Southwest 2012 Potato Collecting Trip Report

August 24-September 06, 2012

a) Venue scounting for Hungry Film Inc.
b) Find fendleri at Demlong 119 at Riggs Lake (PIN) diversity hotspot
c) Matryoshka fruit mutant recollection
d) Fruit gall collecting
e) PAT and CAN mountains exploration
f) 20th anniversary reunion collecting and Hungry Film shooting

Background and Summary

Participants: John Bamberg (JB, a-f), Alfonso del Rio (AdR, d-f), Ingrid Bamberg (IB, a-c), Jana Suriano (JS, a-c), Ben Bamberg (BB, a-c), Anne Ziegelbauer (AZ, a-c), Charles "Chico" Fernandez (CF, f). JB + AdR = USPG research staff, CF = USPG retired, JS = USPG summer student intern researching *Matryoshka* mutant, IB + BB = previous collectors, AZ = spouse of BB.

Concept: Multi-objective trip this year:

a) By instigation of PEO's Karen Williams, JB's group was asked to be filmed collecting in the field as part of a documentary on vulnerability of crop genetic resources for Hungry Film, Inc., NY. We proposed expanded coverage of the whole genebank story (see Appendix). Considering the unpredictable condition of populations in any given year, we sought to do preliminary scouting to determine the optimal 2012 filming location in terms of ease of access, scenic beauty, and showy, abundant wild potatoes. Plan was to scout Santa Catalina (CAT), Pinaleno (PIN) and Santa Rita (RIT) mountains. Only *S. fendleri* (fen) has ever been found in these ranges.

b) While scouting PIN, look for Demlong fen 119 [1989] the only known site south of the lake in the localized Riggs Lake genetic diversity hotspot. This will be 5th attempt (previously searched in 1994, 2008, 2009, 2011).

c) SW10 (RIT) collection #14 (PI 660270) was later found to contain a novel fruit mutant (*Matryoshka*) with nested whorls of floral parts (like nested *matryoshka* dolls). We sought to collect the mutant form *in situ*, and a more thorough genetic sample from the *mat* site, and involve JS, who is doing research on the anatomy and genetics of the mutant.

d) Collecting trip goals: Sample lowland climate change new fen & jam sites from Patagonia (PAT) and Canelo (CAN) mountains. The genesis of this idea was discovery of very low (5200 ft) robust Florida Canyon population of fen in SW2010 expedition to RIT. There are very few samples from this area between RIT and HUA in the genebank.

e) Fruit galls originally observed in collection BAM 008 in RIT (PI 585114) and later at HUA have never been studied to our knowledge, so we sought to collect samples to send to entomologist cooperator Rodney Cooper for identification (see Appendix).

f) First SW trip was in 1992, so final goal of filming constituted an anniversary celebration and review. One of the first research publications resulting from that trip compared re-collections 1958 vs 1992 with RAPDs (*Theoretical and Applied Genetics* 95(1/2):199), and we sought to extend by re-collecting a few 1992 sites to allow 1958 vs 1992 vs 2012 genetic comparisons, using more advanced markers like AFLPs, SNPs, DARTs with collabortion of APIC colleagues at CIP.

Preparations: Funding by Karen Williams, USDA/ARS/PEO, Beltsville (see Appendix). Monitor regional rainfall through spring and summer. Permit from USFS (see Appendix). Consultation and negotiation with film group and proposal of expanded USPG coverage (see Appendix), Garmin GPSs borrowed from PEO, and uploaded tracks, waypoints and notes from DeLorme Topo 7 and GoogleEarth. Preselected stopping sites by GoogleEarth elevation,

vegetation and shadow (steep N/E slopes). Standard collecting clothing and gear. Flights to Tucson from Madison and vehicle rental. Conditioning hiking. Last year's failure of internet maps and tracking prompted use of GPS plugged into canned laptop Topo 7 maps.

Results:

a) Scouting of CAT, PIN and RIT showed beautiful CAT Mount Lemmon summit (with easy, one hour drive-up access from Tucson) to have abundantly flowering and fruiting large stands of *fendleri* rivaling any previously observed by JB. Only thing left to be desired in a potato collecting film was ability to show habitat and plants of the second USA-native potato species, *S. jamesii*. CAT site at Mt. Lemmon Summit was more extensively sampled.

b) Found and collected Demlong 119.

c) Discovered the existence of *mat* mutants *per se* scattered along much expanded general area of 2010 expedition collection #14 (PI 660270).

d) Lowland populations sought in PAT and CON were typically rare with small populations of weak plants, sometimes necessitating clonal collection of limited plants, but important new sites for fen (6) and jam (2) were found. This notably expands our representation of jam in the genebank from this area. Unfortunately, plants from two fen did not survive in genebank. But locations of two new, much more robust populations were identified within 3 miles of these lost collections. To be thoroughly explored, this area requires a vehicle that can pass very rough roads. We also identified specific places with habitats where longer hiking trips would be warranted.

e) About 25 very large fruit galls were collected (site of #4b population) and sent to R. Cooper. Larvae all exited fruits and died, so no adults were observable, but these are likely a *Cecidomyiid* wasp.

f) JB, AdR, and CF, all participants in many of the 20 collecting expeditions to the SW since 1992 were interviewed and shown collecting. Re-collections of jam (SBV 2) and fen (SBV 1) were made. Reunion opportunity resulted in discussions that developed an idea for future field research: We know of exceptionally large collections of jam at the extremes of the USA range (N = Mesa Verde = BKPF 075 = 612450 and S = HUA Ida Canyon = 564047 = SBV 2). These would be models from which to assess the representativeness of the small samples typically collected *by necessity*-- no more than dozens of fruit and tubers. The Mt. Lemmon summit site described here might be a third huge population representing *fendleri*. See Appendix.

In light of *jamesii* dormancy, and indication that it is a survivalist, we could screen tubers looking for frost hardiness.

Deposit of records, materials and files: US Potato Genebank, 4312 Hwy 42, Sturgeon Bay, WI, 54235. 920-743-5406. john.bamberg@ars.usda.gov. Query GRIN text "B4dRFS".

List of collections

Temp trip collection # -- nickname	SPECIES	TYPE	GENEBANK STATUS[1]
Collection #1 –– PIN Demlong 119	fen	New	P
Collection #2 –– *Matryoshka* valley	fen	Re-coll	P
Collection #3 -- *Matryoshka* creek	fen	Re-coll	P
Collection #4a -- Madera Canyon creek	fen	New	PTS
Collection #4b -- Chuparosa Lodge	fen	New	PS
Collection #5 -- Cochise Co Line	fen	New	S
Collection #6 -- HUA Culvert	jam	New	P
Collection #7 -- SBV2 re-collect	jam	Re-coll	P
Collection #8 -- Parker Canyon Lake dam	jam	New	P
Collection #9 -- PAT Valley W	fen	New	S
Collection #10 -- Pless re-collect	fen	Re-coll	S
Collection #11 -- Parker Lake jam	jam	New	T
Collection #12 -- 83 mile 6	fen	New	S
Collection #13 -- D/H/L jct	fen	New	*lost*
Collection #14 -- Harshaw creek	fen	New	*lost*
Collection #15 -- Harshaw E/W	fen	New	S
Collection #16 -- CAT mile 11	fen	New	S
Collection #17 -- Mt Lemmon meadow	fen	Re-coll	S
Collection #18 -- CAT parking summit S	fen	New	S
Collection #19 -- SBV 1 re-collect	fen	Re-coll	S

[1] Plants, Tubers or Seeds

The files prepared for mapping promising sites in DeLorme Topo 7 in advance, and the GPS tracks and collection waypoint logs converted to files that play on GoogleEarth are available on request from JB at USPG. See Appendix for full collection narratives entered into GRIN. Collection sites may be mapped from data in GRIN, so the only missing data will be site unsuccessfully searched. However, as noted in our publication (Am J Potato Res 80:159-172), such negative evidence is not very conclusive.

TRIP LOG

Note: Coordinates in text, when abbreviated, are the decimal minutes within WGS84 degrees implied from site description (usually 31N and 110S).

a) Venue scouting for Hungry Film, Inc.

Friday Aug 24. JB+IB+JS drive to Madison pm & to Outback Steakhouse and lodge with JB/IB daughter and son-in-law.

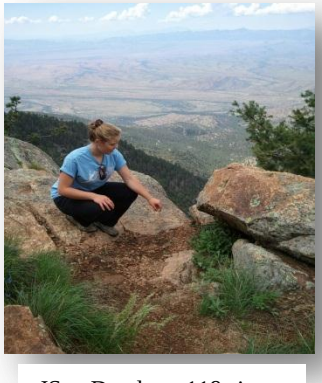
Saturday Aug 25. Up at 4 to go to MSN for flight. Meet BB & AZ there. Fly to Atlanta, get lunch at airport Atlanta Bread Co. Fly to TUS. Upgrade rental to deal on Kia *Sorrento*. Grab bite of groceries and coffee at corner of Tanque Verde & Mt Lemmon Hwy and head up Lemmon Hwy to CAT (these mountains visited many times and extensively collected in 2009 by JB and AdR). Pay $5 for entry. Stop at previous site of PI 658184 [2009] by Hitchcock campground-- some good plants here. Then to Butterfly trailheads. A few here. Then to site of first (1992) SBV 1. Good big, flowering plants in slope. Much different here now than in 1992. New houses and big Ponderosas on N side of road gone from fire. Then up to Lemmon meadow at trail #5 and 15 minute hike past parking lot to summit. Very many large plants flowering in grass and very widely dispersed. Around fallen logs. No traffic noise here. Good scenic lookout southward. Good place to exemplify collecting technique and research regarding genetic diversity hotspots. Down again stopping at Middle Bear Campground. Some here as previously. Back down to mall for Subway supper. Then nighttime drive to Safford, stopping at Wilcox McDonalds for coffee and to stretch legs. At Safford, check into Best Western Desert Inn. Boys in one room, girls in other.

Mt Lemmon summit *fendleri*

Sunday Aug 26. Up 8 for bkfst at motel, then to Safeway for groceries and Starbucks. Up 366 into PIN. This range first sampled in 1995 [BAM 009, PI585115], extensively collected in 2009 by JB+AdR+CF, and Riggs Lake area identified as diversity hotspot (*American Journal of Potato Research* 88:493), re-collected in 2011 by JB+ AdR+IB. Look at a few low elevations, noting a few small plants. Arrive Riggs Lake and break for a snack. Some plants at site of first fen collected in PIN [1994] at parking lot on N side of lake. At S side of lake at cliff looking down to 266. JS first to see nice big healthy plants growing under rock ledge right on edge of cliff.

<u>Collection #1</u> -- PIN Demlong 119

Drive back down as it starts to rain. At Moonshine Creek = abundant plants. Have to run back to the car before getting caught in shower. Come down to 191. S to Wilcox. Eat late lunch at salsa bar Mexican restaurant near 10 jct. Then to the coffee shop on Railroad Ave across from tracks for espresso. Decide it is too late to go on any more exploring detours, so back W on 10 to almost Tucson, then S on 83, and Saguarito Rd to 19 expressway to Green Valley. Get groceries at Safeway for supper and breakfast next AM. Drive up to Madera Canyon and Santa Rita Lodge. Had reserved casitas #10 & #12. Eat on deck overlooking the creek. When done and getting dark, 3 ringtail cats come out.



JS at Demlong 119 site

b) Matryoshka fruit mutant recollection and exploring nearby RIT

Monday, Aug 27. JB+IB up earlier for brewing coffee and boiling eggs bfast on

deck. Then up to gravel road that is access to site of BdR211, where *Matryoshka* originates. We found clusters of plants in various spots, and JS observes that some of the plants collected are mutant. Fruit galls and Colorado Potato Beetle relatives also observed here.

Collection #2 – *Matryoshka* valley

Continue on trail E to where creek crosses road

Collection #3 - *Matryoshka* creek

These collections are being made in quart plastic freezer boxes. It is getting close to time for SRL checkout, so we walk back, get out of rooms and have a light lunch of grocery food. Then drive up to trailheads, pay $5 to park, and start walking downward on trail on W side of road along Madera Creek. This starts at 5400 ft. We collect down to just below Chuparosa Lodge, making GPS tracks all along.

Collection #4a -- Madera Canyon creek

Walking back up road, BB notices big flowering plants in ivy growing right onto the edge of road just S of Chuparosa Lodge. Some intact mature berries here but mostly notice many fruit galls.

Collection #4b -- Chuparosa Lodge

Plan to come back next day to this #4b site to collect galls to send to Rodney Cooper (entomologist). Back to Green Valley La Posada coffee shop, espresso (buy cup) and fudge raspberry dessert. Notice FedEx guy customer and get address of local pack/ship business.

At 4:00 drive E on Whitehouse Canyon road / 63 and to spur 4057 at 48.050x46.068 going N up to almost 5200 ft. Too rough for vehicle, so we walk up. Dead ends in a mine about 0.7 miles from road at 48.383 x 46.045. Go down into slot canyon. Looked good.

Back to vehicle and toward Greaterville road. Decide too late in day to explore that. Continue out to 83 and up to 10 and W to Tucson. Decide to try IHOP, but was a bit rougher than in WI. Back to America's Best Value Inn on Park & Benson Hwy. Rooms only $50 for doubles and $40 for single, so got 3 rooms this night.

Tuesday Aug 28. JB+IB up early and to Starbucks on Irvington. Then dumpster dive for perfect box for the 5 collections. Then back to pick up rest at ABVI and to Rag'n Sage coffee on Campbell & Grant. Then to Taco Factory on Broadway & Tucson. Go to airport after gassing vehicle; drop it off at National. Say goodbye to departing colleagues IB, BB, AZ, JS who take plants collected so far back to USPG.

c) Fruit gall collecting

Meet AdR at National car rental desk. Ironically, the two trucks he reserved for us had problems... One flat tire, the other in an accident. So we had to take a vehicle exactly like the one just dropped off-- except for color. It is 4WD, and pretty high clearance, so maybe OK. Then W on Valencia to 19 and S to Green Valley. Talk to the people in "Packing Plus" and arrange to come back with galls within an hour. Make phone confirmation with R. Cooper that he will receive. Go up to Chuparosa Lodge and get galls in plastic bag.

Shipping store sends them to R. Cooper overnight for about $90. Back to La Posada for coffee & pie.

Fruit galls at Chuparosa Lodge

d) Wild potato PAT and CAN mountains collecting

Down to Nogales and check into Holiday Inn Express. AdR puts JB's GPS marks into GPS and then live on Topo map on laptop. Plan to drive to and start looking at the farthest point (E) from Nogales. Late supper at Panda Express.

Wednesday, Aug 29. Up 6:00, shower, bfast at hotel at 6:30, leave 7:00 to Safeway for groceries. Up 83 at 7:30. Sonoita by 8:00. Vaughn loop road by 8:20, looked 34.720 x 36.253 and 5277ft. At 8:34 at S spur road at 34.520 x 36.308 and 5308 ft. Gate and mudhole, so decided not to go on. This vehicle does not have enough clearance for rough roads. At 8:45 road stops at Open Cross Ranch. Maps apparently not quite right at this spot. At 9:00 creek with herbs and grass at 35.151 x 35.079 and 5100ft. At 9:05 at 83 and road 4620 looked at small grove of big olive trees where very green with herbs at 34.065 x 33.562 and 5143ft.

S on 83 to Cochise Co. line near FR 201.

Collection #5 -- Cochise Co Line

One plant at Cochise Co. line #5 site

Leave 10:30 and arrive previous site BFdR but could not find.

At 11:04 at spur going E = FR 4761 with sycamores along S creek bank. Leave 11:21. At 24.660 x 25.290 and 5625 ft.

At 11:30 at very steep W-facing valley. Road at 24.161 x 25.070 and 5825 ft.

At 12:00 at Joachin Creek at 22.596 x 23.647 and 5430 ft.

E on Montezuma Pass road to 12:20.

Collection #6 -- HUA Culvert

Lunch at Montezuma Pass shelter, departing at 1:50 retracing W.

At 2:00 at Oak Spring trailhead at FR 4782. Hike up trail to 2:30 reach 6500 ft. Looked possible, but dry. At 3:00 continue W to site of 1992 SBV2 collection. At 500 ft N of gate at 22.775 x 19.779.


HUA culvert #6 site

Collection #7 -- SBV2 re-collect

Return on 83 and try going up Sunnyslope road loop. Came to gully full of water so had to turn back at 26.856 x 24.073 and 5951 ft (this about 1/2 mile beyond end of loop and supposedly on Arizona Trail).

Return to Parker Canyon Lake area. S side of lake roads gated preventing access to W side of lake as planned. At 5:00 Parker Canyon Lake N side overlook road.

Collection #8 -- Parker Canyon Lake dam

At 6:00 proceed W to Lakeview campground at 25.715 x 27.135 and 5470 ft. Much green grass and herbs would make it hard to see potatoes if here.

Drive back N to Sonoita and then S to Nogales to lodge.

Thursday, Aug 30. Leave Nogales 7:30 up 83 and 8:00 enter Dusquene Rd going E. At 23.171 x 42.706 and 5850 ft a few plants too small and old to collect in W facing roadcut and in creekbed to W. Proceed E but then retrace to look harder when realizing that this previous spontaneous stop had been a preselected search site.

Collection #9 -- PAT Valley W

At 10:00 at Dusquene - Harshaw - Lochiel roads intersection, NE corner. One small plant only. Decided to wait to collect until last time passing by this spot.

Proceed SE to intersection of driveway going SW at creek just past Majalca Drive. Site of original *Pless* mutant collection (BF 087, PI 620874 , *American Journal of Potato Research* 83:437-445).

Collection #10 -- Pless re-collect

Continue to Lochiel town and E across plains of San Rafael and back up toward Parker Canyon Lake. Up 83 at 11:30 at steep wash above Scotia Canyon at 25.004 x 25.753 and 5600 ft.

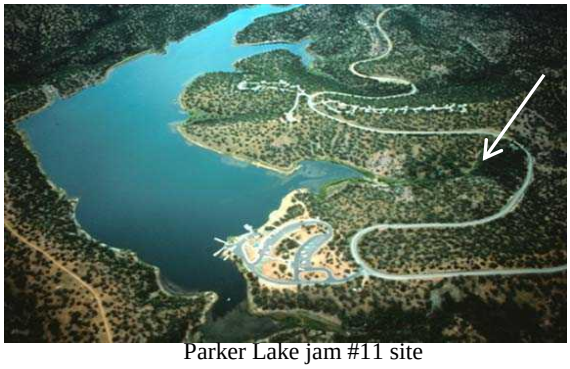
At 12:00 Parker Canyon Lake store picnic lunch, leaving at 12:45.

At 12:52 going N from Parker Canyon Lake on 83.

Collection #11 -- Parker Lake jam

At 1:50 continue up 83 to mile marker 6.

Collection #12 -- 83 mile 6



Parker Lake jam #11 site

At 2:20 continue up 83 finding no N access to loop from which we planned to hike trail to W and S access is very rough jeep trail. Decided to try from Canelo Pass road to W. But when you go to Canelo Pass Road and come S, you come to entry to Umpire Ranch and then Becker Ranch, neither of which have access to the valley to the E. At 3:05 walked E from Canelo Pass road to .800 x .437 search flag, but dry and rocky here, not promising at all.

Went to pass and then return N on Canelo Pass Road. At 3:40 look in valley at 31.144 x 33.045 and 5240 ft. Looked possible.

Back to 83 and S to trailhead at 4:05 from 28.794 x 29.090. Hiked W to creek valley, looked very good. But on return (started at 4:55) looked back across valley at rock spires with NE exposure. These crests are up to 6000 ft. It would be good to start at where valley crosses 83 and walk up creek bed NW and going up side valleys with NE exposures and rocks. Got back to 83 trailhead by 5:30 and drive up to Sonoita for great brisket supper at Sonoita Mexican Cantina on N side of 83 where it is going W heading into town. Drive back to Nogales lodging.

Friday, Aug 31. Up 5:30, hotel bfst 6:00, Safeway grocery lunch buy. Retrace yesterday's eastward route on Dusquene road to Majalca intersection at Washington Camp vicinity. No useful access around N end of a loop across highlands here. Go to lower loop access and by 8:10 up to E facing valley at 22.589 x 41.234 and 5330 near mine. Looked good. At 8:30 look for 1/2 hour at "Dusquene" sign at 22.334 x 41.172. To 22.091 x 41.188 at 5300 ft. In creek bed with NE facing large boulders in black moist sand-- looked very good.

At 9:25 back N to Dusquene - Harshaw - Lochiel roads intersection where one plant previously seen. Looked extensively.

Collection #13 -- D/H/L jct

About 1/2 mile to NE on Harshaw Rd to 23.634 x 41.266 and 5340. Where creek crosses. Explored extensively up this 5300 ft NW/SE valley. Looked very good-- moist black soil under trees in steep slopes.

Collection #14 -- Harshaw creek

At 10:45 at jeep trail jct at creek bed at 24.097 x 41.559 and 5440 ft. Then drive up jeep trail ½ to top of ridge to water tanks at 11:00. Dry and rocky at 5630ft. Here one looks down to the S to the creek of Coll #14 and to the W, coll #9. It might be productive to search the creek and valley slopes while walking from coll #9 to coll #14 (a distance of about 2½ miles and at 5800 to 5300 ft).

About 1.4 miles N on Harshaw Rd to where it runs E/W at creek crossing.

Collection #15 -- Harshaw E/W

At 12:30 Apache road jct and E on Apache road to where the road skirts a steep piedmont, W,N,E-facing at 25.580 x 41.658 and 5340. Steep grades with large rocks, brush and duff under trees. Looked possible, especially among rocks and on E-facing slopes.

Return to Harshaw jct and N on Harshaw past Guajalote Flats to 25.990 x 43.219. Good soil, but perhaps too W-facing. Return S to Guajalote Flats. Sand and junipers here look like NM jam habitat but lower. Ate picnic lunch here leaving 2:00.

At 2:30 steep E facing valley by creek at 26.121 x 43.372 and 5400ft. Continue looking in canyon along creek until stopped by rain.

Go to Patagonia town at 3:45 "Gathering Grounds" coffee shop for espresso and bran muffin.

At 4:30 rain has stopped and return toward Harshaw to find E access to PAT crests and Red Mountain (to 6200 ft) between Patagonia and Harshaw. Road not as shown on Topo map. Lower access is not passable by our vehicle.

At 5:00 return to Patagonia and S on 82 to Flux Canyon road to attempt highland access from NW. Roads there too rough and/or private. Running out of daylight.

Coll #15 Harshaw Road E-W

Return to Nogales with stop at 5:50 at Patagonia Lake (just sightseeing). At 6:30 supper at "City Salads".

Saturday, Sept 1st. Up 5:30 and bkfst with grocery vegetables and hotel eggs. Check out of hotel. Starbucks for Via and two shots, then to Patagonia "Gathering Grounds" for two more. N from Sonoita on 83 to road and up Gardener Canyon at 8:00.

Arrive second mark flag at 42.834 x 45.878 at 8:20. S side of campground up steep rock strewn slope facing N. Black soft soil looked very good. 5450 ft.

Down to creek and to W to 5300 ft. Looked very good, like Florida Canyon. Sycamores. Leave creek 9:00 and back toward vehicle. At big rocks facing N at 43.003 x 46.969.

Drive to stream and N facing rocks at 42.662 x 47.827 at 5600. Looked very good. Road too rough beyond here. This is the place where JB walked among boulders in S creek bed and was very surprised to dislodge one about the size of a basketball. Start return at 9:50. Main collecting done, now return to Tucson to pick up CF from TUS.

e) 20th anniversary reunion collecting and Hungry Film shooting

Drive up to Tucson and do car wash for $4. The vehicle is scratched on the right side and AdR says we scraped a branch, but I don't recall any such serious touch. Picked up CF at TUS. Drive to *La Salsa* on Wilmot & Speedway. Then to Tanque Verde Ramada. A little nap and spend time at pool, then happy hour lunch of chips & salsa. Telling stories about past expeditions and brainstorming future collecting priorities and research objectives.

Sunday, Sept 2nd. Up 6:30 breakfast at hotel. Intent to show RIT habitats to CF. Drove down 19 to RIT and talked to people at Santa Rita Lodge gift shop about potatoes. Walk down Madera Canyon creek to W of road. Then Kent/Bog springs trails and back down road past *Matryoshka* site #2 & #3. Lunch at *La Posada* coffee shop on E side of Green Valley. Back to Tucson, buy scratch remover and apply.

Meet Hungry filming crew Sandy McLeod (SL, director), Kirsten Johnson (KJ, film), Jim Gallup (JG, sound) in hotel lobby and schedule for filming activities which took up all Sept 3-5: staging of shooting of collecting, USPG staff interviews, scenery and other supporting shots, etc.

Monday, Sept 3nd. Breakfast and start up mountain, but KJ missing a filter, return to Tucson to buy one, so got a late start. Early lunch at *Subway*. Wired for sound and filmed in vehicle driving and talking. Drive up Mt Lemmon highway, buying park passes. At 12:05 reach mile 11 and descend to Bear Canyon. E-facing creek bank, under brush and patchy shade. Rocky, sandy, willows, brush, grass.

<u>Collection #16</u> -- CAT mile 11

Up to Mt Lemmon and summit meadow. Filming of walking around looking, finding plants, digging for tubers. Now the plants seen in the scouting expedition on August 25 have mature fruit, so we made actual germplasm collection.

<u>Collection #17</u> -- Mt Lemmon meadow

Filmed an interview of AdR with a backdrop of the scene over the edge to the south from that meadow.

JB interview filming at Rincon trailhead

Tuesday, Sept 4th. Depart hotel 5:30 AM without breakfast to get morning light. Took shots of us driving by the camera. The top of the mountain was so foggy opted for breakfast break, but nothing open at Summerhaven. Back down to Tucson edge for *LaBuzz* cafe. While in vicinity, decided to film hiking and JB interview at Rincons trailhead near Tanque Verde Ranch. Back to mall at start of Mt Lemmon highway for lunch at *Zoe* Mediterranean. Great fava bean salad with tomatoes, onions and garlic. But when I saw a neat little espresso cup, I said to the proprietor that what I really

wanted was that with some Turkish coffee. He said, "I can do that". Turkish with cardamon. Then he brought me a piece of baklava to eat with it for free. Back up to film CF interview about 300 ft due S of summit parking lot. Filmed collecting many berries of many beautiful plants as new collection here.

Collection #18 -- CAT parking summit S

Return to where scouting party saw first SW collection (SBV#1, 1992) on August 25, and collected as 2012 collection #19.

Film shot of JB examining Mt Lemmon *fendleri*

Collection #19 -- SBV 1 re-collect

Back to Tucson late for quick supper at *LaSalsa* Mexican.

Wednesday Sept 5th. Re-do the drive-by shots, so we are not going to meet with film crew until 9:30. At that time, I proposed that I would treat them to a coffee and dessert break. B-line Cafe at university instead at treat of film crew.

Waiting for PM sun, so late start at 9:30 departure for brunch at B-line Cafe near university. More driving shots on highway to Mt Lemmon. JG skins shin slipping off of a rock, and after first aid and reminders to be careful, JB slips down embankment on far side of stone wall, incredibly dislodging boulder about the size of a washing machine, pulling hamstring. Made late time-lapse of sunsets. USPG group move to *Tanque Verde Lodge*, a bit of luxury we allowed ourselves as nostalgia for this 20-year anniversary trip. We had stayed there on the beginning and end days of our backpack hike to top of Rincons in 2006, probably our most strenuous expedition. In 2006 we stayed at this resort because it is within walking distance of the trailhead and cars parked overnight had been vandalized.

Thursday, Sept 6th

Breakfast at Tanque Verde Ranch. To airport, part with CF who is flying to GRB. JB and AdR going to MSN, carrying plants in quart plastic freezer boxes. Arrive about 9:00 PM. IB picks up JB for late drive home to Sturgeon Bay.

APPENDIX

Finances

Karen Williams of USDA/ARS/PEO provides $5,000.

Trip Claims: JB = $2632, JS = $721, CF = $700, AdR = $1096 for Total = $5,000
USPG salaries for time of trip and preparation, plus volunteer travel and time costs for IB, BB, AZ at least an additional $5,000.

Permit

Bamberg, John <John.Bamberg@ars.usda.gov> Aug 24

to me

NO PERMIT

From: Ketcham, Shari -FS
Sent: Wednesday, July 11, 2012 5:58 PM
To: Bamberg, John
Cc: Taiz, Josh -FS; Jones, Larry -FS; Sutton, James J -FS; adelrioc@wisc.edu; Williams, Karen; jd@makedoproductions.com
Subject: RE: Collecting expectations and associated filming plan
Importance: High

John,

Having you collect is not a problem since you are a part of the USDA.

The problem we are having is issuing a permit for the filming crew. Their application indicated that they would only be filming from September 3-5, 2012 on the Santa Catalina Ranger District. I read through your email and it seems that they will be going out to other districts as well, correct? If this is correct, this is where we run into a problem.

When we issue a special use permit for multiple districts, we have to complete a decision memo and allow a 30 day public comment which will mean that the permit would not be approved by the proposed dates.

Two alternatives would be to
(1) only film on a single district for multiple dates <or>
(2) we can give individual permits for each district that you plan to film at during proposed dates at each location (for this option we would need to complete a memo to file).

Either alternative would not require the 30 day public comment period.

Please let me know which option you prefer.

Thank you!

Shari Ketcham
Special Uses Assistant
(520) 749-7701

IDEAS FOR FUTURE WORK

Sample very extensively in the extremely large *jamesii* pops in Mesa Verde and SBV2. How does genetic diversity captured compare to that from many small populations across the range, and how much variance in multiple small samples? That is, are very big pops incubators for much genetic diversity, or just a very large number of uniform plants? Could sample DNA in the field? Return to SBV2 site would also facilitate re-collection of samples at two sites from which plants did not survive in genebank, and exploration of other sites PAT & CON noted in the field as having potential.

Make our own film of whole 20-year & USPG story (see Bamberg's proposal attached).

We need a vehicle that will go on rough trails.

Upcoming priorities: Big Bend (TX), Hualapai Reservation (AZ), Black Range (NM).

Frost hardiness of *fenderli* and *jamesii* tubers?

COLLECTIONS LIST (as numbered in text)

PI 667006. B4dRFS 251. *S. stoloniferum* form *fendleri*. United States. Arizona. Pima county. Pinaleno Mountains. Coronado National Forest. Near Safford. Up 366 to Riggs Lake. At 600 ft SW of lake at cliff edge. At WSG 32° 42.303'N x 109° 58.046'W and 8725 ft. Approximate site of Demlong 119 [1989]. **Coll #1**. Sunday, August 26, 2012. A few dozen robust plants, some small, some flowering, no berries in shade under a NE-facing rock ledge. Among rocks on high alpine cliffs. Collected plants; 6 survive at genebank.

PI 667007. B4dRFS 252. *S. stoloniferum* form *fendleri*. United States. Arizona. Santa Cruz County. Santa Rita Mountains. Coronado National Forest. Near Green Valley. From Green Valley town E on White House / Madera Canyon Road to Madera Canyon. Site of BdR211, Coll #14 of 2010, original *Matryoshka* mutant site. N side of gravel road between Kent Spring and Bog Spring FT jct and Madera Canyon Road. 31° 43.063'N x 110° 52.307'W and 5400 ft. **Coll #2**. Monday, August 27, 2012. Clusters of dispersed plants small to 10 inches. Some are *Matryoshka* mutants. Fruit galls and Colorado Potato Beetle relatives observed here. Near creek bed in leaf mulch and grass, among large boulders under shade of oaks. Collected plants; 10 survive at genebank.

PI 667008. B4dRFS 253. *S. stoloniferum* form *fendleri*. United States. Arizona. Santa Cruz County. Santa Rita Mountains. Coronado National Forest. Near Green Valley. From Green Valley town E on White House / Madera Canyon Road to Madera Canyon. Near site of BdR211, Coll #14 of 2010, original *Matryoshka* mutant site. Where creek crosses under gravel road near Kent Spring and Bog Spring FT jct. 31° 43.045'N x 110° 52.271'W and 5425 ft. **Coll #3**. Monday, August 27, 2012. Occassional small green plants, few flowers, no fruit. Grassy slopes and knolls, rich black soil, especially in steep N facing slope S of creek. Collected plants; 8 survive at genebank.

PI 667009. B4dRFS 254. *S. stoloniferum* form *fendleri*. United States. Arizona. Santa Cruz county. Santa Rita Mountains. Coronado National Forest. Near Green Valley. From Green Valley town E on White House / Madera Canyon Road to Madera Canyon. Along Madera Canyon creek just W of southernmost trailheads parking lot (5400 ft) working down to Chuparosa Lodge. 31° 42.777'N x 110° 52.514'W and 5400-5200 ft. **Coll #4a**. Monday, August 27, 2012. Occassional plants, most small, some flowers, immature fruit. Leaf mulch in shaded creek bottoms. Collected 14 plants, 2 tuber, and two fruit; 12 plants, 2 tubers, and 92 seeds survive at genebank.

PI 667010. B4dRFS 255. *S. stoloniferum* form *fendleri*. United States. Arizona. Santa Cruz County. Santa Rita Mountains. Coronado National Forest. Near Green Valley. From Green Valley town E on White House / Madera Canyon Road to Madera Canyon.W ditch of road at front of Chuparosa Lodge. 31° 42.879'N x 110° 52.547'W and 5300 ft. **Coll #4b**. Monday, August 27, 2012. Many large flowering and fruiting plants with many large fruit galls. Full sun among ivy right next to pavement. Collected plants and 3 fruit; 3 plants and 95 seeds survive at genebank.

PI 667011. B4dRFS 256. *S. stoloniferum* form *fendleri*. United States. Arizona. Cochise county. Canelo Mountains. Coronado National Forest. Near Parker Canyon Lake. From Sonoita S on 83 to Canelo then about 5.5 miles to Cochise county line near FR 201. W of 83 to creek bed, right on E side of creek. Under large boulder along artificial dam. 31° 27.730'N x 110° 27.495'W and 5650 ft. **Coll #5**. Wednesday, August 29th, 2012. One large plant with a single large, mature fruit. Under boulder in creek bed in high desert. Collected one fruit; 82 seeds survive at genebank.

PI 667012. B4dRFS 257. *S. jamesii*. Montezuma Pass. Huachuca Mountains. United States. Arizona. Coronado National Forest. From Sonoita S on 83 past Canelo and Parker Canyon Lake to gravel Montezuma Canyon Road and about 11 miles to where road crosses gulley. Near Cochise county. Culvert on N side of road in washed up sand berm. 31° 22.352'N x 110° 19.805'W and 5780 ft. Many very large and flowering plants all in one small berm of alluvium where the wash water eddied at the culvert, dark green and perfect condition. **Coll #6**. Wednesday, August 29th, 2012. In moist red sand partially shaded from S exposure by a few scrub pines and being below road grade. Collected plants; 3 survive at genebank.

PI 667013. B4dRFS 258. *S. jamesii*. Montezuma Pass. Huachuca Mountains. United States. Arizona. Coronado National Forest. From Sonoita S on 83 past Canelo and Parker Canyon Lake to gravel Montezuma Canyon Road and

about 11 miles to where road crosses gulley. About 0.15 miles E past FR that goes N to Ida Canyon. Near Cochise county. From Montezuma Canyon Road N to Ida Canyon on FR about 0.6 mile to valley at confluence of creeks. 31° 22.903'N x 110° 19.777'W and 6000 ft. Site of SBV2 (1992). Many thousands of plants over a widespread area. Small to about 10 inches, but mostly spindly, yellow, flowers rare. **Coll #7**. Wednesday, August 29th, 2012. In rich valley soil in leaf mulch under shade of sycamore and oaks. Collected about 30 plants; 13 survive at genebank.

PI 667014. B4dRFS 259. *S. jamesii*. United States. Arizona. Cochise county. Canelo Mountains. Coronado National Forest. Near Parker Canyon Lake. From Sonoita S on 83 past Canelo to Parker Canyon Lake. At jct of 83 and gravel Montezuma road, continue W on paved Parker Canyon Lake road toward campsites for about 0.9 miles where a great culvert goes under road for drainage S to the lake. At 31° 25.781'N x 110° 26.759'W and 5425 ft. **Coll #8**. Wednesday, August 29th, 2012. Rare plants only under a few trees. Small to about 10 inches, but mostly spindly, yellow. In rich valley soil in leaf mulch under shade of sycamore and oaks. Collected 7 plants; 5 survive at genebank.

PI 667015. B4dRFS 260. *S. stoloniferum* form *fendleri*. United States. Arizona. Santa Cruz county. Patagonia Mountains. Coronado National Forest. Near Patagonia. From Nogales NE on 82/Patagonia highway to gravel Dusquene road then E into Pagagonia mountains. About 12 miles E from 82 at a roadside pulloff on E side. Then down creek to N and up E facing slopes. 31° 23.201'N x 110° 42.729'W and 5900 ft. **Coll #9**. Thursday, August 30th, 2012. Many widely scattered plants to 10 inches, old, difficult to spot. One or two large, mature fruit per plant. In rich soil under leaf mulch, especially protected by fallen branches and rocks, but mostly in steep, open E-facing slope. Collected 27 fruit; 412 seeds survive at genebank.

PI 667016. B4dRFS 261. *S. stoloniferum* form *fendleri*. United States. Arizona. Santa Cruz county. Patagonia Mountains. Coronado National Forest. Near Patagonia. From Nogales NE on 82/Patagonia highway to gravel Dusquene road then E into Patagonia mountains. About 14 miles E from 82 to Harshaw and Lochiel Rds jct and S another 1/2 mile to driveway where creek crosses road, just past Majalca drive. Site of only previous coll from PAT and carrier of pigmentless mutant (BF 087, PI 620874, coll 2001). 31° 22.805'N x 110° 41.358'W and 5330 ft. **Coll #10**. Thursday, August 30th, 2012. A few 8 inch plants, very old with mature fruit. Only in E-facing bare mulch under trees near creek wash. Collected 4 fruit; 134 seeds survive at genebank.

PI 667017. B4dRFS 262. *S. jamesii*. United States. Arizona. Cochise county. Canelo Mountains. Coronado National Forest. Near Parker Lake. N from Parker Lake on 83, from T jct Montezuma & Parker Canyon Lake Rds, about 2 miles N on 83 across road from PC Ranch. Less than 20 ft from road in W ditch. 31° 26.770'N x 110° 26.860'W and 5510 ft. **Coll #11**. Thursday, August 30th, 2012. A few small yellowed, old plants only in one small area. Very steep E facing open roadcut, with only a few herbs and grass, sandy brown soil. Collected 7 tubers; 4 survive at genebank.

PI 667018. B4dRFS 263. *S. stoloniferum* form *fendleri*. United States. Arizona. Cochise county. Canelo Mountains. Coronado National Forest. Near Parker Lake. N from Parker Lake on 83, from T jct with Montezuma & Parker Canyon Lake Rds, about 3 miles N on 83 near mile marker 6. At a small wash running to W. 31° 27.281'N x 110° 27.154'W and 5575 ft. **Coll #12**. Thursday, August 30th, 2012. A few plants to 8 inches, some flowering and a few fruit. On N facing side of wash, partial shade in rich black soil in grass and herbs. Collected 4 fruit; 55 seeds survive at genebank.

PI 667019. B4dRFS 264. *S. stoloniferum* form *fendleri*. United States. Arizona. Santa Cruz county. Patagonia Mountains. Coronado National Forest. Near Patagonia. From Nogales NE on 82/Patagonia highway to gravel Dusquene road then E into Patagonia mountains. About 14 miles E from 82 to Harshaw and Lochiel Rds jct.; N edge of parking area. 31° 23.205'N x 110° 41.508'W and 5500 ft. **Coll #13**. Friday, August 31th, 2012. One small plant. Under pine tree in grass. Collected 1 plant; none survive at genebank.

PI 667020. B4dRFS 265. *S. stoloniferum* form *fendleri*. United States. Arizona. Santa Cruz county. Patagonia Mountains. Coronado National Forest. Near Patagonia. From Nogales NE on 82/Patagonia highway to gravel Dusquene road then E into Pagagonia mountains. About 14 miles E from 82 to Harshaw and Lochiel Rds jct, then N on Harshaw about 0.6 miles to where a creek crosses the road. 31° 23.634'N x 110° 41.259'W and 5290 ft. **Coll #14**. Friday, August 31st, 2012. Three small plants. In rich black sandy soil under leaf mulch, under one tree in N facing creek bank. Collected 3 plants; none survive at genebank.

PI 667021. B4dRFS 266. *S. stoloniferum* form *fendleri*. United States. Arizona. Santa Cruz county. Patagonia Mountains. Coronado National Forest. Near Patagonia. From Nogales NE on 82/Patagonia highway to gravel Dusquene road then E into Pagagonia mountains. About 14 miles E from 82 to Harshaw and Lochiel Rds jct, then N on Harshaw about 3 miles to where the road curves due E. 31° 25.033'N x 110° 41.803'W and 5380 ft. **Coll #15**. Friday, August 31st, 2012. Rare plants to 10 inches, old, sickly, some dead, sometimes with thick stems regrown after being grazed. Under big junipers in broad grassy floodplain where creek crosses roadway. One plant growing in crotch of a tree. Collected 4 fruit; 172 seeds survive at genebank.

PI 667022. B4dRFS 267. *S. stoloniferum* form *fendleri*. United States. Arizona. Pima county. Santa Catalina Mountains. Coronado National Forest. Near Tucson. From Tucson up General Hitchcock / Mt. Lemmon Highway. At mile 11 in Bear Canyon at the pulloff. 32° 22.252'N x 110° 42.021'W and 5800 ft. **Coll #16**. Monday, September 3rd, 2012. Plants rare to 10 inches, but robust, green, some grazed, some with mature fruit. E facing creek banks among willows, brush, in partial shade in this narrow canyon. Collected 6 fruit; 56 seeds survive at genebank.

PI 667023. B4dRFS 268. *S. stoloniferum* form *fendleri*. United States. Arizona. Pima county. Santa Catalina Mountains. Coronado National Forest. Near Tucson. From Tucson up General Hitchcock / Mt. Lemmon Highway. Past road to Summerhaven up toward ski hill and summit parking lot and meadow trail #5. 32° 26.308'N x 110° 47.550'W and 9090 ft. **Coll #17**. Monday, September 3rd, 2012. Many thousands of robust plant scattered widely, flowering and fruiting. Grassy high flat meadow under shade of very large pines and firs. Collected 105 fruit only 20 of which not ruined by fruit flies; about 200 seeds survive at genebank.

PI 667024. B4dRFS 269. *S. stoloniferum* form *fendleri*. United States. Arizona. Pima county. Santa Catalina Mountains. Coronado National Forest. Near Tucson. From Tucson up General Hitchcock / Mt. Lemmon Highway. Past road to Summerhaven up toward ski hill and summit parking lot. Then directly SE over the steep SE slope. 32° 26.402'N x 110° 47.120'W and 9080 ft. **Coll #18**. Monday, September 4th, 2012. Many thousands of robust plans scattered widely, flowering and fruiting. Rocky, steep open slope among fallen logs. Collected 109 fruit only 24 of which not ruined by fruit flies; about 200 seeds survive at genebank.

PI 667025. B4dRFS 270. *S. stoloniferum* form *fendleri*. United States. Arizona. Pima county. Santa Catalina Mountains. Coronado National Forest. Near Tucson. From Tucson up General Hitchcock / Mt. Lemmon Highway. About 0.2 miles before (NE of) the turnoff to the ski hill and summit. Across from the Emergency services road that runs due N, on the W-facing banks of a small gorge. Re-collection site of SBV 1, 1992. 32° 26.874'N x 110° 45.311'W and 7930 ft. **Coll #19**. Monday, September 4th, 2012. Rare plants, spindly, sometimes flowering or with a few fruit less than fully mature. Steep W-facing slope in black soil with light leaf mulch and debris under small trees or protected by fallen branches, sometimes among large rocks. Collected 19 small fruit, only 4 of which not ruined by fruit flies; 54 seeds (possibly immature) survive at genebank.

Explanation of potential value of *Matryoshka* and other floral mutants; Fruit gall

Matryoshka and other floral mutants

Normal floral meristems do several remarkable things...

1. Halve the number of chromosomes through meiosis in the gametes, and otherwise control hybrid seed production
2. Eliminate the viruses that were present in the mother plant from which it grew
3. Produce a propagule (i.e., a botanical seed) that can dry and remain dormant and viable for 50+ years in a common freezer.

If we better understood, and could better control how these meristems worked, we might be able to modify their normal actions to accomplish some things very useful to potato breeding and improvement...

1. Get desired hybrids that are currently very difficult to make
2. Easily make virus-free shoots of virus infected stocks
3. Put elite selected genotypes (e.g., desirable varieties) that now have to be preserved as tubers or shoots into the form of botanical seeds that could be preserved and distributed with much less effort and expense.

Potential of Fruit Galls

The same issues of control of the fruit meristems may apply.

Also:

1. There is interest in understanding any factor that might be reducing the reproductive capacity of these plants in the wild. That is because we would like to understand the availability of collectable materials in the wild and how the genetic resource in the wild compares to that in the genebank. For example, has the genebank captured a fairly good sample of the genetics available in the Southwest, or have we just scratched the surface? The answer, of course, dictates how concerned we are about factors that would change or extinguish potato germplasm in the wild, and how important it is to continue to collect more.

2. Presumably some kind of wasp is making the fruit tissue grow abnormally. Is that mediated by an associated bacterium that actually genetically transforms the tissue to grow undifferentiated? Understanding these things might provide new opportunities for manipulating the genetics of potato for breeding purposes.

Concept of Film Group 2012 "HUNGRY"

An independent NY film company is doing a documentary on genetic resources. There has already been a focus on CIP and Potato Park (Cuzco) in Peru with the spin of the native home of cultivated potato and the center of diversity for wild relatives. They wanted to portray a real collecting expedition, and Karen Williams of Beltsville introduced them to us. We agreed to have them film our 2012 trip. Actually, it was recognized as being impractical for them to accompany a "real" collecting expedition. So, we orchestrated such that a group would scout a film location that was 1) logistically handy, 2) picturesque, and 3) had robust wild potato plants. On Aug 25-28 we scouted Santa Catalina, Pinaleno, and Santa Rita mountains and chose the first. We (Bamberg and del Rio) did actual exploration and collecting in new site of Canelo and Patagonia mountains on Aug 28 – Sept 1. Then we (Bamberg, del Rio, Fernandez) filmed in Santa Catalinas on Sept 2-5. The Hungry film crew included Sandy McLeod (director), Jim Gallup (sound), Kirsten Johnson (camera). We were the last to be filmed, so the final product should be available soon. We hope some of the pertinent footage will be available for USPG to put on its website for outreach.

Proposed extended filming scheme not accepted by *Hungry* (possible template for in-house film)

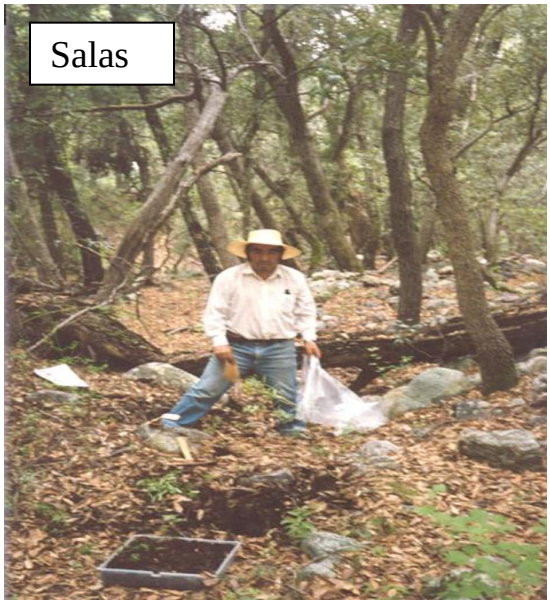
SW potato collecting 2012

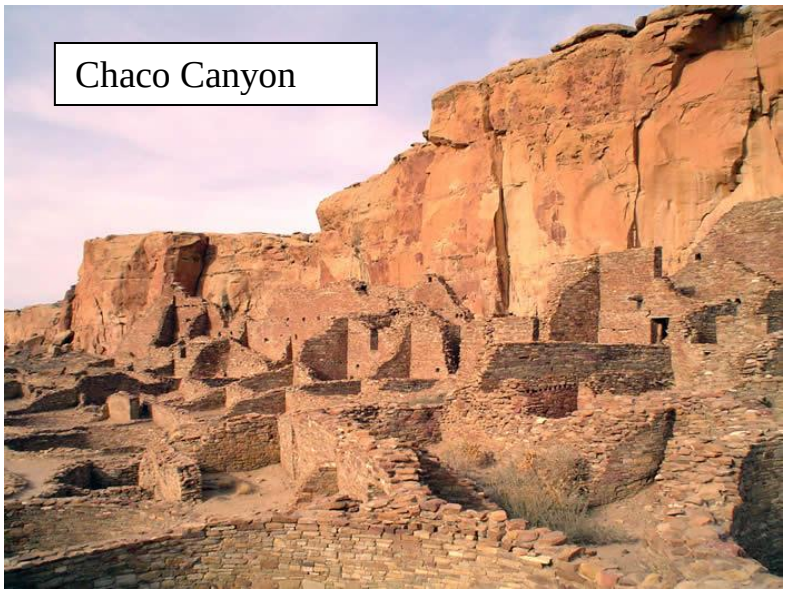
Concept: If the film coverage aims to just be an example of a typical collecting trip, it might not communicate the more interesting "big picture" to the average viewer. This will be the 20th year of our collecting trips—why not make this a celebration... a 20 year reunion tour? We could bring in collectors who have participated over the year, and cooperators who have worked with the material, expanding so as to tell the whole story of what we have learned by collecting and the genebank's mission and impact as related to these collections. If we did that well, it would be worth missing one year of actually collecting new germplasm.

Here are some scenes I envision to communicate teaching points...

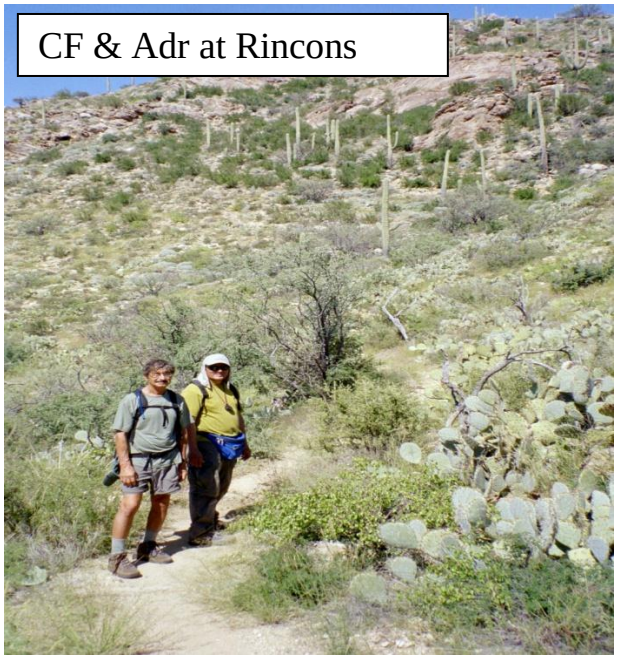
1. Go to Tucson, visit the first collection site of 1992 in the Catalinas... SBV-1. Remark how naive we were in looking for tall, flowering plants that could be spotted driving by, when they are often rare, small, and hidden. Teaching point: **There is a "treasure hunt" feel in collecting.**

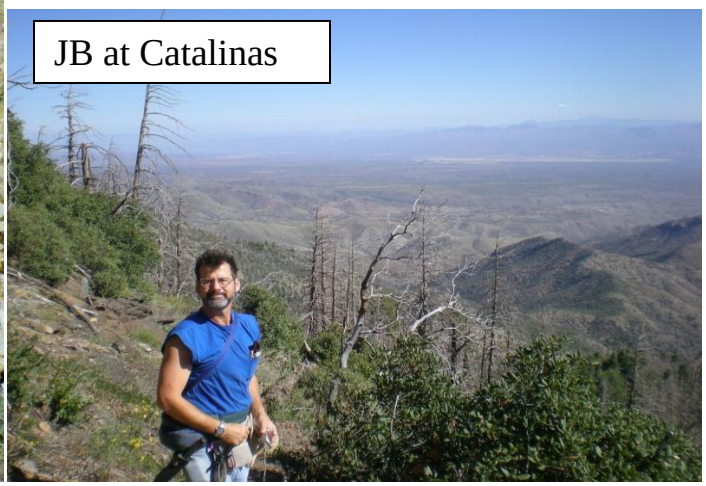
2. Get Alberto Salas to come up from Lima. He is the "S" of the first SBV collections, given the leadership role in deference to his tremendous experience in collecting in Latin America working for the International Potato Center (CIP). We go to Ida Canyon to revisit the first *jamesii* collection. Shoot Alberto saying that USPG freely shares this and other material with CIP and other world potato genebanks. Teaching point: **International effort and benefit.** Also Stepan Kiru, head of the Vavilov Inst Potato Program, St. Petersburg, Russia collected with us in Chaco Canyon. Teaching point: **International effort again, plus, ethnobotanical spin of *jamesii* associated with the ancient Native Americans, found in hearths, probably used as food, stories of being collected by locals when they were kids, etc.**





3. We go to the Rincons trailhead. Shoot long time collecting partner Chico Fernandez of USPG standing among the Saguaros gesturing to the Rincon crest some 5000 feet above, and 13 miles away, he notes backpacking to remote sites took much more time and effort. Then gesturing to the Catalinas to the NW says that we found that those nearby Catalinas (easily accessible by road) actually have more genetic diversity. Teaching point: **Research compares remote vs easy sites and shows hot spots for more intensive collecting**.



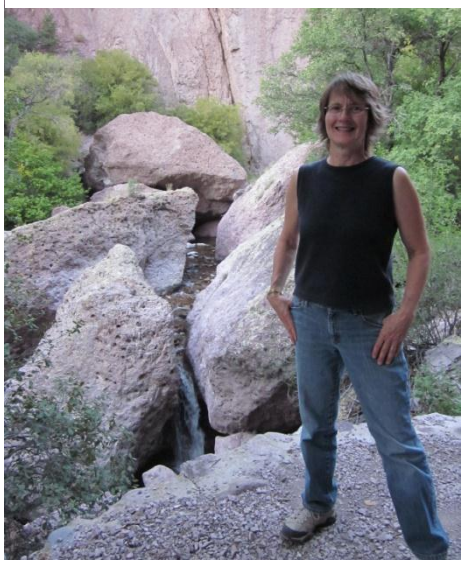


4. Go to Mogollon. Look at plants which were used to compare diversity captured by seeds versus tubers. Teaching point: **Research can show best collecting techniques.**

5. Go to Continental Divide S of Silver City, site of SBV17. Show *jamesii* in Juniper / Pinion habitat. Teaching point: ***S. jamesii* growing in these harsh habitats may have resulted in remarkable traits like its 8-year tuber dormancy (we discovered).**

6. Go to Catwalk at Glenwood. Teaching point: **In shady slot canyons with water, there may be robust populations of potatoes—and here the two species may grow very close to each other.**

Ingrid at Catwalk near Glenwood, NM



7. Get Chuck Brown from Prosser, WA to come with us to Barfoot and Rustler Parks high alpine habitat where he collected with us in 2002. Show Chuck examining the particular spots where the potatoes grow, and remarking that only *some* of the colonies growing here had the remarkable nematode resistance that he discovered. Chuck at home showing nematode-infected tuber? Teaching point: **These plants have valuable breeding traits**. Teaching point: **Diversity is not very well predictable by location, and re-collections can be different, so we need to collect and test everything we can find.**

Chuck Brown

Barfoot Park

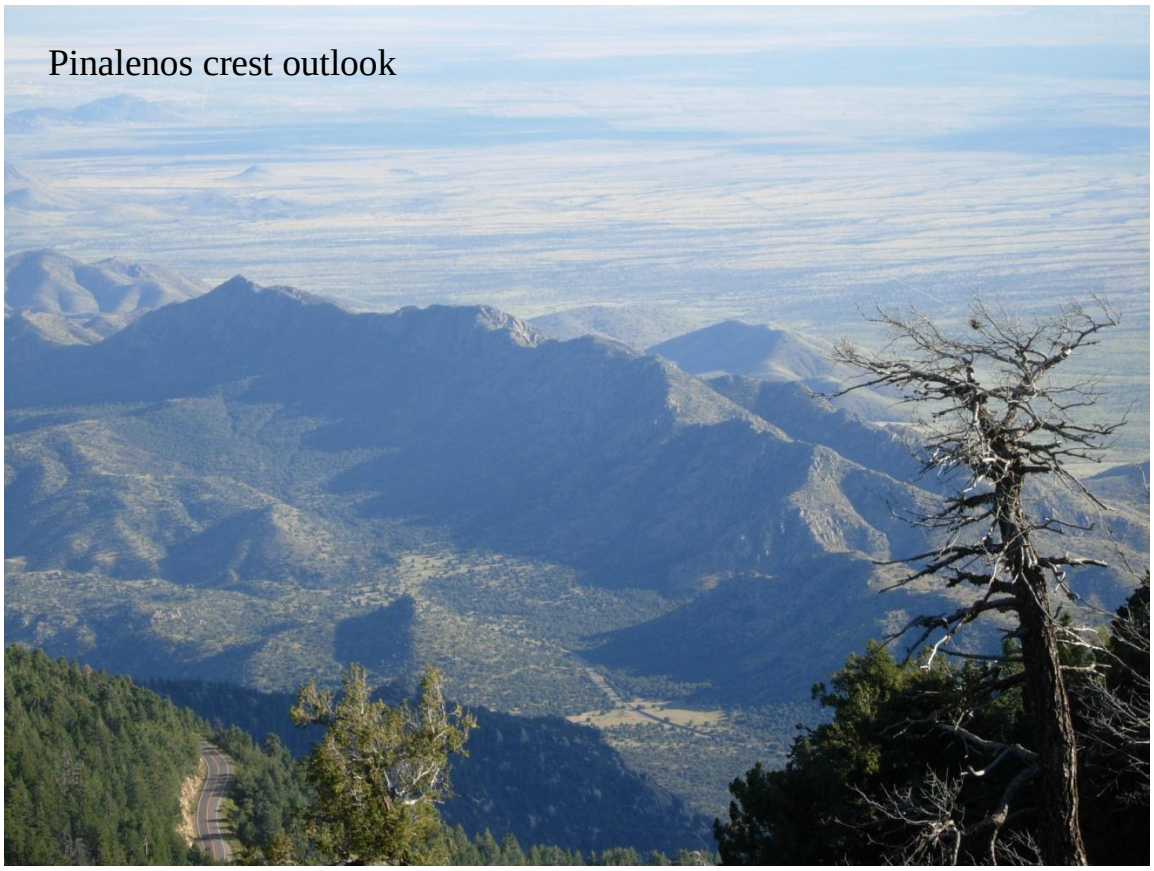
8. Hike to Mt. Wrightson peak, camping one night along the way(?). Look for potatoes at the very summit and along crags of the crest. Teaching point: **Show camping experience and that *fendleri* often likes the cool sky islands.** Note: This area also is source of unique purple-less mutant, and *Matryoshka* fruit mutant we discovered; lowest reported *fendleri*.

summmit of Ritas shown at left with Alfonso

9. Go to Riggs Lake in the Pinalenos. Teaching point: **Are there diversity predictors? Around this artificial high (8750 ft) sky island lake is a diversity hotspot—is that due to long distance transport by birds?**

Riggs Lake in Pinalenos

Note: This is a pretty place, and easy to get to (paved most of the way)...



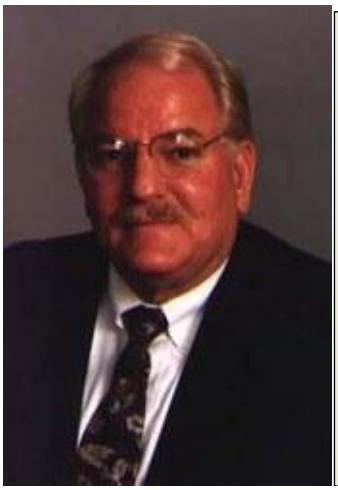
We did camp here in 2008. If we want to depict the camping experience in collecting, but avoid the much extra prep of backpacking, this site would be a good drive-up-camp alternative to Sta Ritas suggested in stop #8 above.

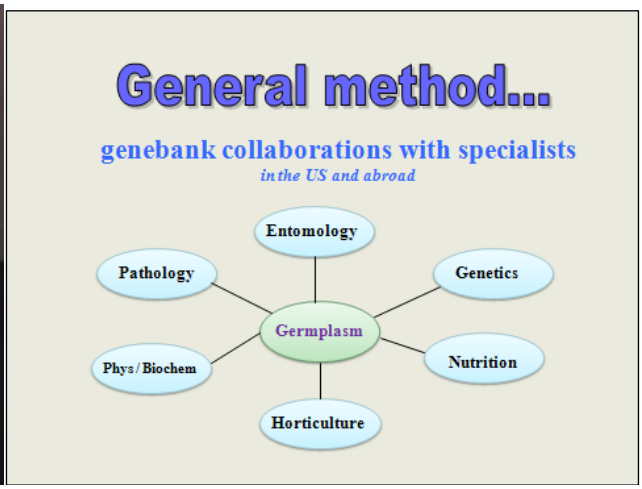
10. Go to Madison. Show Alfonso in the lab doing DNA comparisons that have allowed us to make conclusions about how various aspects of collecting techniques impact the capture of genetic diversity. Also "interview" Sandra Vega, Peruvian-American participant in first collecting expedition in 1992 as a new graduate student. Teaching point: **This work has been used to train graduate students.** Note: stop #4 was also theme of a graduate student thesis.

Sandra Vega

11. Got to USPG at Sturgeon Bay. Show what we do with stocks that have been collected from the wild. Teaching points: **They look different-- a lot more lush with abundant flowering in the greenhouse. We intermate them by hand to make thousands of seeds to store for *free* distribution to researchers and breeders around the country and world. Such storage is also a hedge against extinction in the wild.**

12. Go to TAMU, College Station, TX to interview Dr. J. Creighton Miller. He remarks about the work he did discovering very high antioxidant content and anti-prostate cancer components of the *jamesii* we collected. Teaching point: **Collected stocks have valuable traits. USPG's normal approach to discovering those traits is through research cooperation with specialists in the relevant discipline**.





The collecting spots are not too far apart and close to Tucson airport-- except the option to go to Chaco Canyon (the northern stop 2), which is about 300 miles from Glenwood/Mogollon (stops 4,6)...

Finally: This all envisions more and earlier planning/coordination to make sure schedules and travel money are available for Alberto, Chico, Chuck, Alfonso, Stepan, others(?). Also extra travel to Madison, Sturgeon Bay, College Station sites.