Southwest 2014 Potato Collecting Trip Report

Northern Arizona, September 19-25, 2014

Participants:
Bamberg, John (JB), Alfonso del Rio (AdR), Charles "Chico" Fernandez (CF), all affiliations: US Potato Genebank, 4312 Hwy 42, Sturgeon Bay, WI, 54235.
Collection prefix = BdRF numbers 287-304.

Summary of Objectives, Outcomes, Insights:

1. Sites: Last year we started the project to assess the relative diversity of the "Mega" populations of *S. jamesii* at Mesa Verde. Thus, we sought a 2014 collecting project in northern Arizona, in case collecting germplasm at Mesa Verde was desired. A 100-mile line between Springerville and Flagstaff that runs the Mogollon Rim was selected. We have been in this area before, but new sites have since been reported by botanists in SEINET (see Proposal in Appendix). We sought to collect these sites and other likely habitats in the search area. These were given temporary non-sequential numbers and codes during the expedition, and finally assigned BdRF collector codes and PI numbers later. We found good populations in most sites and in several new sites. It was unexpected to find plants so young and green in the last half of September... abundant in what appeared to be very unlikely habitats... or totally absent where they had been very abundant in previous years. Much rain caused us to avoid dirt roads. The trip might have been planned to be a few days longer, since we did not go to all previous sites planned, and could have searched at more of the apparently promising habitats between planned sites. Or, it would have been better to have a smaller target area and spend less time driving. But we could not have known this until scouted.

2. Techniques: In the 2013 expedition and after returning, we tested collection of pollen, meristems in antibiotic PPM medium, and insecticide treatment for fruit fly grubs. We did not anticipate encountering fruit flies in 2014, but did, and successfully treated fruit after return to the genebank. We did not attempt to collect pollen. Meristem collection in PPM medium was done for nearly all sites, but was a total failure, as all stems died. Tech needs to be refined because this has so much potential-- meristems could be overnighted back to the genebank, and we could send cooperating local collectors simple kits to collect when we are not on location. Seeds and tubers were collected when available. Traditional collection of transplants in native soil was done for most sites, but survival was unusually

poor. We ought to try bringing along Promix or buying local potting soil instead of using the native soil. Fruits were usually not present, but seed collection was usually successful when they were. Tubers were sometimes present, but usually few, very small and somewhat immature. Despite reasonably robust populations and vigorous plants at most places, recovery of propagules was unusually poor, and one collection (ColoRiv) was lost. We should return to at least some of these places again next year to collect a better sample. Then could also go to new places not scouted like Flagstaff lakes and Chevelon Canyon Lake.

Collecting was made more rapid, effective and well-documented by division of labor. Thus, JB as assigned collection of transplants, AdR collection of meristems, and CF collection of fruits and tubers. JB planned itinerary, kept the travel and site log and did all the driving. AdR navigated with laptop DeLorme TopoUSA8 maps pre-spotted with sites of interest and tracked with GPS provided by PEO, and CF navigated from hard maps. When internet was availble, GoogleEarth maps were very helpful, so it would be good to have satellite internet. We found abundant populations in places searched several times in the past because we now have a much better sense of the soil, ground cover, aspect, and soil moisture potential of micro-locations which are the only place potatoes will appear within those places. Superficially, this is vastly more effective than looking hard everywhere. However, there may be a parallel with our other categorization research (cogs): Cognative research shows that categorization is more effective before objective analysis than after. Thus, we may recognize features of the landscape where potatoes are likely to grow by experience, but then when attempting to identify those features mislead others because subliminally recognized clues are the best ones, and consciously rationalized ones are not.

3. Germplasm: Collected 18 samples; 16 of *Solanum jamesii* and 2 of *Solanum fendleri*.

4. Itinerary and Collections:
(collections at sites suffixed "(J)" for *jamesii* and "(F)" for *fendleri*)

Thu18th: Fly to ABQ, rent white 2WD Ford 150 pickup truck, drive to & lodge at Winslow. **Fri19th**: Drive to Flagstaff and N, to sites #16(J), #23(J), #19(J), #27(J),#28. Lodge Flagstaff. **Sat20th**: To Winona #12(J) and bad road prevents attempt to get to Walnut Creek on S side of 40. To Winslow and down 87 to site #14(JF). NW on 211/82 almost to Soldier and Long lakes #34, #39, but road impassible due to mud. Down 87/260 to Payson, looking at likely sites before

coming over Rim. Lodge Payson. **Sun21st**: E on 260 back to top of Rim to look at Woods Canyon Lake. NW on Rim road to two SE aspect sites right on Rim. Back SE to Wallace Rd and N to look at 11 mile marker and E of Black Mesa Work Center. N to jct of road 34 and 211, site #18(J). Up 99 to Winslow and back down to 191 E to 504 and down to first Chevelon bridge at Mormon Crossing, #504(J). SE on 504 to 260 to lodge at Heber. **Mon22nd**: Back up 504 to Chevelon crossing camp #13(J), then S to #53(J) at Wildcat and Daze canyons. To 153 jct and NE for #153(J) collections. Back to 260 and SW to Rim and Woods Canyon Lake #WCL(F). Meristem sample only at BAM005 site for re-collection research, *not for germplasm*. Lodge at Heber. **Tue23rd**: NE on 277/377 toward Holbrook to site #51. Look on way back SW on 377 finding at mile 12 for #377-m12(J). Back to Heber and looking on 260 to #ShowLow(J) . E on 260 and SE on 273 to Big Lake. Then back and NE on 261, looking until 260 jct at #ColoRiv(J). Scout around Eagar and lodge there. **Wed24th**: W on 260 and S on 373 to Greer. Then N of Greer on 1325 to look. Back to Eagar. Looked along city streets on S edge of Eagar, #Eagar-S(J), then to 669594 site #Eagar-Old(J). Take 60 E looking along way to Socorro, notably Magdalena roadsite pulloff. Up 25 to ABQ. Repack transplants in plastic baggies in cardboard box. Lodge ABQ. **Thu25th**: Fly to GRB. **Fri26th**: Repot transplants in flats of Promix, and culture meristems at USPG.

Preparations:
Monitor regional rainfall through spring and summer. Permit from USFS (see Permit section). Garmin GPSs borrowed from PEO, and uploaded tracks, waypoints and notes from DeLorme Topo 8 and GoogleEarth. Sites identified in SEINET from local botanists. Preselected stopping sites by GoogleEarth elevation, vegetation and shadow (steep N/E slopes). Standard collecting clothing and gear. Flights to Albuquerque from Green Bay and Madison and ABQ pickup truck rental. GPS plugged into canned laptop Topo 8 maps due to limited internet reception in remote areas.

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 and additional miscellaneous notes available from JB at USPG.

List of collections

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#	BdRF	PI	Species	site origin	plants	seeds	tubers	meristems
16	287	673353	jam	herb	1		27	C
23	288	673354	jam	herb	1		16	C
19	289	673355	jam	herb	1		6	C
27	290	673356	jam	herb	0		10	C
12	291	673357	jam	scout	0		11	C
14J	292	673358	jam	herb	0		2	C
14F	293	673359	fen	herb	1			C
18	294	673360	jam	herb	0	8	7	C
504	295	673361	jam	herb	1	2	5	C
13	296	673362	jam	herb	0	70	6	C
53	297	673363	jam	herb	5	27	3	C
153A	298	673364	jam	scout	5	273	9	C
WCL-F	299	673365	fen	herb		many		
377-m12	300	673366	jam	scout	1		11	C
ShowLow	301	673367	jam	scout		292		C
ColoRiv	302	673368	jam	herb				C
Eagar-S	303	673369	jam	scout		33		C
Eagar-Old	304	673370	jam	re-coll		many		C

plants: Number surviving. If zero, they were collected but died. If blank, not collected.
tubers: mostly small, immature
site: place identified by herb record, germplasm re-collection, or scouted by habitat
meristems: "C" indicates that meristems were collected. None established.

Financing

Karen Williams of USDA/ARS/PEO provides $5,260.

Permit:

You replied to this message on 8/5/2014 4:01 PM.

From: Dowd, Cathryn -FS
Sent: Tue 8/5/2014 3:54 PM
To: Bamberg, John
Cc: Ray, Kartha A -FS
Subject: RE: Permission to collect potatoes in 2014 -- if you agree, would you please send me a note saying so?

Hi John,
Since our regional office has agreed that no permit is necessary because you are conducting research as part of USDA, please consider this email our agreement that you may collect on Apache-Sitgreaves. I'm copying our LEO assistant so that she can make law enforcement aware that you will be on the forest collecting in September.

Cathy Dowd
Acting Staff Officer: GIS, Recreation, Planning
Apache-Sitgreaves National Forests
PO Box 640
30 S. Chiricahua Drive
Springerville, AZ 85938
cdowd@fs.fed.us
office: 928-333-6268

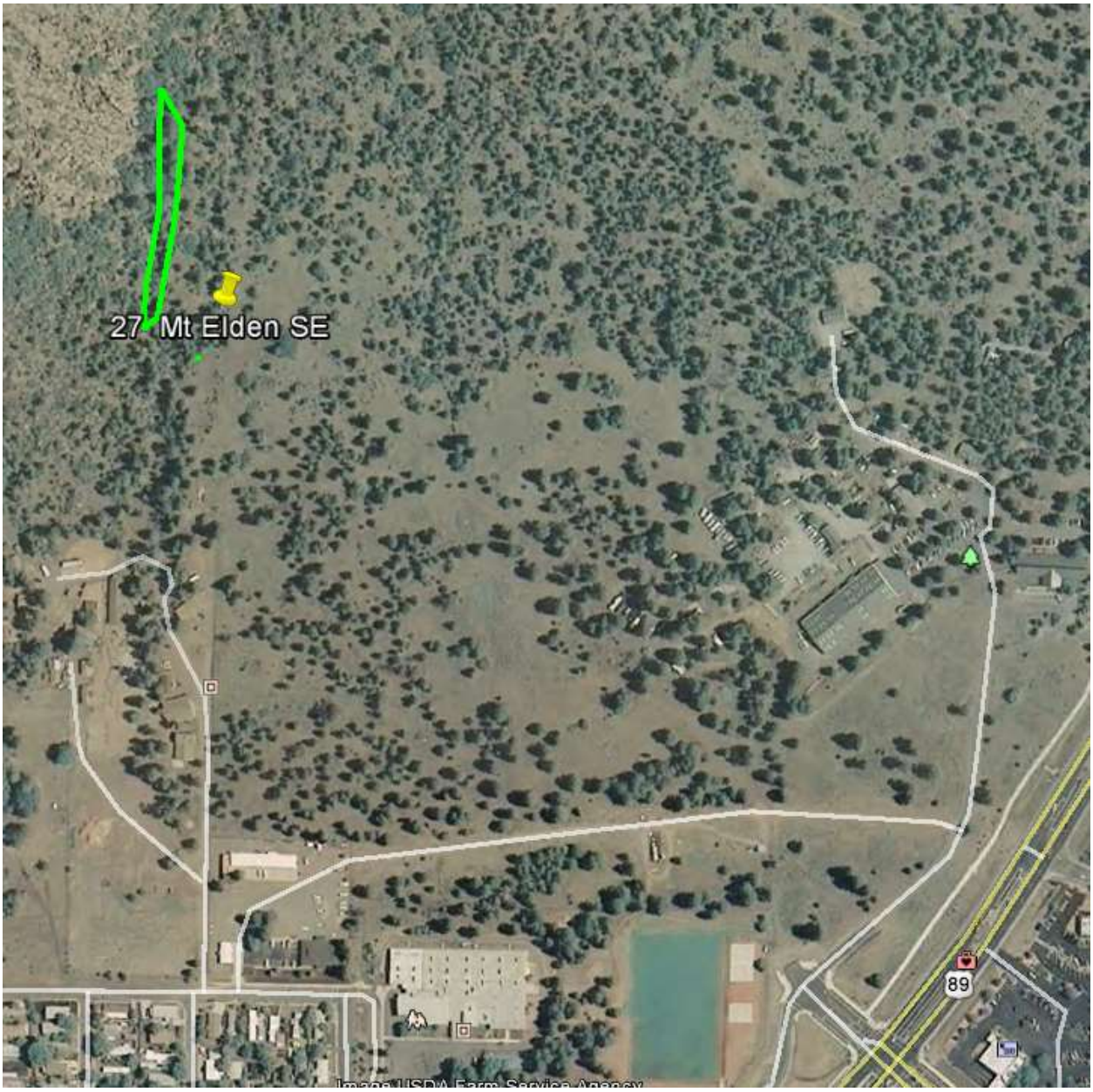
Learn more about the Apache-Sitgreaves: http://www.fs.usda.gov/asnf
Follow the A-S on Twitter: www.twitter.com/A_SNFs

Maps and landscape views

BdRF 287, Coll. #16

BdRF 288, Coll. #23 Near Red Mountain

BdRF 289, Coll. #19 Road Tank

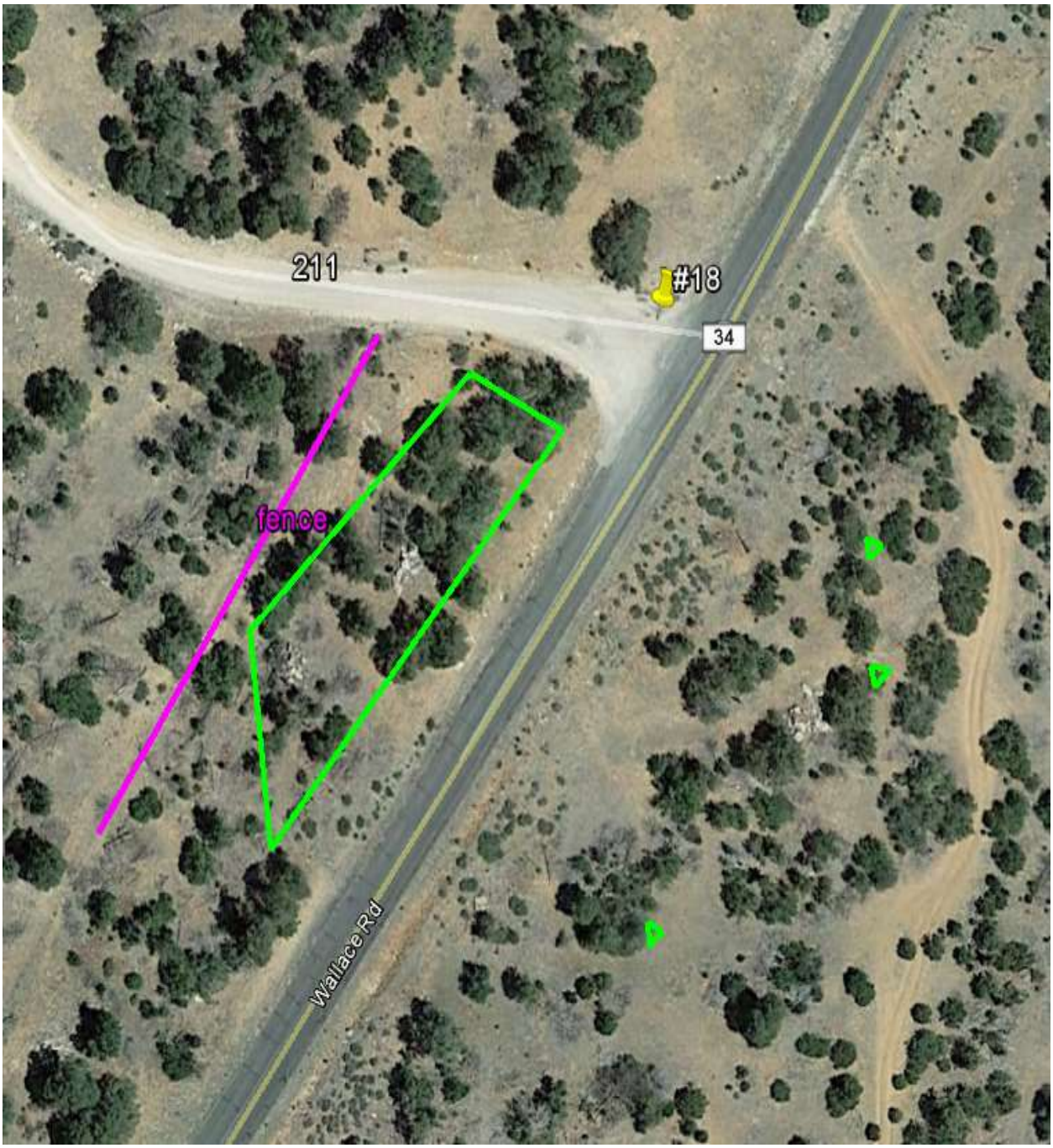


BdRF 290, Coll. #27 Mt Elden

BdRF 291, Coll. #12 area

BdRF 291, Coll.#12 detail Winona at Walnut Creek

BdRF 292/293, Coll. #14F and #14J Clear Creek



BdRF 294, Coll.#18 (Wallace and 211 jct)

BdRF 295, Coll. #504 Chevelon Creek (at first crossing S from 99)

No collection number -- BAM 005 research re-collection of meristems only

BdRF 296, Coll. #13 = Chevelon Camp S side of bridge (close up)

BdRF 296, Coll. #13 = Chevelon Camp N side of bridge

BdRF 296, Coll. #13 Chevelon Camp (whole area)

BdRF 297, Coll. #53 Wildcat Canyon (at bridge)

BdRF 297, Coll. #53 Daze Canyon (at bridge)

BdRF 298, Coll. #153

BdRF 299, Coll. #WCL-F, Woods Canyon Lake *fendleri*

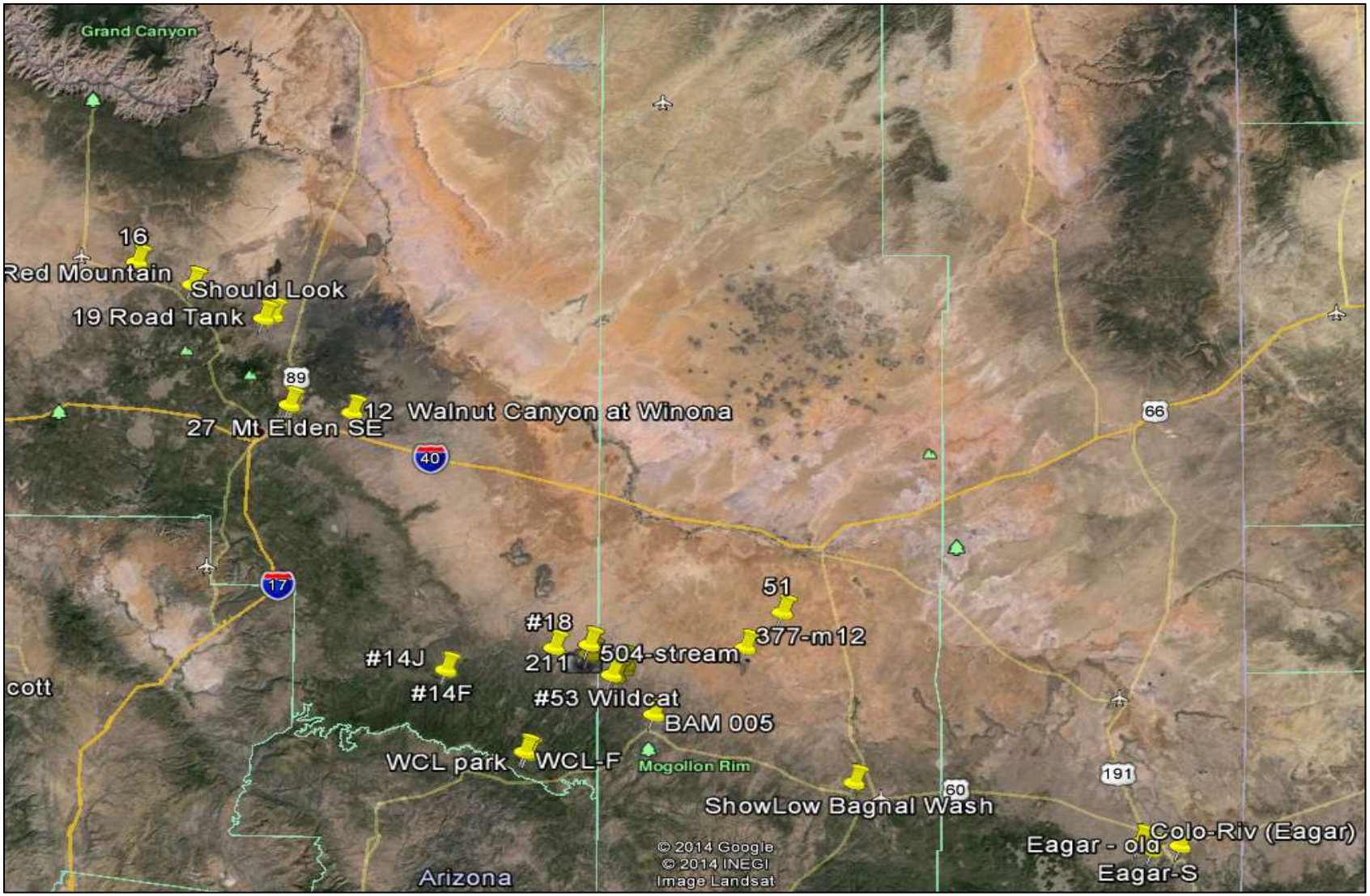
BdRF 300, Coll. #377-m12

BdRF 301, Coll. #ShowLow

BdRF 302, Coll. #ColoRiv

BdRF 303, Coll. #Eagar-S

BdRF 304, Coll. #Eagar-Old



All collections in GoogleEarth

Photos:

CF on Mogollon Rim above Rt. 260

Road Tank *S. jamesii* habitat N of Flagstaff

Large fruiting *jamesii* at 153 site

AdR collecting meristems

Transplants transported back to USPG

S. jamesii directly in bed of Chevelon creek

S. jamesii under Ponderosas at ShowLow

AdR and CF at Wildcat Canyon

Large robust *S. fendleri* at Woods Canyon Lake

Abundant, green *S. jamesii* at S edge of Eagar

Unshaded *S. jamesii* on 377 mile 12 N of Heber

Appendix. **Collecting narratives as submitted to GRIN**

PI 673353. BdRF 287. S. jamesii. United States. Arizona. Coconino County. Kaibab National Forest. Near Flagstaff. Site of herbspec by K. Christie 2005. N of Flagstaff on 180 about one-half mile past powerline and 10 miles before jct 64. At wash on E edge of FR87, and both sides of 180 ditch. At WSG 35.594609° x -112.004135° and 6240 ft. Coll #16. Friday, September 19, 2014. Scattered healthy green plants. In full sun in sandy red soil in wash, herbs and rabbit brush. Collected plants, meristems, 20 tubers.

PI 673354. BdRF 288. 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 #23. Friday, September 19, 2014. Thousands of robust plants to 12 cm, flowers rare and no fruit. Open sun or in Sacaton and rabbit brush, sandy gravel soil. Collected plants, meristems, 3 tubers.

PI 673355. BdRF 289. S. jamesii. United States. Arizona. Coconino County. White Horse Hills. Coconino National Forest. Near Flagstaff. Site of herbspec by K. Christie 2004. N of Flagstaff on FR523 shortcut between 180 and 89. S side of FR523 at W edge of Road Tank (small dug-out pond). At WSG 35.452708° x -111.659778° and 7200 ft. Coll #19. Friday, September 19, 2014. A few small green plants, no flowers or fruit. Under trees and otherwise hiding from cattle grazing, in fallen tree branches and brush. Collected plants, meristems, 5 tubers.

PI 673356. BdRF 290. 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 edge of Mt. Elden, toward cliff and watercourse just off trail. At WSG 35.230384° x -111.586852° and 8500 ft. Coll #27. Friday, September 19, 2014. Many green plants to 15 cm, flowers scarce. Among boulders of shaded shear SE exposure of Mt. Elden. Collected plants, meristems and 9 tubers.

PI 673357. BdRF 291. S. jamesii. United States. Arizona. Coconino County. Coconino National Forest. Near Winona at Walnut Canyon. From Flagstaff W on 40 to Winona Exit 211. N then W on Rt 349, Townsend 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 #12. Saturday, September 20, 2014. About 50 plants, most spindly and without flowers or fruit. W facing slope under shade of bridge, rich black alluvium with grass and brush. Collected plants, 9 tubers and meristems.

PI 673358. BdRF 292. S. jamesii. United States. Arizona. Coconino County. Coconino National Forest. 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 Clear Creek along footpath W of bridge, and under SE corner of bridge. At WSG 34.550477° x -111.164073° and 6510 ft. Coll #14J. Saturday, September 20, 2014. A few scattered spindly plants without flowers or fruit. In N exposure near creek, under shade of trees, brush and grass. Collected plants and meristems.

PI 673359. BdRF 293. S. stoloniferum form fendleri. United States. Arizona. Coconino County. Coconino National Forest. From Winslow SW on 87, then SE and S on FR95 to jct FR96 at SW side of bridge, at parking lot & recreational area. S of bridge, about 150 ft. S of parking lot, and on W banks of stream that runs to E of 96. At WSG 34.549556° x -111.162522° and 6510 ft. Coll #14F. Saturday,

September 20, 2014. Only one small group of plants, a few >10 cm, but without flowers or fruit. In NE exposure near stream, under shade of trees, brush and grass, sandy moist alluvium. Collected plants and meristems.

PI 673360. BdRF 294. S. jamesii. United States. Arizona. Coconino County. Sitgreaves National Forest. On Wallace Road /FR34/Rt 99. From Winslow S (on 99) or N from Woods Canyon Lake. At jct with FR211, SW corner of intersection. At WSG 34.609030° x -110.880120° and 6670 ft. Coll. #18. Sunday, September 21, 2014. Dozens of plants, but widely scattered. To 7 cm, no flowers or fruit. Under many downed branches and under pines in sandy soil of J/P woodland. Collected plants, one tiny immature fruit on transplant, meristems, 5 tubers.

PI 673361. BdRF 295. S. jamesii. United States. Arizona. Coconino County. Sitgreaves National Forest. Chevelon Creek. On FR504 S from Winslow via Rt 99 or N from Heber. Mormon Crossing of Chevelon Creek at bridge on W side of 504. At WSG 34.617134° x -110.787839° and 6130 ft. Coll #504. Sunday, September 21, 2014. A few spindly plants on W banks of creek or growing right in streambed. Under shade of brush and in grass in moist black soil on E-facing slope W of creek, or in fine gravel of dry streambed. Collected plants, fruit, 2 tubers and meristems.

PI 673362. BdRF 296. S. jamesii. United States. Arizona. Coconino County. Sitgreaves National Forest. Chevelon Creek. Site of herbspecs by B.E. Nelson 2006. On FR504 S from Winslow via Rt 99 or N from Heber. About 1 mile N of powerlines at Chevelon Campground (S side of bridge), plants just below welcome sign & outhouse; and at pullout (N side of bridge) under one juniper about 100 ft N of pullout. None in rocky willow streambed. At WSG 34.591002° x -110.787448° and 6160 ft. Coll #13. Monday, September 22, 2014. A few small plants with one large mature fruit. On E-facing slope in grass under branches and in rich black soil. Collected plants, one fruit, 5 tubers and meristems.

PI 673363. BdRF 297. S. jamesii. United States. Arizona. Navajo county. Sitgreaves National Forest. Chevelon Creek. Site of herbspecs by B.E. Nelson 2006. On FR504 S from Winslow via Rt 99 or N from Heber. SE side of Wildcat Canyon bridge and NE corner of Daze Canyon bridge (about 1/2 miles apart). Coordinates for Wildcat. At WSG 34.540133° x -110.728349° and 6440 ft. Coll #53. Monday, September 22, 2014. Dozens of green plants to 10 cm, but often spindly. No tubers or flowers, but one large mature fruit at Wildcat. Wildcat = In open in grass and herbs among large fallen trees in streambed, rich black soil. Daze = In steep sandy N-facing slope only under N branches of one large pine very close to bridge. Collected plants, one fruit yielding 27 seeds, and meristems.

PI 673364. BdRF 298. Monday, September 22, 2014. S. jamesii. United States. Arizona. Navajo county. Sitgreaves National Forest. Near Chevelon Creek. Near site of herbspecs by Theresa Tharalson 1990. On FR504 S from Winslow via Rt 99 or N from Heber. Then on FR153 running N from 504 along E side of powerlines. At jct with FR153A and about one mile S of jct on FR153 on top of ridge. Coordinates for jct. At WSG 34.569871° x -110.693907° and 6475 ft. Coll #153A. Monday, September 22, 2014. Many large green plants >20cm with multiple large mature fruit. No tubers. Under juniper branches in J/P forest in sandy mulch. Collected fruit yielding 273 seeds, plants and meristems.

PI 673365. BdRF 299. S. stoloniferum form fendleri. United States. Arizona. Coconino County. Sitgreaves National Forest. Woods Canyon Lake. From Heber SW on 260 then NW on Rim road. From trailhead at parking lot which is about 1/3 mile NW of camp store, take footpath along W bank of NW spur of the lake, about 1/2 mile. Plants right along W side of trail. At WSG 34.339688° x -110.955272°

and 7550 ft. Coll. #WCL-F. Monday, September 22, 2014. Very many large green plants with many mature fruit. Steep NE-facing slope, rich black fine sandy soil, among rocks and herbs under shade of huge firs. Collected 56 fruit yielding thousands of seeds.

PI 673366. BdRF 300. S. jamesii. United States. Arizona. Navajo county. Between Heber and Holbrook on 377. SW 8 miles from site of herbspec by G. Goodwin 2010. Between Dry Lake / Twin Lakes. At 30 ft NE of mile 12 marker in E ditch of 377. At WSG 34.612059° x -110.377659° and 5850 ft. Coll. #377-m12. Tuesday, September 23, 2014. One colony of about 12 plants. Small, stout, green to about 8cm, with no flowers or fruit. In open in grass and some sage, sandy soil with run-off from nearby farm irrigation. Collected plants, 7 tubers, meristems.

PI 673367. BdRF 301. S. jamesii. United States. Arizona. Navajo county. Show Low. Rt 260 (N Clark road) in W suburb of ShowLow city, between N Bison Ridge Trail and W Willis streets, both sides of Rt 260 in Bagnal Wash. Coordinates and description for collection on SW side of Rt 260. About 100 yards W of Rt 260 on raised berm N of creek. At WSG 34.262913° x -110.091392° and 6260 ft. Coll. #ShowLow. Tuesday, September 23, 2014. Many green plants with mature fruit. In grass under large Ponderosas. Collected 13 fruit yielding 292 seeds and meristems.

PI 673368. BdRF 302. S. jamesii. United States. Arizona. Apache county. Apache National Forest. Eagar (near Springerville). Three miles W of Eagar at jct Rt 261. Take first gravel driveway and frontage road S on 261, very near bridge. At WSG 34.103537° x -109.342958° and 7150 ft. Coll. #ColoRiv. Tuesday, September 23, 2014. Rare, very spindly and yellow plants among willows. A few scattered larger green plants under pines. Along frontage road toward river bottom in willows and in nearby J/P habitat. Collected meristems.

PI 673369. BdRF 303. S. jamesii. United States. Arizona. Apache county. Apache National Forest. Eagar (near Springerville). On S edge of Eagar, take Amity Lane to dead end of Double Tree Lane , both sides of road. At WSG 34.084333° x -109.310875° and 7300 ft. Coll. #Eagar-S. Wednesday, September 24, 2014. Many green plants of various sizes, occassional flowers, one fruit. In open lot on S side of road where manure had been dumped, surrounded by J/P woodland; also woodland on N side of road. Collected plants, meristems and one fruit yielding 33 seeds.

PI 673370. BdRF 304. S. jamesii. United States. Arizona. Apache county. Apache National Forest. Eagar (near Springerville). First E exit S of triangle intersection of Rts 191/180/160 two miles E of Eagar. Then one mile SE on Picnic Creek Road at bottom of loop. At WSG 34.094227° x -109.236349° and 7300 ft. Coll. #Eagar-Old. Wednesday, September 24, 2014. Very many green plants of all sizes, no flowers but occassional large mature fruits with fruit fly scars. No tubers. Sandy mulch soil of J/P woodland, under trees, hiding in fallen branches, or sometimes in open. Collected meristems and 37 fruit yielding thousands of seeds.

Potato Collecting Proposal for *Solanum jamesii*, 2014

February 11, 2014

Time: Up to ten days in September, 2014

Participants: John & Ingrid Bamberg, Alfonso del Rio, Chico Fernandez

Objectives and expedition methods:

1. *Mogollon Rim jamesii*. In hindsight, our early explorations of east central AZ may have been less successful because those years were very dry. In the mean time, botanists have identified many more sites between Flagstaff and the NM border that we should sample:

Current genebank samples

New sites that could be collected

2. *Mega-pop sampling*. Last year we collected ~120 bulk DNA samples from a mega-population at Mesa Verde near Cortez, CO. We are comparing these to all *jamesii* collections from the region. If results warrant, we want to keep open the option to germplasm sample in 2014, under the last year of cooperator D. Kinder's permit.

3. *Collecting technology*. Discussion during last year's trip made us realize that sometimes the most remote and unique sites have stressed plants that cannot be reliably transplanted, have no mature tubers, or have fruits completely infested with seed grubs. We provisionally tested some methods in the genebank that we would like to validate more fully in the field. We tested nicotinoid insecticide treatments on

infested whole fruits brought to the genebank. Grubs were killed in insecticide treated fruit with no apparent impact on seed maturation or germination compared to untreated fruit.

We tested "dirty" (without sterile hood) *in vitro* rescue of mature *jamesii* shoots using antibiotic medium. This works surprisingly well, with rapid vigorous shoot grow-out, no medium contamination, and good rooting of *ex vitro* transplants. This should be far superior to on site transplanting into soil.

Pollen from flowers that had been collected at site of 2014 collection PI 669594 was used to pollinate a "surrogate mother" in the genebank. Seeds have formed, sprouted and hybrid plants being confirmed by DNA markers.

Contingency plan:

East foothills from Las Vegas, NM to CO border-- about 100 miles. Potatoes known on both ends, but none between, despite assumed appropriate habitat.

Budget:

1960	lodge (two collectors per room)
1400	per diem (IB and CF participate with their own funds)
800	air for two (WI to Albuquerque or Las Vegas)
600	truck rental
300	gas
200	supplies, permits, misc.
5260	