and early summer and usually dry
out by mid-summer. Mixtures of grasses, sedges and rushes, as
well as a diversity of forbs generally dominate meadows. Most
of these forbs are palatable forage and are commonly grazed by cattle. Trampling and grazing result in bare spots in which species composition is changed and many non-native forbs establishing Taraxacum officinale, Rumex acetosella, Avena fatua, Veronica arvensis and Bromus tectorum. The impacts of grazing are evident in most of the meadows on the reservation as well as those near Rodger’s Camp and Round Meadow in the Sequoia National Forest. Common herbaceous perennials found in almost all montane meadows are Veratrum californicum var. californicum, Helianthus bigelovii, Viola macloskeyi, Sidalcea spp., Carex spp., Juncus spp., Senecio triangulatus, Drymocallis spp., Achillea millefolium, Epilobium ciliatum, Hypericum anagalloides, Oreostemma alpigenum var. andersonii, Bistorta bistortoides, Perideridia parishii, and Erythranthe primuloides.

Table 4. Numerical summary of minimum-rank taxa occurring in the study area, including largest families, largest genera, life forms, and native vs. non-native.

<table>
<thead>
<tr>
<th>Number of taxa</th>
<th>% Total flora</th>
</tr>
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<tbody>
<tr>
<td>Largest families</td>
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<td>Asteraceae</td>
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<tr>
<td>Poaceae</td>
<td>43</td>
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<tr>
<td>Boraginaceae</td>
<td>39</td>
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<td>Fabaceae</td>
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<tr>
<td>Brassicaceae</td>
<td>26</td>
</tr>
<tr>
<td>Caryophyllaceae</td>
<td>17</td>
</tr>
<tr>
<td>Plantaginaceae</td>
<td>17</td>
</tr>
<tr>
<td>Apiaceae</td>
<td>16</td>
</tr>
<tr>
<td>Onagraceae</td>
<td>16</td>
</tr>
<tr>
<td>Cyperaceae</td>
<td>14</td>
</tr>
<tr>
<td>Largest genera</td>
<td></td>
</tr>
<tr>
<td>Lupinus</td>
<td>14</td>
</tr>
<tr>
<td>Carex</td>
<td>12</td>
</tr>
<tr>
<td>Phacelia</td>
<td>10</td>
</tr>
<tr>
<td>Viola</td>
<td>9</td>
</tr>
<tr>
<td>Acmispon</td>
<td>8</td>
</tr>
<tr>
<td>Bromus</td>
<td>8</td>
</tr>
<tr>
<td>Erythranthe</td>
<td>8</td>
</tr>
<tr>
<td>Trifolium</td>
<td>8</td>
</tr>
<tr>
<td>Ceanothus</td>
<td>7</td>
</tr>
<tr>
<td>Clarkia</td>
<td>7</td>
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<tr>
<td>Juncus</td>
<td>7</td>
</tr>
<tr>
<td>Life forms</td>
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<tr>
<td>Perennial herb</td>
<td>256</td>
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<tr>
<td>Annual</td>
<td>199</td>
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<td>Shrub</td>
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<tr>
<td>Tree</td>
<td>37</td>
</tr>
<tr>
<td>Geophyte</td>
<td>28</td>
</tr>
<tr>
<td>Native</td>
<td>492</td>
</tr>
<tr>
<td>Non-native</td>
<td>70</td>
</tr>
</tbody>
</table>

Flora

Numerical summary.—This study documented 562 minimum-rank vascular plant taxa (including species, subspecies and varieties) in the study area (Table 3). These taxa represent 80 families and 270 genera. The majority of the taxa are eudicots, representing 78% of the total flora. Asteraceae are the largest family represented, accounting for 9.9% of the total flora, followed by Poaceae with 7.6%, and Boraginaceae and Fabaceae each with 6.9% (Table 4). The largest genera in the watershed are Lupinus (14 taxa), Carex (12), Phacelia (10) and Viola (9). Perennial herb is the most common life form, with 45.3%, followed by annuals making up 35.7% of the total flora. Non-native taxa account for 12.5% of the total flora. Non-native taxa occur primarily in the disturbed foothill and grassland communities, including roadsides and heavily grazed areas, and in mesic areas. The non-native taxa are mainly grasses. Non-native species found throughout the study area, including a range of elevations and variety of plant communities, are Bromus tectorum, Poa annua, Taraxacum officinale, and Rumex acetosella.

Rare species.—Thirteen species in the study area are listed in the California Native Plant Society (CNPS) Inventory of Rare, Threatened, and Endangered Plants of California (2016; Table 5). There are four rank 1B.2 species (rare, threatened, or endangered in California and elsewhere; moderately threatened in California), including one that is also listed as federally endangered, one rank 1B.3 species (rare, threatened, or endangered in California and elsewhere; not very threatened in California), five rank 4.3 species (limited distribution; not very threatened in California) and two rank 4.2 species (limited distribution; moderately threatened in California). Several populations of Clarkia springvillensis, a federally listed endangered species, occur in the South Fork Tule River watershed.
are known on the Tule River Indian Reservation, including two newly documented populations. The Tule River Tribe has already begun to use data generated in this study to monitor populations of this endangered species.

Not all previously documented rare species were located during the course of this study (Table 5). Drought conditions as well as the very nature of rare species may be reasons why these species were not encountered. It is also possible that the populations of these rare species may have been extirpated from the watershed. Iris munzii, for example, a rank 1B.3 species, was collected in 1967 on Tule River Indian Reservation (see Appendix). However, the collection locality is vague and may fall within a densely settled area along the South Fork Tule River that has been both developed and heavily disturbed by grazing (A. Wheeler, pers. comm.). Several attempts to relocate it on the Tule River Indian Reservation have been unsuccessful and it is thought that I. munzii has been extirpated due to development and grazing.

**Phytogeography.**—The southernmost distributions of several species occur within the study area. The gymnosperm Torreya californica is considered a paleoendemic, meaning it was formerly more widespread. This species appears to have been adapted to a climate similar to the modern one in the southeastern United States by the late Eocene (Bouchal et al. 2014). When California became more arid and shifted towards a more Mediterranean climate, species that were adapted to cool and mesic conditions could not cope and suffered fragmentation of their distribution, becoming restricted to microclimatically humid areas (Bouchal et al. 2014). Torreya californica is now restricted to small patches along streams, on cool shady slopes, and in canyon bottoms between coniferous forests and chaparral (Howell 1949). A small population of Torreya californica was documented near the Chololo Campground on the Tule River Indian Reservation by Twisselman and I was able to locate this as well as another small population.

The fern Pellaea bridgesii is another species that has its southernmost populations within the watershed. This species is nearly endemic to California, but there is a disjunct population in Idaho (Baldwin et al. 2012). The species is known from granitic rock crevices and the rocky talus slopes of Mule Peak and Slate Mountain in the Giant Sequoia National Monument.

Oemleria cerasiformis (Rosaceae) is a shrub with a distribution from the Pacific Northwest to California’s coastal ranges and the western slope of the Sierra Nevada. The southernmost populations of O. cerasiformis are found on the Tule River Indian Reservation in foothill woodland.

Viola pendunculata, distributed mostly in the coastal ranges, has disjunct populations within the South Fork Tule River watershed. I discovered two populations at lower elevations of the Tule River Reservation in the valley and foothill riparian and foothill woodland communities. According to CCH (2016) it previously had been collected only twice in the southern Sierra Nevada foothills, in Fresno and Mariposa counties. The study area populations represent the southernmost known populations in the Sierra Nevada, but I believe that it is more common in the region, and the dearth of collections from the southern Sierra Nevada foothills reflects the need for more exploration.

**Floristic Affinities**

**Tule River watershed.**—An objective of this project was to determine the floristic affinities or similarities of the South Fork Tule River watershed with adjacent areas. The South Fork is part of the larger Tule River system that consists of the North, Middle, and South forks. Using specimen data from CCH (using the data extraction method described above) along with the data from my study, I compared the number of species that each watershed has in common with the others (Fig. 6). In order to make comparisons, the nomenclature for the CCH collections was updated to reflect that of Baldwin et al. (2012). The analysis did not take into account specimens that may be misidentified, as I did not examine all collections from the North and Middle fork watersheds.

According to this analysis, the three forks of the Tule River do not have many species in common, which might lead one to believe that they are not very similar floristically. However, given that they are part of the same river system and are geologically and climatically very similar, I believe this could be due to collection bias. The species lists for the North and Middle forks, neither of which has been the focus of a systematic inventory, show a bias towards showy flowers, in particular annuals. Perennials, including tree species, seem to be correspondingly underrepresented. Alternatively, if the majority of undocumented taxa are dominant species that do not contribute many additional numbers to diversity, then the forks would not actually be that similar in species composition, but may appear similar because of dominant species that are present.

Taxa may not be documented for an area for various reasons. In the South Fork watershed, taxa may have been overlooked because of access limitations (historic and geographic) and the drought that coincided with this study. In the North and Middle forks, even commonly occurring taxa may be undocumented for lack of a focused inventory effort. For example, Platanus racemosa, a wide-ranging species dominant in riparian areas, is documented in the North and South forks but not the Middle Fork. Quercus douglasii is another wide-ranging species common in foothill woodland. It is documented in the Middle Fork but not the North Fork. Both of these species should be present in all three forks. Overall, while the CCH database is a reasonable proxy for the species diversity of many areas, it should be augmented by focused fieldwork in order to better capture actual species diversity.

**Statewide.**—The State of California contains a higher diversity of native and endemic vascular plant species than any other state or province north of Mexico (Baldwin 2014). The state includes ca. 88% of the California Floristic Province (CA-FP), which is characterized by a relatively young, isolated Mediterranean-like climate, coupled with a diversity of substrates and topography (Baldwin 2014). The non-CA-FP areas are in eastern California and are characterized by cold desert conditions of the Great Basin and warmer Mojave and Sonoran deserts. To investigate the floristic affinities of the South Fork Tule River watershed with the flora of California as a whole, I used a subset of the eco-geographic subdivisions of California to determine presence or absence of each native species from the watershed (non-native and infraspecific taxa were omitted) in each of 10 eco-geographic subdivisions from Hickman (1993) and Baldwin et al. (2012).

The Jepson eFlora is the leading online authority on the native vascular plants of California and contains taxonomic treatments, distributions and identification keys (JEPS 2016). I used the Jepson eFlora website to determine the presence/absence of each
native species in each of the following eco-geographic areas: the Sierra Nevada Foothills (SNF), High Sierra Nevada (SNH), Tehachapi Mountains (Teh), Cascade Ranges (CaR), Northwestern California (NW), Great Central Valley (GV), Central Western California (CW), Southwestern California (SW), Great Basin Province (GB), and Desert Province (D).

Foothill woodland and chaparral characterize the lower elevations of the South Fork Tule River watershed, whereas coniferous forests and montane riparian communities characterize the upper reaches. The highest affinities of the flora are with the SNF and the SNH subregions, with 73% and 83%, respectively. This is as expected because the watershed traverses these two geographic subregions. The flora also has high affinities with the SW region at 66%, followed by CaR with 65%, CW with 61%, NW with 60%, Teh with 59%, GV with 40%, GB with 34%, and D with 17% (Fig. 7).

The deserts have least in common with the study area, which makes sense because the watershed is on the western slope of the Sierra Nevada and is part of the CA-FP. One of the plant communities found within the watershed is valley grassland. This plant community defines the GV eco-geographic subdivision used in this analysis. Given its proximity, I expected the flora to share more in common with GV than just 40%. There are areas in the lower elevations, including the Wheatons area (Fig. 2), that are Great Valley grassland but are surrounded by foothill woodland and mixed Sierran hardwood forests that are more typical of the SNF region. The grasslands of Wheatons are maintained by cattle grazing and contain many non-native, invasive grasses. The Wheatons area and others like it represent an ecotone, where the transition between GV to SNF is evident.

The prevalence of riparian habitats throughout the watershed also contributes species that are found in similar habitats in other eco-geographic regions. Along with lying outside the CA-FP, this could also explain why the GB and D regions have the fewest number of species in common with the watershed. The GB and D are on the eastern side of the Sierra Nevada, which is more arid. In California, rain shadows develop on the eastern side of north-south trending mountains, resulting in low annual precipitation (Holland and Keil 1995). Vegetation in these xeric regions is characterized by desert shrublands, which are plant communities absent from the study area.

The flora of the South Fork Tule River watershed is diverse and prior to my study relatively understudied. Poorly documented plant diversity on tribal trust lands speaks to the need for more collaboration with tribal communities to better understand the flora of California as a whole. Continued progress in the study of the California flora will depend on floristic inventories and systematic sampling of poorly known geographic areas such as the South Fork Tule River. The results of this floristic study are a contribution to that effort.

ACKNOWLEDGEMENTS

This work wouldn’t have been possible without all the support of my family and friends who kept me motivated when life’s obstacles got in my path. Specifically, I want to thank Nick Jensen for all his help with mapping. I want to thank Erika Gardner, Sandy Namoff, Valentine Arvizu, Daniela Klein, Philip Huhn, Matt Beyers and Cassie Freeman for field assistance. I owe much gratitude to Joan Stewart, who opened up her home and heart to me during the course of my fieldwork. I want to thank my committee for all their encouragement, and Diana Jolles, Tommy Stoughton, Marina Wood, Diana Campbell, David Coxen, and Zoe Estrada for all the emotional support. I also want to thank the Tule River Tribe for sharing the beauty of

Fig. 7. Comparison of the floristic affinities of the South Fork Tule River watershed with other eco-geographic subdivisions of California from Hickman (1993) and Baldwin et al. (2012).
their land with me. In particular I owe many thanks to Brian Rueger, Kerri Vera and Charles Lawyena of the Environmental and Tribal Forestry Departments for their advocacy and to the Tule River Tribal Council for approving the project. This study was funded by Rancho Santa Ana Botanic Garden, Southern California Botanists, California Native Plant Society, and Claremont Graduate University.

This project is dedicated to the memory of my grandmother Adena Zook and my mother Kelly Orozco who would have loved to see this project in its completion. I wouldn’t be where I am today if it weren’t for them, and I know they would have been very proud of me.

REFERENCES CITED


APPENDIX I

ANNOTATED CHECKLIST OF THE VASCULAR FLORA

List of all the vascular plant taxa documented from the South Fork Tule River watershed. This list is the result of fieldwork and herbarium searches as of November 2015. Nomenclature and classification follow Baldwin et al. (2012), unless otherwise noted. Selected synonymy is provided. Plant communities follow Holland and Keil (1995). Elevations are derived directly from vouched records. All specimens cited are housed at RSA unless noted otherwise. Frequency of taxa is denoted by the terms common, locally common, occasional, uncommon, and rare. Indicated are

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taxa, along with their rankings, listed in the California Native Plant Society (CNPS) Inventory of Rare, Endangered, or Threatened Plants of California as of November 2015. (*) denotes non-native taxa and (†) denotes rare taxa.

**LYCOPHYTES**

**Selaginellaceae**

†Selaginella asperrilla Maxon. Perennial herb. Rare, CNPS list 4.3, limited distribution. Cow Mountain, NW-facing slope, rocky granitic outcrops in foothill woodlands. 769 m. Orozco & Jensen 820.

**Ferns**

**Azollaceae**


**Dennstaedtiaceae**


**Equisetaceae**


**Pteridaceae**


**Woodsiaceae**


**Gymnosperms**

**Cupressaceae**


**Pinaceae**

Abies concolor (Gordon & Glend.) Hildebr. Tree. Common. Dominant in red fir and mixed coniferous forests. 2350–2470 m. Orozco & Columbus 1180, Orozco 390.


**Taxaceae**


**Magnoliids**

**Lauraceae**


**Aristolochiaceae**

**Eudicots**

**Adoxaceae**


**Anacardiaceae**


**Apoecynaceae**

_Aciphyllum androsaemifolium_ L. Perennial herb. Locally common. Exposed decomposing granite soils in mixed coniferous and mixed sierran hardwood forests. 2440–2485 m. _Orozco_ 1319, 1341.

_Apocynum cannabinum_ L. Perennial. Uncommon. Growing in sand in southerly exposure along river, just above the painted rock. 426–440 m. _Smith, C.N._ 1267 (JEP59384).


_Asclepias eriocarpa_ Benth. Perennial herb. Occasional. Roadside, highly disturbed foothill woodlands. 300 m. _Orozco_ & _Stewart_ 93.


**Asteraceae**


*Centaura melitensis_ L. Annual. Common. Disturbed foothill woodlands and all riparian communities. 329 m. _Orozco_ 74.


Desandra kelloggii (Greene) Greene. Annual. Common. Cow Mountain, foothill woodlands and chaparral communities. 404 m. Orozco & Stu...
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BERBERIDACEAE


BEUTELACEAE


BORAGINACEAE


Peucedanum hydrophyloides A. Gray. Perennial herb. Common. Disturbed granite soils of giant sequoia forests, mixed coniferous
forests and red fir forests. 2070–2490 m. Orozco, Jensen & Namoff 1233, 1340.


**Brassicaceae**


Nasturtium officinale W.T. Aiton. Perennial herb. Locally common. Aquatic plant, found in slow flowing streams and drainages in sierran mixed hardwood forest and foothill woodlands. 329 m. Orozco 77.


*Streptanthus barnsworthianus* J. Howell. Annual. Rare, CNPS list 4.3 (limited distribution). Rock outcrop near the base of Chololof falls in riparian foothill woodlands surrounded by sierran mixed hardwood forest. 1223 m. Orozco & Gardner 595.


DICOTYLEDONES

TRUMPET CUP


CAMANULACEAE

ASYNEUMA PRENANTHOIDES (Durand) McVaugh. Perennial. Uncommon. NW slopes of Slate Mountain, on granitic soils in a mixed coniferous forest and giant sequoia forests. 1950 m. Shevock, J.R. 10105 (RSA400572).

CAPRIFOLIACEAE


CARYOPHYLLACEAE

†ANDROSACE ELONGATA L. subsp. ACUTA (E. Greene) G. Robb. Annual. Rare, CNPS list 4.2 (limited distribution). Mine Hill southeast of California highway 190 above Lake Success and south of South Fork Tule River. 363 m. Shevock, J.R. 9117 (CAS1018152).


STELLARIA GRAMINEA L. Perennial herb. Occasional. Disturbed soils and roadsides of mixed coniferous forests and red fir forests. 2276 m. Orozco 369.

STELLARIA LINGIPES Goldie subsp. LINGIPES. Perennial herb. Occasional. Disturbed soils of montane riparian in mixed coniferous forests and red fir forests. 2167 m. Orozco 1287.


COMANDRACEAE


CONVOLVULACEAE


CORNACEAE


CRASSULACEAE


594, Orozco & Namoff 911, Orozco 187, 556, 1012, Shevock, J.R. 10573 (CAS1145423).


**Cucurbitaceae**


**Erectaeae**


Pyrola dentata Sm. in Rees. Perennial herb. Occasional. Understory of mixed coniferous forests and red fir forests. 2382 m. Orozco 334b.


**Euphorbiaceae**


**Fabaceae**


Acmeplon glaber (Vogel) Brouillet var. glaber. Occasional. Cow Mountain, in exposed, granitic soils in valley grassland and foothill woodlands. 504 m. Orozco & Stuart 86.


Astragalus Bolanderi A. Gray. Perennial herb. Occasional. SW-facing slopes of mixed coniferous forests and red fir forests. 2457 m. Orozco 1314.


Lupinus breviflorus A. Gray. var. grandiflorus C.P. Sm. Perennial. Occasional. Mat-forming in exposed, disturbed decomposing
granitic soils of mixed coniferous and red fir forests. 2042 m. *Orozco 1105, Shevock, J.R. 9848 (RSA788609, RSA790679).


**FAGACEAE**


**GARRYACEAE**


**GENTIANACEAE**

*GENTIANOPSIS SIMPLEX* (A. Gray) H.H. Iltis. Annual. Restricted to montane meadows in mixed coniferous forests and red fir forests. 2176 m. *Orozco 1290.

**GERANIACEAE**


**GROSSULARIACEAE**

*RIBES CEREUM* Douglas var. *CEREUM*. Shrub. Common. Understory in montane meadows and montane riparian areas of mixed coniferous...

*Ribes cereum* Douglas var. *inernius* (Lindl.) C.L. Hitchc. Granitic outcrop in montane riparian areas of mixed coniferous and red fir forests. 2152 m. *Orozco & Columbus* 1130.


**Hydrangeaceae**


**Hypericaceae**


**Lamiaceae**


**Limonanthaceae**


**Loasaceae**


**Lythraceae**


**Malvaceae**


**Meliaceae**


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CLAYTONIA RUBRA (Howell) Tidestr. subsp. RUBRA. Annual. Common.


CLARKIA SPRINGVILLENSES Vas.ck. Annual. Rare. CNPS list 1B.2, and listed by the State and federal government as endangered. SW-facing slopes and roadsides in decomposing granitic soils of chaparral, foothill woodland communities, possibly hybridizing with *C. unguiculata*. 550–1360 m. *Oroco* 184, 564, 755, 1021, Dean, E. 2991 (UC1873573), Twisselmann, E.C. 14141 (RSA516813).


EPILOBIUM CIATIUM Raf. subsp. CIATIUM. Perennial herb. Common. SW-facing slopes in montane meadows and montane riparian areas in mixed coniferous forests and red fir forests. 2167 m. *Oroco* 1271.

EPILOBIUM CIATIUM Raf. subsp. GLANDULOSUM (Lehm.) P. Hoch & P.H. Raven. Perennial herb. Common. SW-facing slopes in montane meadows and montane riparian areas in mixed coniferous forests and red fir forests. 2425 m. *Oroco* 750.


ONAGRACEAE


OLEACEAE


ONAGRACEAE


*Orobanchaceae

*Castilleja appendicata* Fernald subsp. PALLIDA (Fernald) T.I. Chuang & Heckard. Perennial herb. Common. Exposed, dry decomposing granitic soils as well as montane riparian areas of mixed coniferous forests and red fir forests. 2107 m. *Oroco* 1210.


OXALIDACEAE

*OXALIS CORNICULATA L. Perennial herb. Occasional. Disturbed soil along water’s edge in valley and foothill riparian communities. 996 m. Orozco 98.

PAPAVERACEAE


PAPAVER HETEROPHYLLUM (Benth.) Greene. Annual. Locally common. Roadsides and disturbed decomposing granitic soils in chaparral and foothill woodlands. 768 m. Orozco & Gardner 606.


PHYRMACEAE


PLANTAGINACEAE


PENSTEMON SPECTOSUS Lindl. Perennial herb. Occasional. Along roadsides and exposed, SW-facing slopes of chaparral and sierra mixed hardwood forests. 1402 m. *Orozco 211.


PLATANACEAE


POLEMONIACEAE


POLYGONACEAE


ERIOGONUM WRIGHTII Benth. var. SUBSCAPOSUM S. Watson. Perennial. Mule Peak in exposed, disturbed decomposing granitic soils in red fir forests and mixed coniferous forests. 2470 m. OROZCO & COLUMBUS 1179.

†ERIOGONUM TWISSELMANNII (J. Howell) Rev. Shrub. Rare, CNPS list 1B.2, and listed by the State as rare. Exposed, talus slopes of Slate Mountain, in mixed coniferous forests and red fir forests. 2411 m. OROZCO & BETERS 699, SHEVOCK, J.R. 5697 (CAS713490, RSA320334), SHEVOCK, J.R. 10041 (CAS713481, RSA320923), SHEVOCK, J.R. 6215 (CAS713488), SHEVOCK, J.R. 9828 (CAS713486, RSA320922), STUART, J. 2423 (RSA804097), SHEVOCK, J.R. 5699 (RSA320335), SHEVOCK, J.R. 6215 (RSA320920).

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ERIOGONUM WRIGHTII Benth. var. SUBSCAPOSUM S. Watson. Perennial. Mule Peak in exposed, disturbed decomposing granitic soils in red fir forests and mixed coniferous forests. 2470 m. OROZCO & COLUMBUS 1179.
**ROSACEAE**


CHAMAEBATIA FOLIOLOSA Benth. Shrub. Common. Growing as a ground cover in understory of giant sequoia forest, red fir forest, ponderosa pine forest, mixed coniferous forest and sierran mixed hardwood forests. 1300–2490 m. *Oroko & Namoff 868, 875, Oroko 152, 655, 1054a, 1334.*

DRYMOCALIS GLANDULOSA (Lindl.) Rydb. var. GLANDULOSA. Perennial herb. Common. Understory and exposed areas in decomposing granitic soils of giant sequoia forests and red fir forests. 1750–2370 m. *Oroko, Jensen & Namoff 1260, Oroko 196, 1103, Twisselmann E.C. 12155 (CAS591286).*


CHAMAEBATIA FOLIOLOSA Benth. Shrub. Common. Growing as a ground cover in understory of giant sequoia forest, red fir forest, ponderosa pine forest, mixed coniferous forest and sierran mixed hardwood forests. 1300–2490 m. *Oroko & Namoff 868, 875, Oroko 152, 655, 1054a, 1334.*

DRYMOCALIS GLANDULOSA (Lindl.) Rydb. var. GLANDULOSA. Perennial herb. Common. Understory and exposed areas in decomposing granitic soils of giant sequoia forests and red fir forests. 1750–2370 m. *Oroko, Jensen & Namoff 1260, Oroko 196, 1103, Twisselmann E.C. 12155 (CAS591286).*

**SALICACEAE**

ACER MACROPHYLLUM Pursh. Tree. Occasional. Valley and foothill riparian areas and foothill woodlands. 1147 m. *Oroko 430, Leskinen, P. 1252 (CAS579075), Twisselmann, E.C. 14193 (CAS543178).*

SALIX DRUMMONDIANA Hook. Tree. Occasional. Restricted to valley and foothill riparian, and montane riparian in mixed coniferous forests and red fir forests. 2045 m. *Oroko 290.*


SALIX LASIANDRA Benth. var. LASIANDRA. Tree. Occasional. Montane riparian areas of mixed coniferous forests and red fir forests. 2300 m. *Oroko 1298.*

SALIX LASOLEPIS Benth. Tree. Occasional. Montane riparian areas of mixed coniferous forests, sierran mixed hardwood forests and ponderosa pine forests. 1207 m. *Oroko & Gardner 590.*

**SAPINDACEAE**


**SAXIFRAGACEAE**


HEUCHERA RUBESCENS Torr. Perennial. Uncommon. Slate Mountain Botanical Area, on steep rocky granitic canyon in a mixed coniferous forest. 2316 m. *Sherlock, J.R. 9856 (RSA789914).*


**RUBIACEAE**

CEPHALANTHUS OCCIDENTALIS L. Shrub. Locally common. Restricted to valley and foothill riparian areas and foothill woodlands. 320–720 m. *Oroko 79, 418.*


GALIUM PARSIFENSE L. Annual. Uncommon. Flood plain along the river in oak woodland communities. 275 m. *Twisselmann, E.C. 14199 (JEPS37842).*


GALIUM TRIFIDUM L. subsp. COLUMBIANUM (Rydb.) Hultén. Perennial herb. Occasional. Montane meadows and montane riparian areas in mixed coniferous forests and red fir forests. 2160–2440 m. *Oroko, Jensen & Namoff 1268, Oroko 748.*
**Microanthus integrifolia** (Hook.) Small. Perennial herb. Uncommon. Montane meadows disturbed by cattle grazing and foot traffic in mixed coniferous forests and red fir forests. 2167 m. *Orozco 1361.*

**Microanthus integrifolia** (Hook.) Small. Perennial herb. Uncommon. Montane meadows disturbed by cattle grazing and foot traffic in mixed coniferous forests and red fir forests. 2167 m. *Orozco 1361.*

**Solanum xanti** A. Gray. Perennial herb. Occasional. Exposed, rock outcrops in mixed coniferous forests and red fir forests. 2394 m. *Orozco 573.*


**Scrophulariaceae**


**Solanaceae**


**Urticaceae**

**Urtica dioica** L. subsp. holosericea (Nutt.) Thorne. Perennial herb. Locally common. Riparian areas of giant sequoia forests, sierra mixed hardwood forests and foothill woodlands. 1773 m. *Orozco & Kamansky 713.*

*Urtica urens* L. Annual. Locally common. Decomposing granitic soils of drying creek in heavily disturbed valley grasslands and foothill woodlands. 297 m. *Orozco & Jensen 797, Shevock, J.R. 10344 (CAS1145531).*

**Valerianaceae**


**Violaceae**


**Alliaceae**


**Allium rivicolum** Douglas subsp. praemorsa. Perennial herb. Occasional. Understory in disturbed soil of mixed coniferous forests and red fir forests. 2200 m. *Orozco & Columbus 1136.*


**Allium semprevirens** Greene. Perennial herb. Occasional. Restricted to montane meadows and montane riparian areas of giant sequoia forests and mixed coniferous forests. 1971 m. *Orozco 672.*

**Vincaceae**

**Arceuthobium campylopodum** Engelm. Perennial (parasite). Common. Growing on red fir in red fir forests and mixed coniferous forests. 2351 m. *Orozco 391.*


**Monocotyledons**

**Alliaceae**


**Allium beciferum** S. Watson. Geophyte. Uncommon. Found growing along old abandoned mining road in open mixed coniferous forests and sierra mixed hardwood forests. 1333 m. *Orozco 1054b.*


**Allium himalayense** Curran. Geophyte. Common. In decomposing granite soils in valley grasslands, foothill riparian, and in the moist duff and dirt that collects on boulders in sierra mixed hardwood forests. 260–1240 m. *Orozco 38, 471, Orozco & Gardner 536, 574.*


**ARACEAE**

**LEMINA MINUTA** Kunth. Perennial herb. Locally common. Aquatic plant in drying creek in valley and foothill riparian and montane riparian areas of mixed coniferous forests and red fir forests. 297 m. *Orozco & Jensen 795.*

**CYPERACEAE**

**CAREX ANGIUSTATA** Boott. Perennial herb. Common. Moist soils of montane meadows and montane riparian areas in mixed coniferous forests and red fir forests 1230–2430 m. *Orozco 742, 1005.*


**CAREX SCHINATA** Murray subsp. SCHINATA. Perennial herb. Occasional. Onion Meadow, near Slate Mountain Summit Trail, in mixed coniferous forests and red fir forests. 2461 m. *Orozco 1308.*

**CAREX ILLOTA** L. Bailey. Perennial herb. Occasional. Moist soils of montane meadows and montane riparian areas in mixed coniferous forests and red fir forests. 2278 m. *Orozco, Klein & Huhn 635a.*


**CAREX NEBRASCENSI** Dewey. Perennial herb. Occasional. Moist soils of montane meadows and montane riparian areas in mixed coniferous forests and red fir forests. 2167 m. *Orozco 1291.*


**CAREX ROSSI** Boott. Perennial herb. Occasional. Slate Mountain Botanic Area, headwaters of Tule River, on rocky metamorphic ridge and slope in open mixed coniferous forest with pinesmat manzanita. 2590 m. *Shevock, J.R. 9832 (RSA788421).*


**IRIDACEAE**

†**IRIS MUNZII** R. Foster. Perennial herb. Rare, CNPS list 1B.3 (rare, threatened, or endangered in CA and elsewhere). Oak-woodland shade on slope adjacent to South Fork Tule River. Several unsuccessful attempts have been made to relocate this historical population. 335 m. *Wills, L.A. 144 (SJSU9898).*

**LYSIRINCHIUM ELBERI** Greene. Perennial herb. Occasional. Montane meadows and drainages in red fir forests and mixed coniferous forests. 2167 m. *Orozco 1270, Shevock, J.R. 10042 (RSA80197).*

**JUNCACEAE**


**JUNCUS ORTHOPHYLLUS** Coville. Perennial herb. Occasional. Montane riparian and montane meadows in red fir forests and mixed coniferous forests. 2157 m. *Orozco 1292.*

**JUNCUS MACRANDRUS** Coville. Perennial herb. Common. Slate Mountain Summit Trail, along streams in montane riparian areas of mixed coniferous forests and hardwood forests. 2423 m. *Orozco 327, 347, 1293.*


**JUNCUS PARRYI** Engelm. Perennial. Occasional. Slate Mountain Botanic Area, on steep rocky granitic canyon in a mixed conifer forest. 2320 m. *Shevock, E.C. 9835 (RSA807024).*


**LILIACEAE**


**CALOCHORTUS LEICHTLINII** Hook. f. Geophyte. Uncommon. Slate Mountain Summit Trail 31E14 at VABM 8704 on rocky metamorphic and granitic ridge top. 2650 m. *Shevock, J.R. 10044 (RSA790364, RSA796225).*

**CALOCHORTUS LUTUS** Lindl. Geophyte. Uncommon. Tule River Indian Reservation. 610 m. *Winblad, Y.W. s.n. 20 May 1933 (UC843663).*


†**EYTHRONIUM PUSATERTI** (Munz & J.T. Howell) Shevock, Bartel & G. A. Allen. Geophyte. Rare. CNPS list 1B.2 (rare, threatened, or endangered in CA and elsewhere). Rocky canyon on Slate Mountain, 0.5 mile SW of Quaker Camp. 2225 m. *Shevock, J.R. 9841 (CAS733430, RSA20416).*

†**FEITILARRIA PINITORUM** Davidson. Perennial herb. Rare, CNPS list 4.3 (limited distribution). Slate Mountain Botanical Area. Along ridge...
off of the Summit Trail 31E14. 2590 m. Shevock, J.R. 9830 (RSA790360), Stewart, J. 610 (RSA804058).


**Melanthiaceae**

*Veratrum californicum* Durand var. *californicum*. Perennial herb. Locally common. Restricted to montane meadows and drainages of montane riparian areas in mixed coniferous forests and red fir forests. 2160–2400 m. *Orozco 320, 374, 1286.*

**Orozco**


*Spiranthes romanzoffiana* Cham. Perennial herb. Occasional. Restricted to montane meadows in mixed coniferous forests and red fir forests. 2167 m. *Orozco 1289.*

**Poaceae**


*Briza minor* L. Annual. Uncommon. Disturbed valley and foothill riparian communities. 323 m. *Orozco 69, Twisselmann 14190 (CAS585613).*


*Bromus laevipes* Shear. Annual. Occasional. Disturbed soil of roadsides in red fir forests and mixed coniferous forests. 2200 m. *Orozco & Columbus 1143.*


*Lamarckia aurea* (L.) Moench. Annual. Common. Rock crevice on SW-facing slope in full sun in chaparral and sier-


**Ruscaceae**


**Themidaceae**


