

Southwest 2015 Potato Collecting Trip Report

Northern Arizona, September 13-25, 2015

Genebank participants:

John (JB) and Ingrid (IB) Bamberg, Alfonso del Rio (AdR), Charles "Chico" Fernandez (CF).
All affiliations: US Potato Genebank (USPG), 4312 Hwy 42, Sturgeon Bay, WI, 54235.
Collection prefix = BdRF numbers 305-321.

Other participants

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1. General Goals, Outcomes, and Observations: We aim to expand geographic coverage, which is generally considered the first goal when seeking to capture *ex situ* diversity. USPG has no germplasm from Prescott National Forest (Yavapai county with reasonably high elevation near Prescott and Jerome cities), which would be the western limit of the potato range. There are only 4 reports of *jamesii* in Yavapai county to our knowledge, all near Prescott city at Ft. Whipple (now site of VA hospital) from the late 1800's (see Correll 1962, p. 277). USPG staff searched there about 20 years ago, as did this 2015 expedition. Prescott is only 5300 ft elevation. Most sites in the highlands (~ 6500 ft) S of Prescott (except around Goldwater Lake) had very appropriate-looking habitats, but we did not get to the Crown King area.

Perhaps the 3 days searching by two people in likely sites in PNF without success should be considered only an introduction to the area. Prescott city is easily accessible. Perhaps a return with extensive searching by 3-4 people for several days, a month or so earlier (as documented in the old herbspes collections), would find *jamesii* in the creek bottoms there. This might also be an ideal site at which to enlist a local cooperater living in Prescott city or Flagstaff or Phoenix, both less than a two hour drive away.

Oak Creek Canyon at Sedona city is too low (4200 ft), but the very top of the canyon to the N at the switchbacks on 89A on the road to Flagstaff is over 6000 ft and looked appropriate from aerial photos. Many sightings of non-potato *Solanum* species have been reported there. We searched there, but without success, although the habitat did look ideal. If *jamesii* really can live at 5300 ft in this area (as per old Prescott sightings), perhaps one might reasonably search

in Oak Creek Canyon at appropriate E-facing habitats near the creek for up to 3-4 miles S of the switchbacks that climb out of the canyon.

Next we sought to explore more sites in Coconino county at the general areas visited in 2014: From Flagstaff to the Grand Canyon in cooperation with local collectors, additional sites in the Mogollon Rim area between Winslow and Payson, and on the Rim between Payson to Heber-Overgaard. We particularly sought habitat around lakes, suspected to be gathering sites for migrating birds and other possible carriers of potato seeds.

The seasonal climate and timing of the trip this year coincided to make what appeared to be good conditions for collecting germplasm (for example, we sometimes found large mature fruit on *jamesii*, which is rather rare). On the other hand, heavy rain before the start of the trip and on the 21st - 22nd thwarted exploration around some Flagstaff lakes, Bear Canyon Lake and other lakes in the central section of Rim Road (300), and other sites accessible only by dirt roads. We would particularly like to find more *fendleri* in this area. In some sites where potatoes were abundant in 2014, they were surprisingly rare this year, for no apparent reason. See section 8. below for summary of possible future exploration in the area.

2. Preparation: Permit from USFS for all NFs of the Southwest Region (see Permit section). Garmin GPSs borrowed from PEO, and uploaded tracks, waypoints and notes from DeLorme Topo 8 and GoogleEarth. We reviewed all known potato sightings and herbarium records (particularly from SEINET) and also scouted and marked promising new sites to explore in electronic maps before the trip. We navigated on roads mostly by laptop, then recorded walking tracks, sites explored, and collection sites in the GPS. Some division of labor made collecting more efficient: AdR navigating, helping collect *in vitro* shoots, taking photos; JB driving, taking field notes and GPS coordinates, making and caring for *in vitro* and potting-medium plantlets; IB taking additional notes and photos; CF taking photos, collecting tubers, carrying and indexing tubers and fruit, extracting seeds and establishing plants at USPG. As in previous years, GoogleEarth aerial photos were very helpful in showing the exact ground cover, aspect (steep and shaded NE preferred), and soil moisture potential of the micro-locations which are the small niches in which potatoes are most likely to appear within a general area. This year we came to understand that GoogleEarth close-up images can be used later without internet if you previously zoom in on them (when you do have internet access), so they are memorized in cache on the laptop hard-drive. As in previous expeditions, the conclusion was again validated that models based on general eco-geo parameters are virtually useless for predicting the micro-habitats where potatoes may be found, except perhaps that they are not likely to be found far outside the known range, nor below 5000 ft.

3. Techniques: Travel was by air to Arizona, then we rented a 4W drive vehicle. We collected rooted plantlets in potting medium, shoots *in vitro* (see below), and fruits and tubers as available. In the 2014 expedition, we tried collecting meristems in agar-based antimicrobial (PPM) media, but that almost totally failed. This year we tried to root whole shoots in agar-

based medium in plastic vials, but only some of these established in the genebank. Apparently, more work is needed to find a fully reliable technique for *in vitro* capture of wild plants. We also brought commercial potting medium (ProMix) along to root plantlets in, which appears to be superior to using native soil. So agar media in 100 plastic culture tubes and enough dried ProMix to fill 12 plastic quart boxes (once sold for home food freezing, now hardly available) were carried to AZ. Bleach was purchased on site. Drove Jeep 1650 miles and the saved GPS walking tracks totaled ~30 miles.

4. Germplasm: *Solanum jamesii* and *S. stoloniferum* form *fendleri* were collected. Populations were sampled from a total of 17 sites. Of these, 4 were re-collections (to get a broader sample of plants than that which survived from the 2014 expedition). Of the 13 new sites, 9 were previously unreported locations. This expedition added three new samples of *fendleri* for which USPG had no germplasm from this NW corner of the range before the 2 samples discovered in 2014. Shoots established in the USPG winter greenhouse produced tubers. These, along with collected tubers and seeds will be organized for a grow-out in spring 2016 for the purpose of producing sib-seed of all propagules from each respective collection site. Collections were given temporary codes (#) during the expedition, and assigned BdRF collector codes and PI numbers later. We also scouted for *Ipomoea* spp. at the request of Bob Jarret of the genebank S9. We documented 4 sites and collected some shoots in potting mix and *in vitro* but none survived (this part of the trip will be separately reported).

5. Deposit of records, germplasm and files:

US Potato Genebank, 4312 Hwy 42, Sturgeon Bay, WI, 54235. 920-743-5406.
john.bamberg@ars.usda.gov. Query GRIN text "BdRF". Detailed trip log, GPS track and Waypoints files, and additional miscellaneous notes available from JB at USPG.

6. Claimed USPG trip expenses: JB=\$2645, AdR=\$2450, CF=\$1383, Total=\$6487.

Collectors that were not funded by USPG greatly contributed to the trip. KO had previously identified the #K307 and #Chavez sites and was wholly responsible for predicting plants found at #Bird. IB was wholly responsible for predicting the plants at #307Rocks; was the first to find plants at #Clover Creek, and the only collector who found plants outside the canyon proper; also contributed many of the best photos. LL and BP joined us for only one day but were collecting and discovering sites elsewhere, which we expect to eventually result in new germplasm samples at USPG. We thank K. Williams of PEO for \$7K funding.

7. Itinerary and Collections abstract:

(collections at sites are suffixed "(J)" for *jamesii* and "(F)" for *fendleri*).

Sun13th: AdR and JB fly to PHX, rent 4WD Jeep *Compass* from *National*, explore access to Crown King and Horse Thief Lake near Bumble Bee & Bloody Basin road, then to Prescott to lodge *Holiday Inn Express*.

Mon14th: S on Walker road to look at Lynx Lake environs. Continue S looking along Walker road and toward Mt. Union in steep canyon. Looking all the way back toward Prescott via Senator Highway to Groom Creek and scout access to Goldwater Lakes. Lodge Prescott.

Tues15th: Look Prescott Town Square. To E to look at Old Miner road canyon then look at Groom Creek and School Campground. Back N to Upper Goldwater Lake looking along both shores. Lower Goldwater Lake is not accessible. Back to Prescott and Ft. Whipple (now VA hospital at edge of town) to look along Granite Creek bottoms and then up 89 to look under bridge at Granite Creek. E looking along 89A, up to summit and over to Jerome, scouting road to Mingus. Down to Cottonwood to lodge at *The View* motel.

Wed16th: Back up W on 89A looking up to Jerome and to summit looking around Potato Patch campground. S across 89A to look around Mingus Lake at Elk Wells and then E to look at escarpment at T-intersection. Back down through Jerome and Cottonwood to Sedona and at N end of canyon along 89A to look where it rises up to >6000 ft approaching Flagstaff. Lodge N of Flagstaff at *Ski Lift* cabins.

Thu17th: on 180 N to Red Mountain access road known from 2014, for *in vitro* shoots, **#Red(J)**. Back S to Snowbowl road and E to look near ski parking area. Back down to 180 and S to look along Schultz Pass Road to E as it skirts N side of Mt. Elden. Became too rough to continue E to 89, so backtrack to Flagstaff and E on 40 to Winona for *in vitro* shoots at 2014 site, **#Win(J)**. W through Winona on Townsend-Winona road to look at Slayton Ranch road corner and back E to look at 419 (Leupp road) corner, then N about 1.2 miles to find site #419, pick one berry, **#419(J)**. To Flagstaff airport to pick up CF and IB and back to lodge at *Ski Lift* cabins.

Fri18th: N on 87 to Red Mountain access road for plants at 2014 site, **#Red(J)**. N to 2014 site, **#FR87** for plants. To Grand Canyon Village for lunch, to Buggeln parking lot to meet LL and BP and observe long known Buggeln (J) site. With BP and LL, went E and S on 64 then NW on 307 to look for previously observed KO site K307-1 (none found). Then W on 307 to look for previously observed KO site K307-2, collect *in vitro* shoots and plants of **#K307(J)**. Then W on 307 to look at rocky canyon and find new site plants at **#307Rocks(J)**. BP and LL separate from USPG group, which proceeds to Cameron, Flagstaff, Winslow to lodge at *Quality Inn*.

Sat19th: Winslow down 87 to 69 and W to Chavez Canyon which crosses perpendicular to 87. The more showy geo-feature is Jack's Canyon which runs parallel to the W of 87, near KO1093 site for plants and *in vitro* shoots, **#Chavez(J)**. S on 87 and E on Enchanted Lane road and S on Green Ridge Drive to Cedar Circle and down footpath to what we knew as Cherry Creek, but actually is East Clear Creek, for tubers only, **#Cherry/Clear Creek(J)**. Back to 87 and S to 95 and E/S to intersection with 96 at bridge for 3-4 plants, *in vitro* shoots, one tuber, **#95Bridge(J)**.

Back to 87 and S to 751 E to Blue Ridge Reservoir-- but road work results in no access. S on 87 to Clint's Wells and to Payson to lodge at *America's Best Value*.

Sun20th: N on 87 to 147 E and false Deaver 1695 site (later found to be mistaken coordinates for a 1946 *jamesii* from Mormon Lake). Back W to 87 and across to Licher 1588 [2006] site, **#Clover Creek(F)**. Clover Creek was later recognized as more specific name than originally denominated "West Clear Creek". To Strawberry for lunch and then 300 E toward Potato Lake (no access N through campground). Back to 87 and 616 for N approach to Potato Lake (no access). Then back to 300 to 147 N to successful access and search at Potato Lake (probably named for shape of lake). Back to Payson to lodge.

Mon21st: E on 260 to Willow Springs Lake, **#Willow(J)**, **#Willow(F)**. Rim road 300 W to SE of Woods Canyon Lake dam, at Mason 2291 [1963] site, **#Woods-S(F)**. E on 260 to Heber to observe reliable BAM05 [1993] site. Then Heber-Overgaard cemetery, **#HOcem(J)**. Look in town at site of old BAM 004 [1993], observing rare small plants. Back to Payson to Lodge.

Tues22nd: N on 260 to 87 and Lake Mary Road (Rt. 3) to Flagstaff, looking along way. At Mormon Lake E banks could not find expected abundant *jamesii*. To Flagstaff and meet KO for tour of her work at Museum of Northern Arizona. Then USPG group goes to Mt Elden Lookout at road to E facing canyon slopes at lower Oldham Trailhead. Lodge *Days Inn* on Woodlands Village Blvd, Flagstaff.

Wed23rd: Meet KO at Ranger Station E side of Flagstaff, trail to Elden Spring, **#Elden(J)**. With KO back to Winona site to collect plants, more *in vitro* shoots, tubers, **#WIN(J)**. Return to 419 site to collect plants, tubers, and *in vitro* shoots, **#419(J)**. Continue NE on 419 = Leupp looking along the way to NF boundary. Backtrack to Townsend-Winona road and W to bird sanctuary at Rio de Flag, **#Bird(J)**. Part with KO, lodge Flagstaff.

Thurs24th: Return to **#419(J)** collection site to get *in vitro* shoots in 2% bleach for 10 minutes since 20% nearly killed others. To Mormon Lake W shore road, looking at various spots, **#Mormon Lake-W(J)**. To Phoenix, lodge *Econolodge* near PHX.

Fri25th: Drive to airport, return car, fly to Wisconsin, drive home, arriving 10:30 PM.

Tables. List of collections, general and detailed

Full narratives with location coordinates, habitat and plant descriptions, collection details and disposition are available in GRIN by query on individual PI number or the "BdRF" collector prefix. Also access GRIN for updates and eventual evaluation data on these stocks.

Temp coll #CODE	Sept date	BdRF	PI	Sp.	site origin	plants	IV shoots	Total plants estab.	fruits	seeds	tubers
RED	17+18	305	676000	jam	re-coll	5	7	7			3
WIN	17+23	306	676001	jam	re-coll	0	2				10
FR87	18	307	676002	jam	re-coll	0	0				5
K307	18	308	676003	jam	herb	8	6	6			2
307Rocks	18	309	676004	jam	new	7	4	4			6
Chavez	19	310	676005	jam	herb	0	0				1
Clear Creek	19	311	676006	jam	new						10
95/96 bridge	19	312	676007	jam	re-coll	0	0				1
Clover Creek	20	313	676008	fen	herb	1	0	1	6	120	21
Willow(F)	21	314	676009	fen	new	5		4			17
Willow(J)	21	315	676010	jam	new		1	1			3
Woods-S	21	316	676011	fen	new		0		8	320	10
HO cem	21	317	676012	jam	new	0	0		19	750	
Elden	23	318	676013	jam	herb	5	3	3			
419	17+23	319	676014	jam	new		7	7	6	30	38
Bird	23	320	676015	jam	new		5	2			28
Mormon-W	24	321	676016	jam	new	0	0				1

Site: Found by herbspec record, known as re-collection, or new scouted *de novo* by habitat.

Plants / IV: Coll. = viable to USPG, estab.= established at USPG, (blank indicates not collected).

PI 676000. BdRF 305. *S. jamesii*. United States. Arizona. Coconino County. Coconino National Forest. Near Flagstaff. Site of herbspec by P. West [1996]. N of Flagstaff on 180. In ditch on W side of 180 N of Red Mountain trailhead access road. At WSG 35.537981° x -111.852887° and 6745 ft. Coll #Red. September 17, 2015. Scattered plants, small and without flowers or fruit (much less abundant and robust than observed in 2014). Open sun or in grass and rabbit brush, sandy gravel soil. Collected plants, in vitro shoots, 3 tubers.

PI 676001. BdRF 306. *S. jamesii*. United States. Arizona. Coconino County. Coconino National Forest. Near Winona at Walnut Canyon. From Flagstaff E on 40 to Winona Exit 211. N then W on Rt 349, Townsend-Winona Road. Under NE corner of abandoned bridge just N of new bridge which is just E of Spud Drive. At WSG 35.211761° x -111.421009° and 6200 ft. Coll #Win. September 17, 2015. About 50 plants, most spindly, no fruit, flowers rare. W facing slope under shade of bridge, rich black alluvium with grass and brush. Collected 10 tubers and in vitro shoots.

PI 676002. BdRF 307. *S. jamesii*. United States. Arizona. Coconino County. Coconino National Forest. Near Flagstaff. Site of herbspec by K. Christie [2005]. N of Flagstaff on 180 at ~ 1.5 mile past powerline and 9 miles before jct 64. At wash to E of FR87, and both sides of 180 ditch. At WSG 35.594609° x -112.004135° and 6240 ft. Coll #FR87. September 18, 2015. Scattered healthy green plants. In full sun in sandy red soil in wash, herbs and rabbit brush. Collected 5 tubers.

PI 676003. BdRF 308. *S. jamesii*. United States. Arizona. Coconino County. Lee Canyon. Kiabab National Forest. Near Grand Canyon. Site of observation by K. Olmon 631. From Grand Canyon E and S on 64, then W on FR307 for ~8 miles to cattle guard and ~ 1/2 mile E on dirt track which runs on S side of a fence. NW edge of large open meadow with dry watercourse running down middle. At WSG 35.942330° x -111.870760° and 6520 ft. Coll #K307. September 18, 2015. Many scattered green plants to 15 cm. Open field in moist, light brown soil, typically under rabbit brush. Collected plants, in vitro shoots, 2 tubers.

PI 676004. BdRF 309. *S. jamesii*. United States. Arizona. Coconino County. Lee Canyon. Kiabab National Forest. Near Grand Canyon. From Grand Canyon E and S on 64, then W on FR307 for ~10 miles. At the shear 15 ft E-facing rock cliffs on W side of canyon and along ~1 mile loop where 307 follows very close to the creek. At WSG 35.956160° x -111.892860° and 6680 ft. Coll #K307Rocks. September 18, 2015. Thousands of green, robust, scattered plants of various sizes, some flowering. In open in mulch among rocks or under pines, and on berms near creek. Shady wooded creek bottom with some grass and herbs. Collected plants, in vitro shoots, 6 tubers.

PI 676005. BdRF 310. *S. jamesii*. United States. Arizona. Coconino County. About 3 miles SE of Chavez Mountain. Coconino National Forest. Near Winslow. Site of K. Olmon 1093 observation. From Winslow SW on 87 for ~32 miles to rough jeep trail 69 and ~2 miles N. Along 69 and to jct of Chavez Draw and Jack's Canyon Creek. At WSG 34.743714° x -111.090651° and 6140 ft. Coll. #Chavez. September 19, 2015. Very rare. One mature plant 30 cm in steep rocky bank of Jack's Creek, a few others spindly, yellow under junipers. E-facing steep bank of Jack's Canyon Creek among rocks and brush or in dry rocky soil in grass under Junipers. Collected plants, in vitro shoots, 1 tuber.

PI 676006. BdRF 311. *S. jamesii*. United States. Arizona. Coconino County. Coconino National Forest. From Winslow SW on 87, then E on FR319 = Enchanted Gardens, S on Green Ridge, S on Cedar to dead end and walk down trail ~1.5 miles to Mack's Crossing ford, then ~500 ft up trail on opposite bank of East Clear Creek. Just below trail. NE-facing steep banks of East Clear Creek. At WSG 34.619194° x -111.093639° and 6300 ft. Coll #Clear Creek. September 19, 2015. About 40 yellowed plants up to 15 cm without flowers or fruit. Among rocks, grass, mulch under shade of brush and large Ponderosas. Collected 10 tubers.

PI 676007. BdRF 312. *S. jamesii*. United States. Arizona. Coconino County. Coconino National Forest. Near Pine. From Winslow SW on 87, then SE and S on FR95 to jct FR96 at S side of bridge, at parking lot & recreational area. S banks of East Clear Creek along footpath W of bridge, and under SE corner of bridge. At WSG 34.550477° x -111.164073° and 6510 ft. Coll #95/96 bridge. September 19, 2015. A few scattered spindly plants without flowers or fruit. In N exposure near creek, under shade of trees, brush and grass. Collected plants, in vitro shoots, one tuber.

PI 676008. BdRF 313. *S. fendleri*. United States. Arizona. Coconino County. Coconino National Forest. Near Pine. Site of Licher 1588 [2006]. From Pine, N on 87 then NW and E on 142 to trailhead, then along Clover Creek to just inside Coconino NF boundary (sign at fence says "West Clear Creek"). NE-facing banks of Clover Creek. At WSG 34.511867° x -111.360902° and 6800 ft. Coll #Clover Creek. September 20, 2015. Occasional small green plants, and some clusters of dozens of larger green, mature plants with mature berries. Above creek on NE-facing slopes among rocks and grass. At base of or in ledges of steep rocky shaded E-facing cliffs. Moist black soil and grass, herbs, in mulch. Obviously much more favorable habitat than other side of NF boundary fence where there is heavy grazing pressure from cattle. Collected plants, in vitro shoots, 6 fruit yielding 120 seeds, 21 tubers.

PI 676009. BdRF 314. *S. fendleri*. United States. Arizona. Coconino County. Sitgreaves National Forest. Near Heber. Willow Springs Lake. From Heber SW on 260 then N on access road to lake. From N point of lake, about 1000 ft. N of dam. Above creek banks. At WSG 34.318365° x -110.877507° and 7520 ft. Coll #Willow(F). September 21, 2015. Scattered, rare, small yellow plants. On both E and W-facing creek banks. *S. jamesii* growing here too. In rich, black soil among grass and rocks and protected by fallen trees. Collected plants and 17 tubers.

PI 676010. BdRF 315. *S. jamesii*. United States. Arizona. Coconino County. Sitgreaves National Forest. Near Heber. Willow Springs Lake. From Heber SW on 260 then N on access road to lake. From N point of lake, about 1000 ft. N of dam. Above creek banks. At WSG 34.318365° x -110.877507° and 7520 ft. Coll #Willow(J). September 21, 2015. Scattered, rare, small yellow plants. On W-facing creek banks. *S. fendleri* growing here too. In rich, black soil among grass and rocks and protected by fallen trees. Collected in vitro shoots and 3 tubers.

PI 676011. BdRF 316. *S. stoloniferum* form *fendleri*. United States. Arizona. Coconino County. Sitgreaves National Forest. Near Heber. Woods Canyon Lake. Approx. site of C. T. Mason 2291 [1963], Hesselber s.n. [1966]. From Heber SW on 260 then NW on Rim road. From dam continue to 1/2 mile SE along Chevelon Creek. Both sides of creek (both N and S exposures). At WSG 34.33176° x -110.93500° and 7550 ft. Coll. #Woods-S. September 21, 2015. About 60 plants, some large and dark green with mature fruit, no flowers. Steep shady creek banks, especially in mulch atop rock shelves, among large ponderosas, firs, ferns, oaks. Collected in vitro shoots, 10 tubers and 8 fruit yielding 320 seeds.

PI 676012. BdRF 317. *S. jamesii*. United States. Arizona. Navajo county. Sitgreaves National Forest. Heber-Overgaard cemetery. In Heber from 260 go S on Buckskin Canyon Rd. to second right (W) = Memorial Park Rd, then 1/2 mile W. Around perimeter of cemetery. At WSG 34.426934° x -110.604849° and 6480 ft. Coll #HO cem. September 21, 2015. Many hundreds of green plants to 20 cm, rarely with mature fruit. In moist, sandy, grassy margins of cemetery and in open among graves. Under junipers along N perimeter at Black Canyon. Collected plants and in vitro shoots, 19 fruit yielding 750 seeds.

PI 676013. BdRF 318. *S. jamesii*. United States. Arizona. Coconino County. Mt. Elden. Coconino National Forest. Near Flagstaff. Site of herbspec by J.D. Morefield [1985]. Rt 89 in Flagstaff. Hiking path from Ranger Station to SE shear cliffs at foot of Mt. Elden, and along ~2 mile trail to Elden Spring. At WSG 35.227958° x -111.601394° and 7100 ft. Coll #Elden. September 23, 2015. Occasional single plants, usually small to 15 cm, green but flowers scarce and no fruit. In grass and among herbs, protected by brush and in shade. E and S exposures. Collected plants and in vitro shoots.

PI 676014. BdRF 319. *S. jamesii*. United States. Arizona. Coconino County. Coconino National Forest. Near Flagstaff. From between Flagstaff and Winona on 394 = Townsend-Winona Rd go NE on 419 = Leupp Rd for ~1.2 miles to E at N Copley Rd intersection, then N along dirt frontage road on E side of 419. W roadside at T-intersection of dirt lane going E to private ranch. At WSG 35.230574° x -111.426509° and 6250 ft. Coll #419. September 23, 2015. Hundreds of robust green plants, many large and some with mature fruit. In mulch under shaded E side of large junipers and protected by fallen branches. Collected in vitro shoots, 6 fruit that yielded 30 seeds, 38 tubers.

PI 676015. BdRF 320. *S. jamesii*. United States. Arizona. Coconino County. Coconino National Forest. Near Flagstaff. From E Flagstaff 89 about 4.6 miles E on 394 = Townsend-Winona Rd, then N on dirt driveway of parking lot; hike down to canyon. Rio de Flag canyon. At WSG 35.244433° x -111.489105° and 6420 ft. Coll #Bird. September 23, 2015. Rare. Few small, yellow plants with no flowers or fruit. In grass and among herbs in creek floodplain, protected by brush and low-hanging juniper branches. Collected in vitro shoots and 28 tubers.

PI 676016. BdRF 321. *S. jamesii*. United States. Arizona. Coconino County. Mormon Lake. Coconino National Forest. Near Flagstaff. W banks of (dry) Mormon Lake across from other sites found on E bank: Bamberg PI 592423 [1995]; herbspes by Hammond [1994], Tourney [1892]. From Flagstaff ~21 miles SE on Lake Mary Road = Rt 3, then W on 209 that circles to W side of lake, then S about 0.3 miles from jct. with Double Springs Campground rd. About 100 ft N of natural drainage that allows access over steep, 15-ft high cliffs. Just at shoreline. At WSG 34.939699° x -111.487743° and 7140 ft. Coll #Mormon-W. September 24, 2015. Very rare. Only 2 small yellow plants seen. Growing under ferns and mints. Collected one tuber.

8. Summary of additional and more intensive future exploration possibilities in the area.

- a. More at creek bottoms very close to Prescott / Whipple vis-a-vis, 1800's herbspecs.
- b. More at E-facing cliffs of Mingus escarpment near Jerome.
- c. Central Rim lakes as suggested by success at Willow, Woods.
- d. Farther NW on 307 near Grand Canyon
- e. Sites of KO observations at lakes S of Flagstaff where we could not go in 2014 or 2015 due to impassible dirt roads after rainy weather
- f. More at N end of Oak Creek Canyon between Sedona and Flagstaff.

9. Permit

USDA Forest Service

PERMIT

Permit FS-2400-000 (V. 04/2012)
OMB No. 0596-0065

Region: Southwest
National Forest: All
Ranger District: All

Forest Products Free Use Permit
PERSONAL USE ONLY (Not for Resale)
(Ref. FSM 2400 and FSH 2409.18)

Permittee's Name and Complete Address:		Permit No.		Preparation Date	
Name:	John Bamberg	R-3 RO 256		9/02/2015	
Address:	US Potato Genebank	Effective Date	Termination Date	Lead Ticket Numbers	
	4312 Hwy 42	9/03/2015	9/02/2016	From: N/A	Thru: N/A
City/State:	Sturgeon Bay, WI	Product Plan		From:	Thru:
Zip Code:	54235	Number:	Name:		
Permittee Identification	Type	Permit Area Description:			
DL B518-4625-8218-03	WI D.L.	Southwestern Region, All Forests			
Vehicle(s) Information					
Year:	Rentals	Year:			
Make:		Make:			
Model:		Model:			
Color:		Color:			
License:		License:			
State:		State:			

Remarks: Free-Use permit for collections of botanical specimens to be used for scientific purposes. Authorization pursuant to 36 CFR 223.2(c). Wilderness addendum is made part of this permit. (Use as appropriate)

Cell Phone John Bamberg 920-559-2006
Names of Other Collectors(s):
Alfonso del Rio 608-217-7422
Charles Fernandez 920-559-9362

Other vehicles may be utilized.

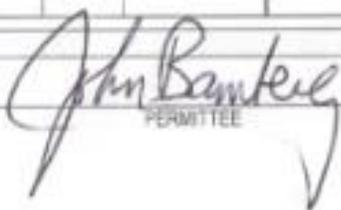
**Collection tools must be cleaned between population sampling.

**Any publications resulting from Forest Service collections, shall be sent to the Regional Botanist for the Southwest Region, electronically. Forest Service shall be identified as a cooperator in the publication

PRODUCT DESIGNATION					
Product	Species	Unit of Measure (UOM)	Quantity	Rate per Products (UOM)	Total Value (Frac)
Total Permit Value \$					

PRODUCT QUANTITY REMOVAL RECORD											
Date	Time	Quantity Removed	Date	Time	Quantity Removed	Date	Time	Quantity Removed	Date	Time	Quantity Removed

SIGNATURES


 PERMITTEE

9-4-15
Date

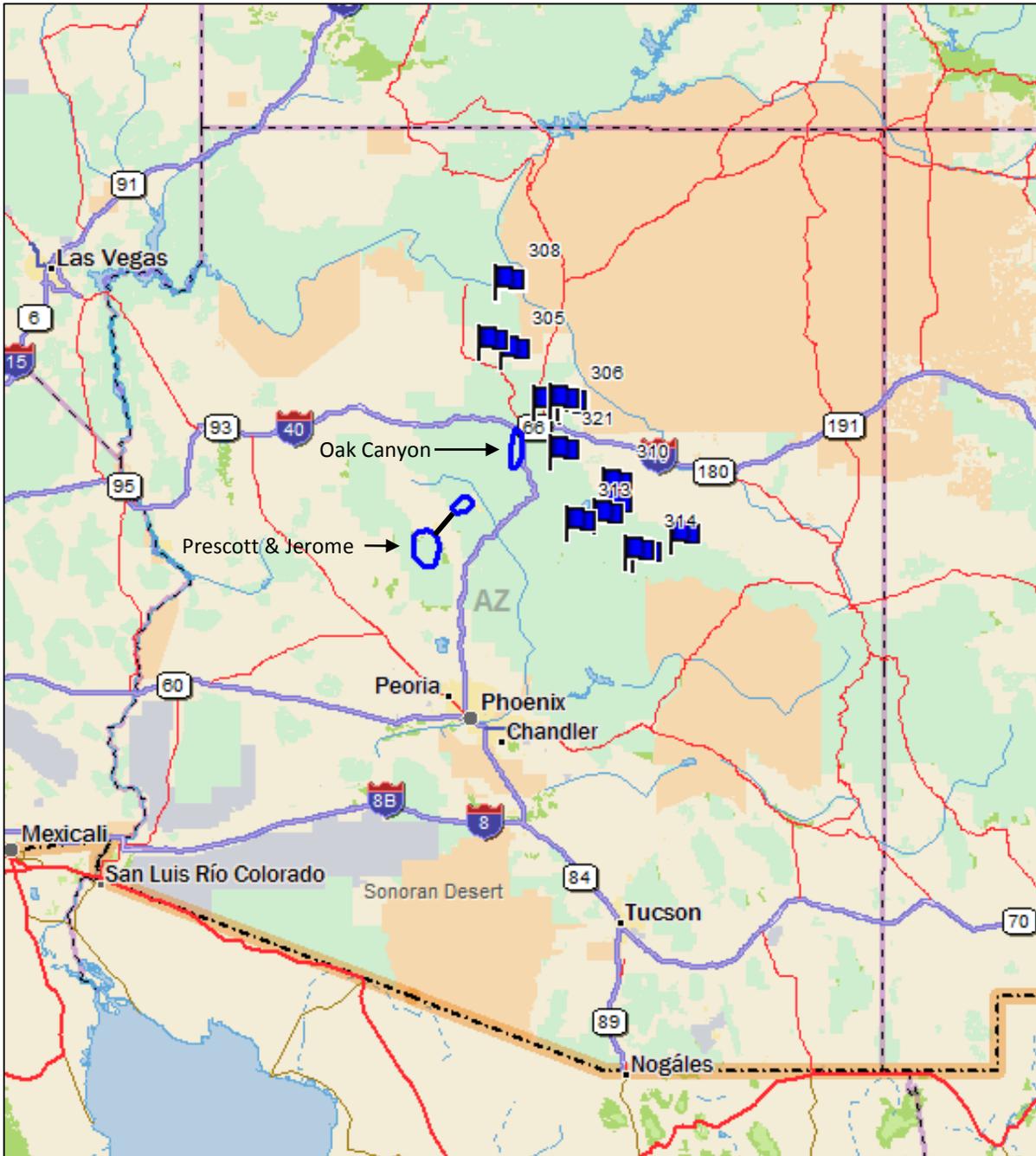

 FOREST OFFICER

9.2.15
Date

10. Photos and maps of locations, habitats, and plants

General Area Map

Places looked as loops and collections by BDRF number as flags



#Red BdRF 305



IB searching #Red *jamesii* habitat. View is to NE to route 180.



#Win BdRF 306



#WIN *jamesii* location (looking to W under abandoned bridge). Arrow shows location of most plants.



#FR87 BdRF 307. Plants within green perimeters.

Habitat insert photo taken from view of white arrow.



Buggeln (J) PI 612454 [1999] habitat with CF (not collected in 2015)



Buggeln site *jamesii* protected by brush (at arrow above)



Observation KO307#2 = KO631 verbatim coordinates; sites of #K307 and #307Rocks collections



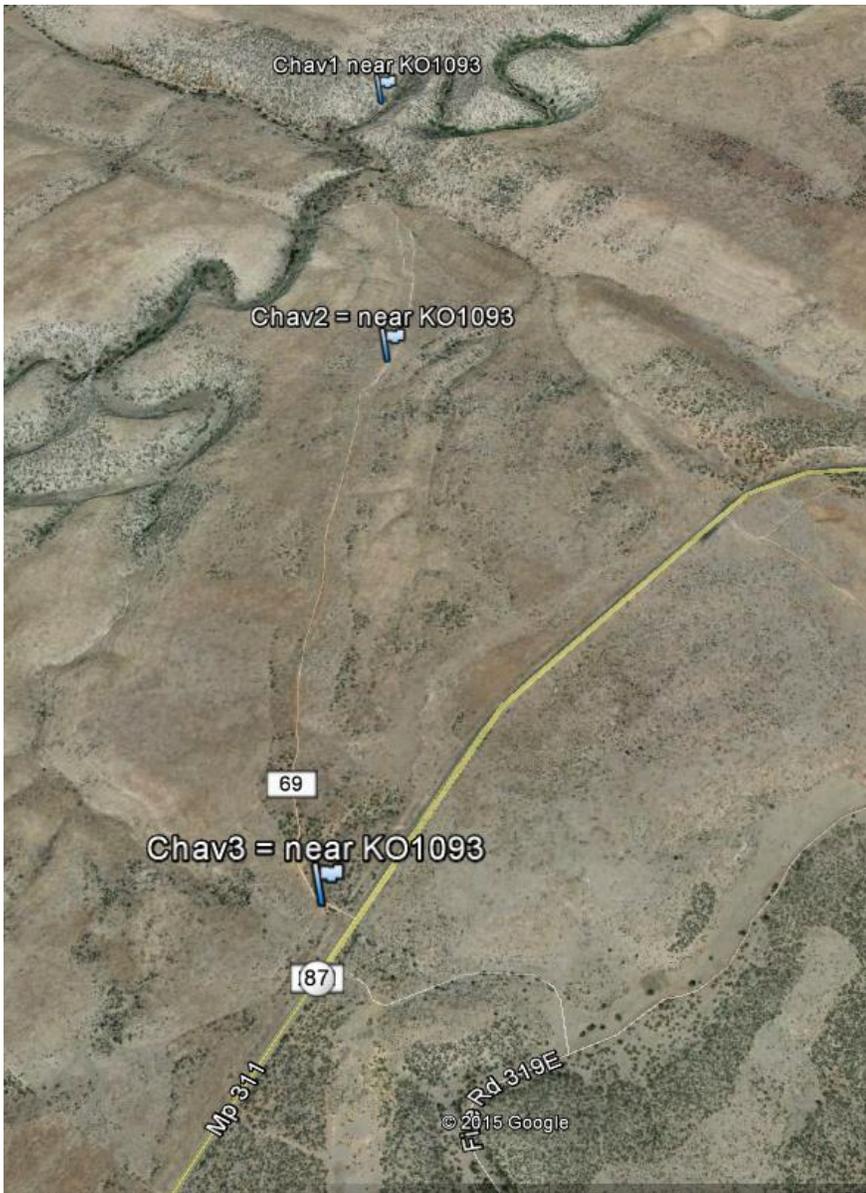
#K307 habitat with CF, BP, LL (L-R) ↓



#307Rocks flowering *jamesii* →



#Chavez BdRF 310 (all three Chavez Draw finds were combined)



Approaching Chavez Canyon and Chav1



Chav3 site with one rare struggling *jamesii* plant



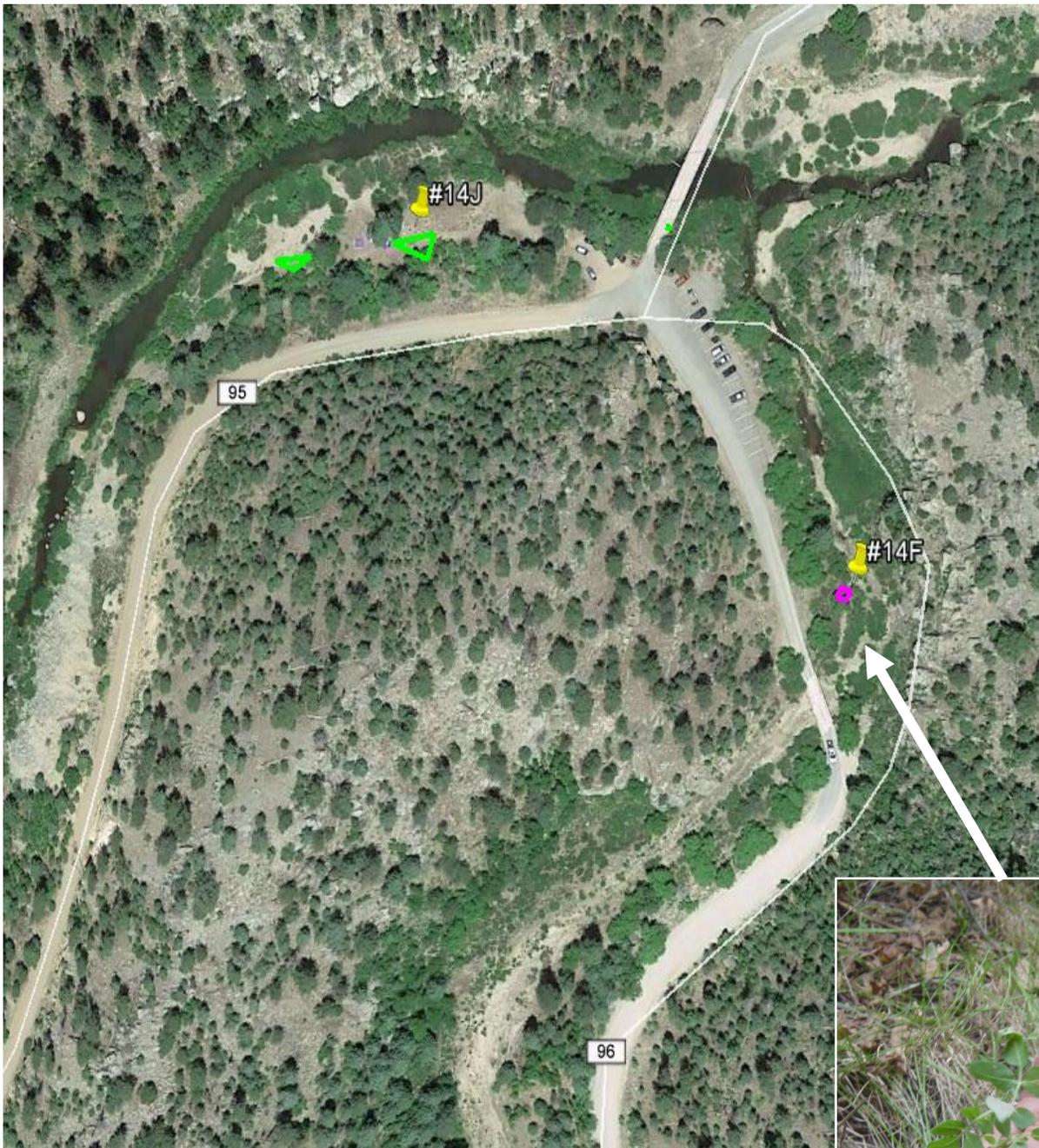
#Clear Creek BdRF 311 (initially recorded as "Cherry Creek")
Viewed looking to S.



AdR at Clear Creek ford



#95/96 bridge BdRF 312 (same locations as 2014 expedition #14) *fendleri* (inset) was observed only, (J) was re-collected in 2015.



#Clover Creek BdRF 313 (herbspec Licher 1588 [2006]) *fendleri*



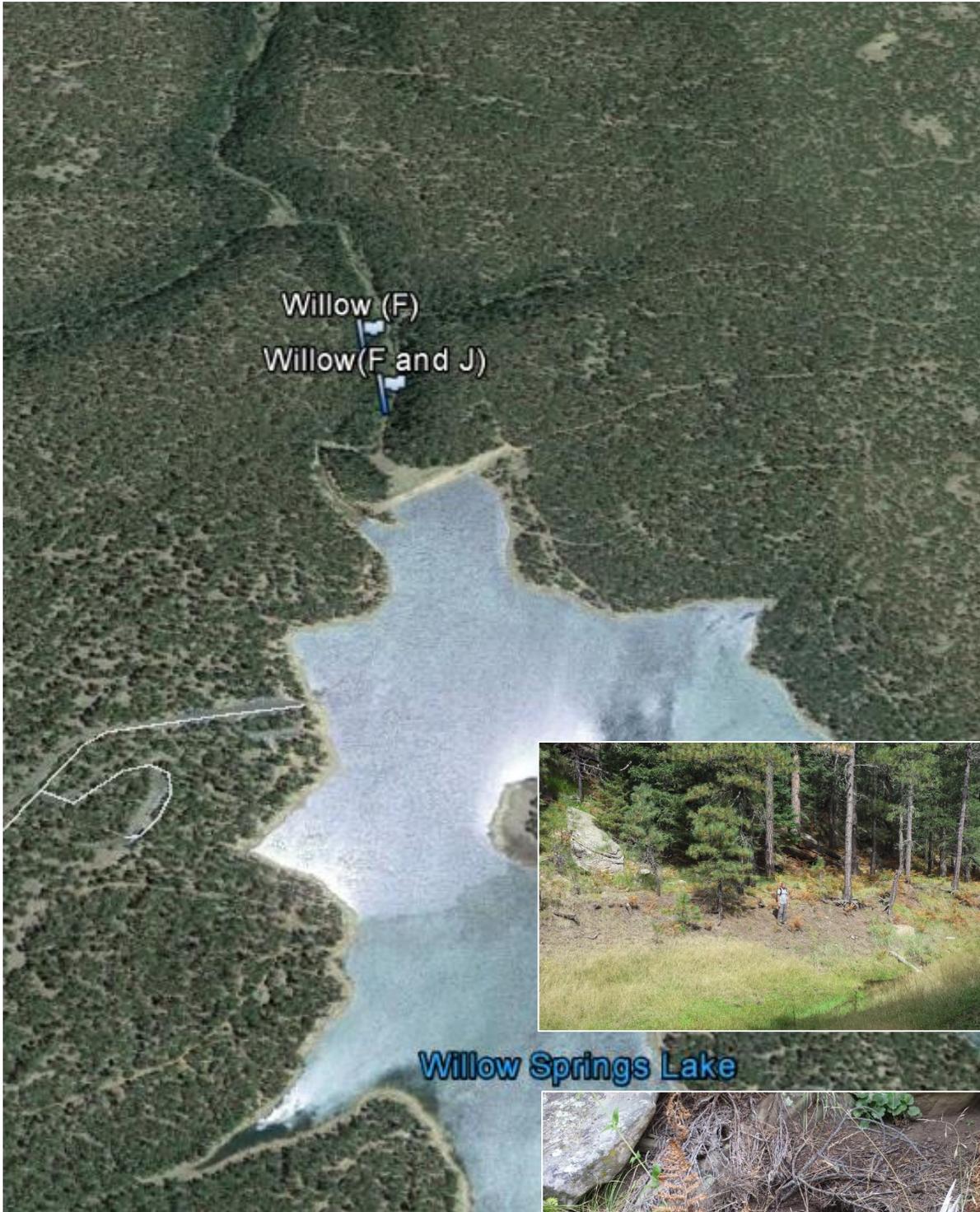
#Clover Creek habitat ↓ and IB showing *fendleri* appearance →



Potato Lake (good habitat, but no potatoes found).



#Willow BdRF 314&315. Both species within a few feet of each other.



small yellow *fendleri*

#Woods-S(F) BdRF 316. Sites found by JB and CF.



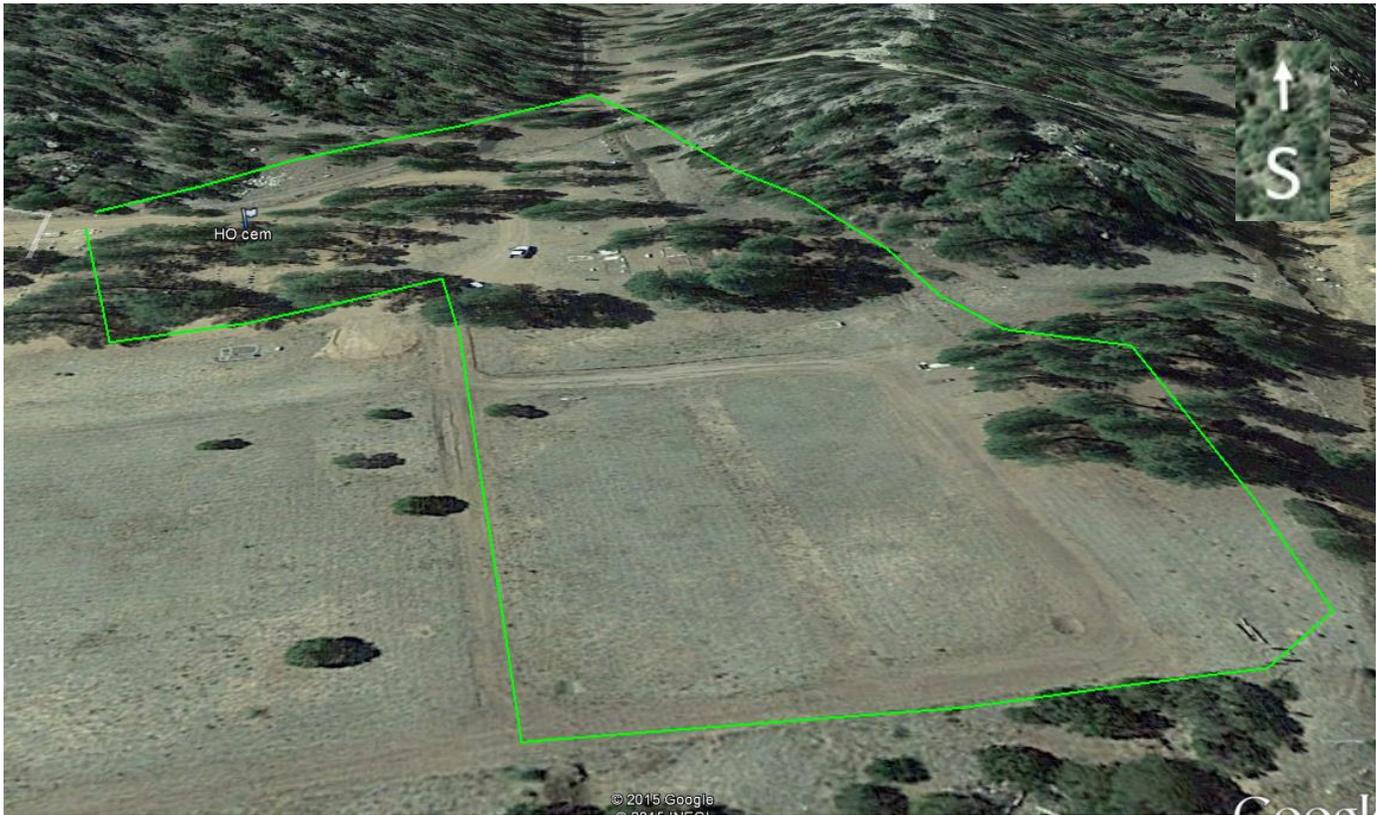
#Woods-S "CF" site for *fendleri*. AdR collecting plants growing in mulch on rock shelf



BAM005 = PI 578238 [1993] reliable *jamesii* site W of Heber
(not collected)



#HO cem BdRF 317. (plants particularly abundant around the cemetery perimeter as shown). Map view is to South.



jamesii plant with two mature fruit seen at flag in aerial photo above



Mormon Lake (east shore), site usually reliable for robust *jamesii* (e.g. PI 592423 [1995], observed [2001]), but none seen in 2015.

Parking lot looking west



Rocky shore banks below parking lot



#Elden collection sites (J) BdRF 318. All combined to #Elden.



Collecting along trail from Flagstaff Ranger Station to Elden Spring (CF, KO, JB, AdR)



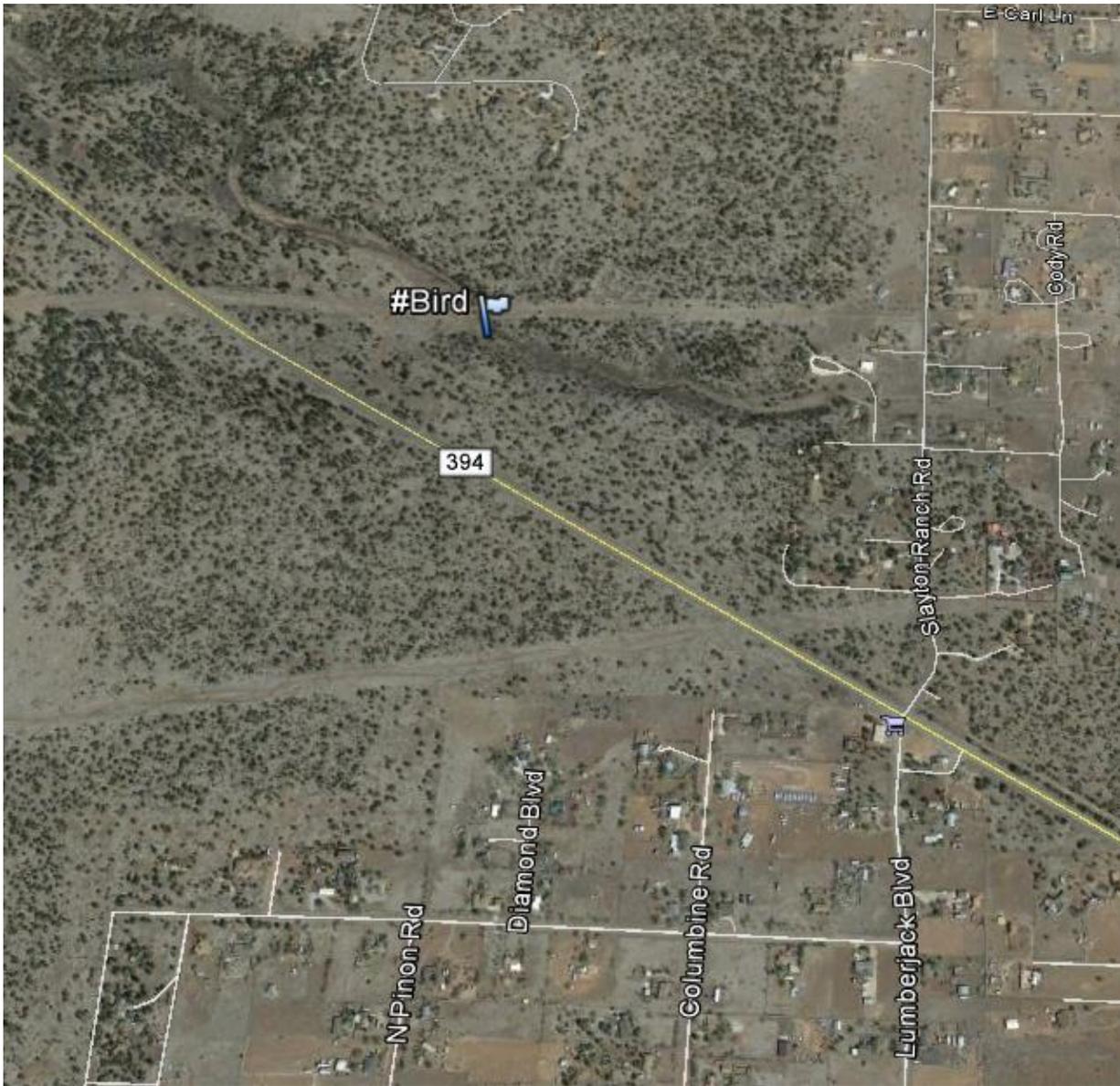
#419 BdRF 319. Most plants were found at the juniper at "collected" site shown below



Many large green plants protected by branches on shaded E side of juniper which is E of drainage under 419



#Bird (J) BdRF 320



Shady canyon bottom of Rio de Flag



KO shows one of 28 mature tubers found.



#Mormon-W (J) BdRF 321. View is to the West.

