

Appendix B: Spring Inventory and Assessment Reports for Springs Surveyed in the Upper Santa Cruz Basin Study Area

Springs surveyed in the Upper Santa Cruz River Basin

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Agua Caliente Spring
Survey Summary Report, Site ID 12823

Location: The Agua Caliente Spring ecosystem is located in Pima County in the Rillito Arizona 15050302 HUC, managed by the private US owner. The spring is located at 32.28068, -110.72896 in the Agua Caliente Hill USGS Quad (NAD 83). The elevation is approximately 822 meters. Sky Island Alliance surveyed the site on 4/15/13 for 03:00 hours, beginning at 9:00, and collected data in 3 of 12 categories.

Physical Description: Agua Caliente Spring is a limnocrone spring. This site is in a Pima County Park. It is developed, and consists of three ponds and the habitat that surrounds them. The geomorphic diversity is 0.00, based on the Shannon-Weiner diversity index.

The distance to the nearest spring is 5259 meters.

Alamo Spring Survey Summary Report, Site ID 11964

Location: The Alamo Spring ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 15050301 HUC, managed by the US Forest Service. The spring is located in the Sierra Vista RD, Coronado NF at 31.36593, -111.13737 in the Alamo Spring USGS Quad, measured using a GPS (NAD83, estimated position error 20 meters). The elevation is approximately 1319 meters. Cory Jones, Karen Caruso, John Caruso, and Jim Littlejohn surveyed the site on 8/27/14 for 00:45 hours, beginning at 10:45, and collected data in 5 of 12 categories.

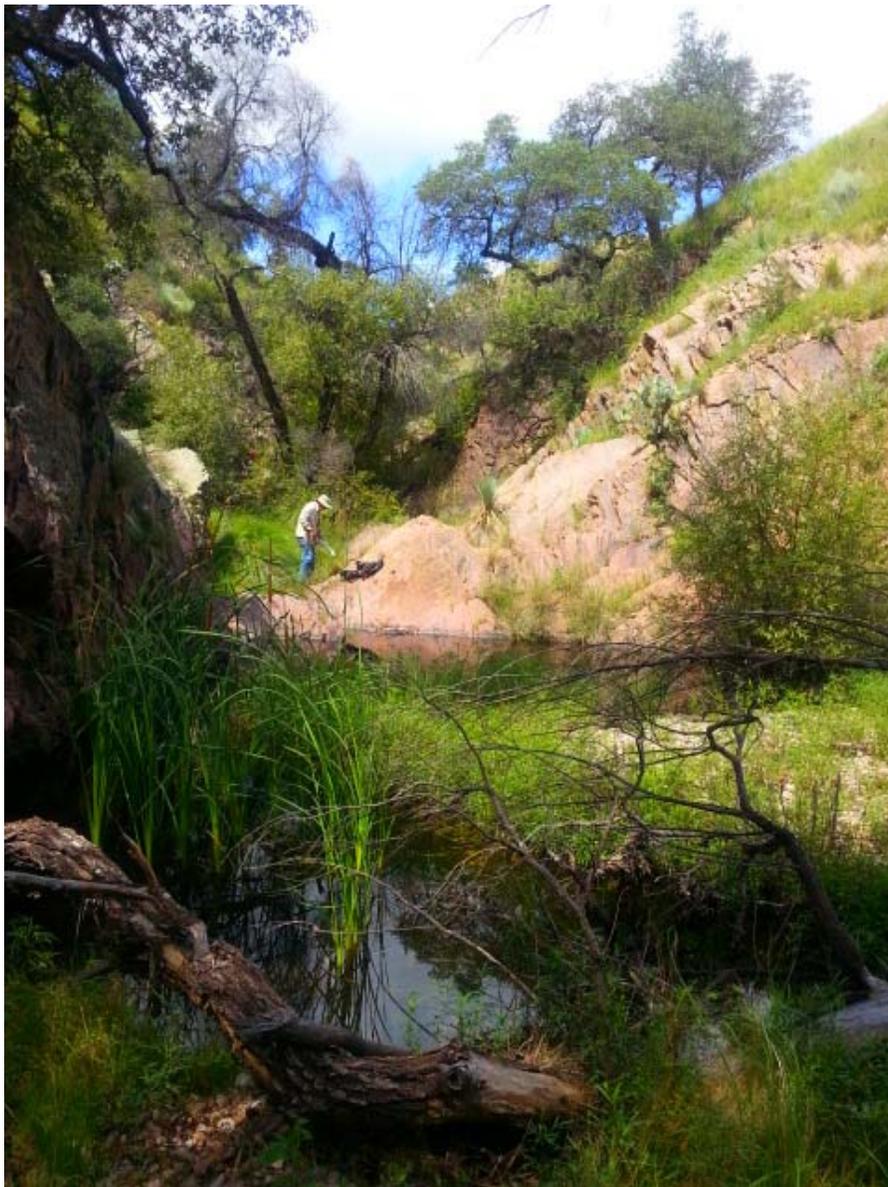


Fig 1 Alamo Spring: Upper pool.

Physical Description: Alamo Spring is a rheocrene spring. Waters from this rheocrene spring create a shaded oasis of cottonwood and willows over two or three pools encircled by deergrass in an otherwise open canyon.

The emergence environment is subaerial, with an artesian flow force mechanism. The distance to the nearest spring is 1132 meters.

Survey Notes: Recent monsoon rainfall has inundated the entire site. All three previously defined pools have combined into one running channel. The site was lush with wildflowers and grasses. Normally the hike from the end of FS4188 to the site takes 45-50 minutes. Due to surface flow down the entire run of Alamo Canyon and thick vegetative cover, the hike took 1.5 hours to the site.

Table 1 Alamo Spring Water Quality with multiple readings averaged.

Characteristic Measured	Average Value
pH (field)	7.79
Specific conductance (field) (uS/cm)	350
Temperature, water C	24.8

Fauna: Surveyors collected or observed 3 vertebrate specimens.

Table 2 Alamo Spring Vertebrates.

Species Common Name	Count	Detection
Bullocks oriole	1	obs
Chiricahua Leopard frog	3	obs
canyon wren	1	call

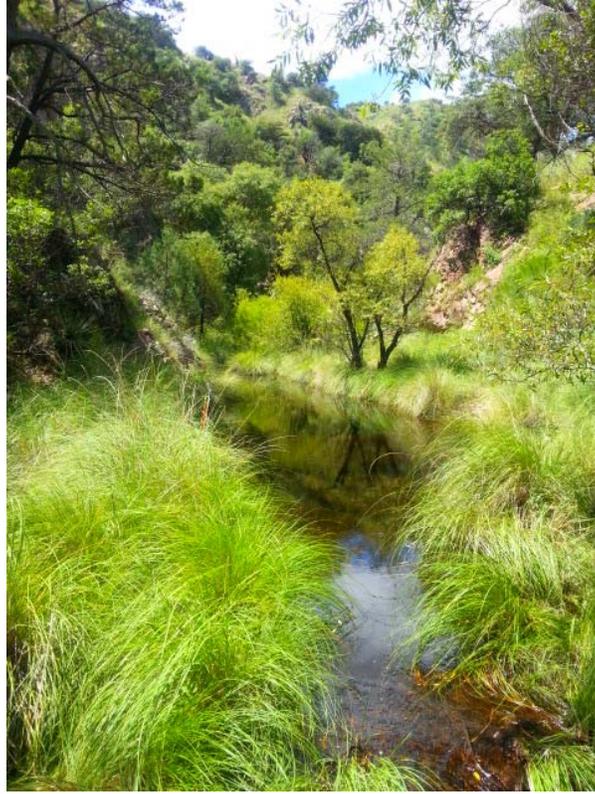


Fig 2 Alamo Spring: Middle pool.

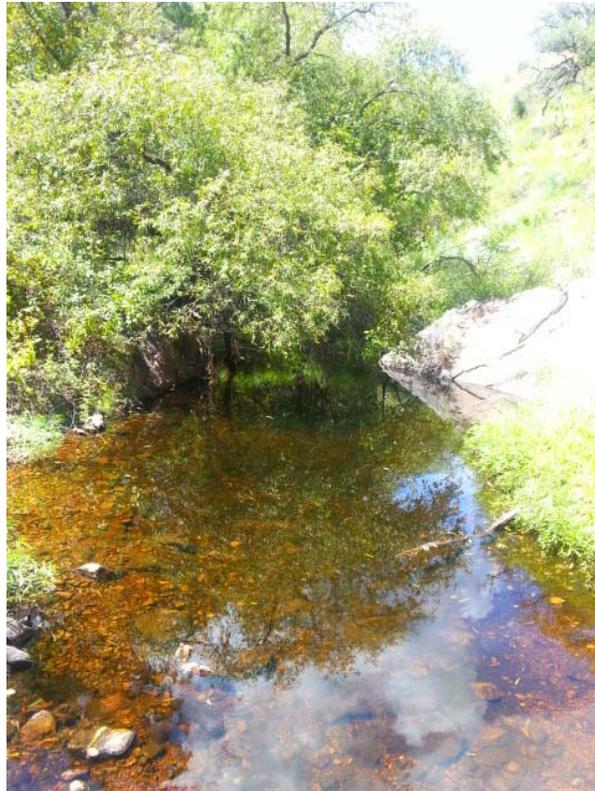


Fig 3 Alamo Spring: Lower pool.

Barrel Spring Survey Summary Report, Site ID 12846

Location: The Barrel Spring ecosystem is located in Pima County in the Rillito Arizona 15050302 HUC, managed by the private US owner. The spring is located at 32.30478, -110.78146 in the Sabino Canyon USGS Quad (NAD 83). The elevation is approximately 875 meters. Samantha Hammer, Mirna Manteca surveyed the site on 9/11/15 for 00:45 hours, beginning at 9:15, and collected data in 1 of 12 categories.

Physical Description: Barrel Spring is a hypocrene spring. A possible spring on/near a hill with no surface water emerging, but with a mesquite bosque about 30m below the coordinates. Maybe a hypocrene spring? There are several golf greens within 10-30m of the coordinates, so the spring emergence may have been destroyed in the construction of the golf course. This spring and several others in the immediate area appear to emerge at a detachment fault at the base of the Catalinas. It is possible the location was wrong for this spring, and Barrel Spring actually refers to a spring ~300m to the west that was previously unmapped (Sabino Greens Unnamed, 179834).

The distance to the nearest spring is 767 meters.

Survey Notes: The surveyors spent nearly an hour searching the hillside and approaching the coordinates from several directions and did not find evidence of a current or past spring. The coordinates were on a hillside of desert vegetation. It may have been destroyed by the development of the golf course. There is a mesquite bosque nearby, so it may just be a hypocrene spring currently. The presence of several springs nearby suggests it was probably near these coordinates at some point, in some form. It could also have dried up from internal dynamics in the fault. *Examination of another topo map shows the spring between two houses, an area that was not searched. This location should be checked.*

Basin Spring Survey Summary Report, Site ID 11946

Location: The Basin Spring ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 15050301 HUC, managed by the US Forest Service. The spring is located in the Sierra Vista RD, Coronado NF at 31.42181, -110.75956 in the Cumero Canyon USGS Quad (NAD 83). The elevation is approximately 1636 meters. Louise Misztal, Carianne Campbell, Randy Seraglio, Tim Cook, Steve Buckley surveyed the site on 4/19/14 for 00:00 hours, beginning at 0:00, and collected data in 1 of 12 categories.



Fig 1 Basin Spring: possible previous location of spring

Physical Description:

The distance to the nearest spring is 1663 meters.

Survey Notes: Spring not found. There was no sign of spring vegetation or habitat found. There was a small depression that may have previously been a hillslope spring site.

Bellows Spring Survey Summary Report, Site ID 17067

Location: The Bellows Spring ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 15050301 HUC, managed by the US Forest Service. The spring is located in the Nogales RD, Coronado NF at 31.69882, -110.85090 in the Mount Wrightson USGS Quad (NAD 83). The elevation is approximately 2574 meters. Louise Misztal, Randy Seraglio, Chris Hefner, Anamarie Shaecher, Aida Castillo-Flores, Glenn Furnier surveyed the site on 11/15/14 for 01:30 hours, beginning at 13:00, and collected data in 7 of 12 categories.



Fig 1 Bellows Spring.

Physical Description: Bellows Spring is a rheocrene spring emerging from multiple points in a rock channel in very steep terrain. The site has 2 microhabitats, including A -- a 140 sqm channel, B -- a 0 sqm terrace.

Bellows Spring emerges as a contact spring from a igneous, rhyolite rock layer in an unknown unit. The emergence environment is subaerial. The distance to the nearest spring is 570 meters.

Survey Notes: This spring is in an area that burned severely several years ago, which may have influenced the spring. There is a recreational trail created by hikers experiencing some erosion to the side of the channel. Overall, the spring is in good shape and providing water for wildlife.

Table 1 Bellows Spring Water Quality with multiple readings averaged.

Characteristic Measured	Average Value
pH (field)	6.84
Specific conductance (field) (uS/cm)	44.5
Temperature, air C	5
Temperature, water C	5.95

Flora: Surveyors identified 9 plant species at the site, with 0.0643 species/sqm. These included 9 native and 0 nonnative species.

Table 2 Bellows Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	2	1
Shrub	1	0
Mid-canopy	2	0
Tall canopy	3	1
Basal	0	0
Aquatic	0	0
Non-vascular	1	0

Table 3 Bellows Spring Vegetation.

Species	Cover Code	Native Status	Wetland Status
<i>Aquilegia chrysantha</i>	GC	N	W
<i>Fraxinus velutina</i>	TC	N	R
<i>Heuchera sanguinea</i>	GC	N	
moss	NV	N	F
<i>Pinus strobiformis</i>	TC	N	
<i>Populus tremuloides</i>	TC	N	U
<i>Quercus gambelii</i>	MC	N	F
<i>Ribes</i>	SC	N	F
<i>Robinia neomexicana</i>	MC	N	F

Fauna: Surveyors collected or observed 8 vertebrate specimens.

Table 4 Bellows Spring Vertebrates.

Species Common Name	Count	Detection
house wren	1	obs
White-breasted nuthatch	1	obs
canyon wren		call
Green-tailed Towhee	1	call
yellow-eyed junco	10	obs
dark-eyed junco	10	obs
ruby-crowned kinglet		
woodpecker		sign

Assessment: Assessment scores were compiled in 5 categories and 24 subcategories, with 18 null condition scores, and 18 null risk scores. Aquifer functionality and water quality are good with significant restoration potential and there is negligible risk. Geomorphology condition is good with significant restoration potential and there is negligible risk. Habitat condition is good with significant restoration potential and there is low risk. Biotic integrity is excellent with no need for restoration and there is negligible risk. Human influence of site is good with significant restoration potential and there is low risk. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is good with significant restoration potential and there is negligible risk.

Table 5 Bellows Spring Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	4	1.8
Geomorphology	4.6	1.8
Habitat	4.6	2
Biota	6	1.5
Human Influence	4.8	1.9
Administrative Context	0	0
Overall Ecological Score	4.7	1.8

Management Recommendations: This spring is in an area that burned severely years ago which may have influenced spring flow amount. There is a recreational trail created by hikers experiencing some erosion to the side of the channel. Overall this spring is in good shape and can continue to be managed as is. Is providing water for wildlife.

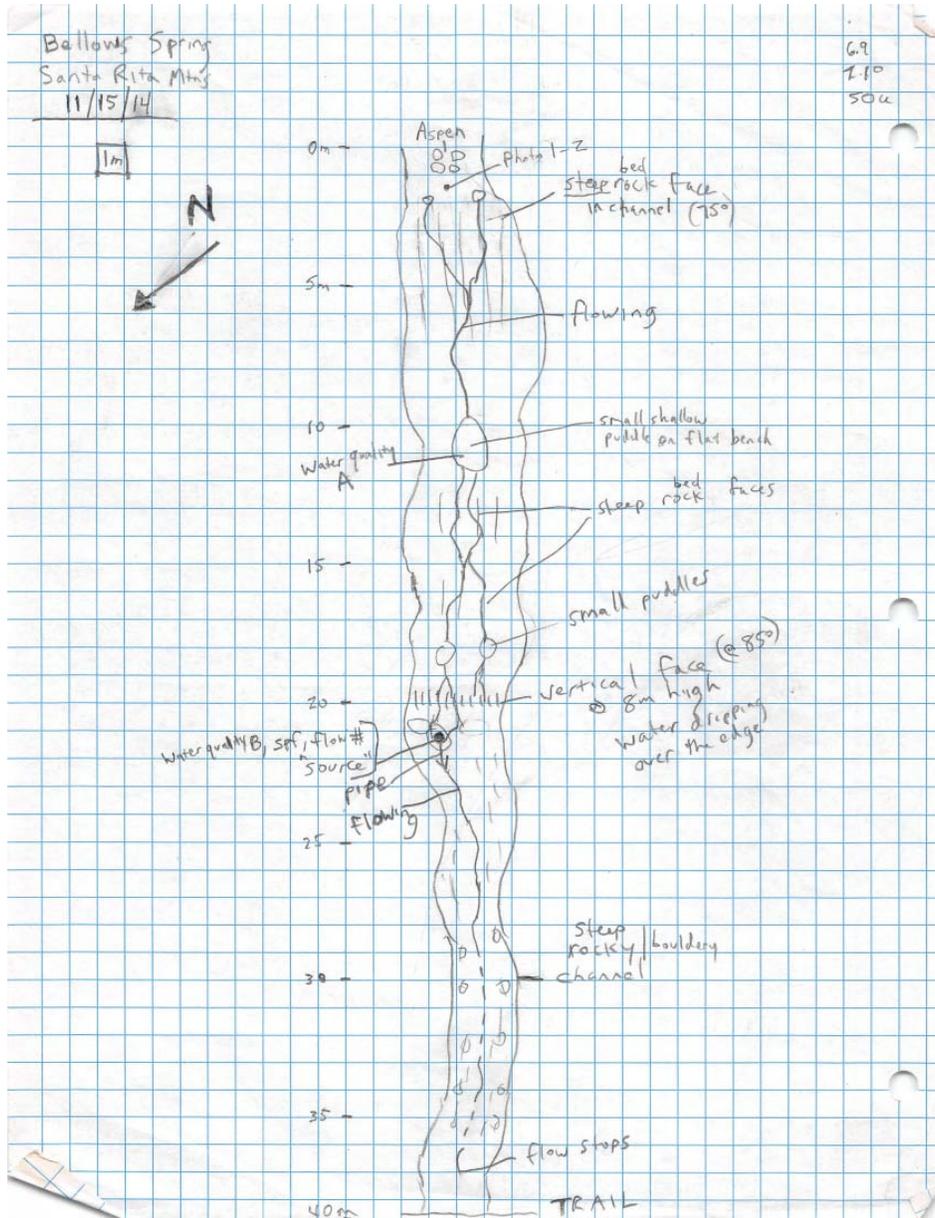


Fig 2 Bellows Spring Sketchmap.

Bog Springs

Survey Summary Report, Site ID 12971

Location: The Bog Springs ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 15050301 HUC, managed by the US Forest Service. The spring is located in the Nogales RD, Coronado NF at 31.72149, -110.86315 in the Mount Wrightson USGS Quad (NAD 83). The elevation is approximately 1748 meters. Louise Misztal, Randy Seraglio, John Pachita, Barbara Coon, Sydney Coen, Chris Hefner surveyed the site on 11/16/14 for 01:36 hours, beginning at 10:54, and collected data in 8 of 12 categories.



Fig 1 Bog Springs.

Physical Description: Bog Springs is a hillslope spring. Bog Springs are a group of low volume springs and seeps on the eastern slope of Madera Canyon. According to the Pima Co. GIS layer, these springs use 2,920,000 gallons a year for domestic water supply. The site has 3 microhabitats, including A -- a 5 sqm pool, B -- a 320 sqm channel, D -- a 2 sqm other.

Bog Springs emerges from a igneous, rhyolite rock layer in an unknown unit. The emergence environment is subaerial. The distance to the nearest spring is 798 meters.

Survey Notes: There is lots of bear sign and human recreation. There is a constructed hunting blind near the spring source and a wildlife camera.

Table 1 Bog Springs Water Quality with multiple readings averaged.

Characteristic Measured	Average Value	Comments
pH (field)	7.41	average of 2 measurements
Specific conductance (field) (uS/cm)	361	average of 2 measurements
Temperature, air C	14.7	
Temperature, water C	10.9	average of 2 measurements

Flora: This plant list is for the site as a whole. Surveyors identified 9 plant species at the site, with 0.0276 species/sqm. These included 5 native and 0 nonnative species; the native status of 4 species remains unknown.

Table 2 Bog Springs Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	2	1
Shrub	4	2
Mid-canopy	1	0
Tall canopy	0	0
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 3 Bog Springs Vegetation.

Species	Cover Code	Native Status	Wetland Status
Arbutus arizonica	SC	N	
Carex			
Equisetum	GC	N	WR
Fraxinus			R
Juniperus	SC	N	U
Lamiaceae	GC		
Quercus gambelii	MC	N	F
Rubus	SC		R
Vitis arizonica	SC	N	R

Fauna: Surveyors collected or observed 3 aquatic invertebrates and 9 vertebrate specimens.

Table 4 Bog Springs Invertebrates.

Species	Lifestage	Habitat	Method
Ephemeroptera	L	A	Spot
Hemiptera Gerridae	Ad	A	Spot
Mollusca Physidae Physa	Ad	A	Spot

Table 5 Bog Springs Vertebrates.

Species Common Name	Count	Detection
common bushtit	10	obs
ruby-crowned kinglet		
American black bear		sign
deer		sign
White-breasted nuthatch		
bridled titmouse		
hermit thrush		
cooper's hawk		
brown creeper		

Assessment: Assessment scores were compiled in 5 categories and 28 subcategories, with 14 null condition scores, and 15 null risk scores. Aquifer functionality and water quality are good with significant restoration potential and there is low risk. Geomorphology condition is good with significant restoration potential and there is low risk. Habitat condition is good with significant restoration potential and there is low risk. Biotic integrity is very good with excellent restoration potential and there is low risk. Human influence of site is good with significant restoration potential and there is low risk. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is good with significant restoration potential and there is low risk.

Table 6 Bog Springs Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	4.4	2.4
Geomorphology	4.2	2
Habitat	4	2.3
Biota	5	2
Human Influence	4.7	2.1
Administrative Context	0	0
Overall Ecological Score	4.5	2.1

Management Recommendations: Site may be threatened by proposed Rosemont Mine. The site shows signs of hiker/other human use including and eroding trail accessing the ponded water near the spring box.

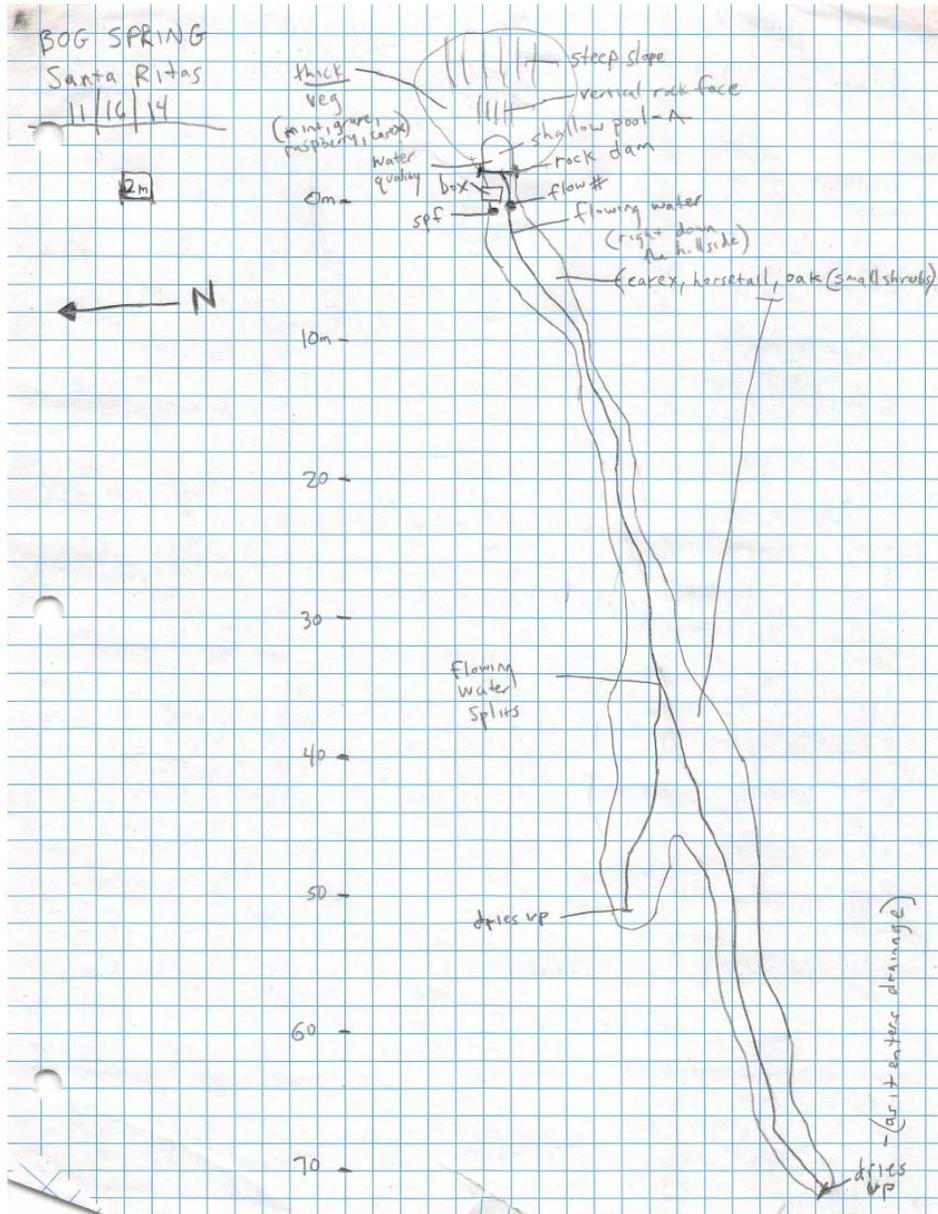


Fig 2 Bog Springs Sketchmap.

Box Spring
Survey Summary Report, Site ID 12418

Location: The Box Spring ecosystem is located in Pima County in the Rillito Arizona 15050302 HUC, managed by the US Forest Service. The spring is located in the Santa Catalina RD, Coronado NF at 32.40617, -110.75877 in the Mount Lemmon USGS Quad (NAD 83). The elevation is approximately 1997 meters. Sami Hammer, Bryon Lichtenhan, Glenn Furnier, Emily Patterson, Aida Castillo-Flores, Sierrane Gatela, Joe Black, Michela Wilson, Leocadie Haguma, Paola Rocha, Christian Galindo, Michael Parker surveyed the site on 6/27/15 for 01:00 hours, beginning at 10:00, and collected data in 0 of 12 categories.

Physical Description:

The distance to the nearest spring is 2743 meters.

Survey Notes: This spring is likely still in the area, but the area was very thick and overgrown with vegetation as it recovers from the Aspen Fire. The trail appears to be rerouted. Bryon bushwhacked to the coordinates and spent ~1/2 hour searching and could not find the spring. There was at least one minor seep in the current trail as we dropped from the last saddle down toward the spring coordinates.

Breazeal Spring
Survey Summary Report, Site ID 19965

Location: The Breazeal Spring ecosystem is located in Pima County in the Rillito Arizona 15050302 HUC, managed by the US Forest Service. The spring is located in the Santa Catalina RD, Coronado NF at 32.43091, -110.75688 in the Mount Lemmon USGS Quad (NAD83). The elevation is approximately 2288 meters. Sami Hammer, Glenn Furnier, Emily Patterson, Aida Castillo-Flores, Sierrane Gatela, Katy Brown, Kristi Argenbright surveyed the site on 6/13/15 for 00:30 hours, beginning at 9:30, and collected data in 0 of 12 categories.

Physical Description: Spring not found.

Survey Notes: We searched the area on the hillside at the coordinates and in the adjacent drainages for about half an hour and found no sign of a spring. With the open understory, the search felt pretty thorough. Interestingly, the CalTopo map shows a structure of some kind only about 60m uphill from the point - perhaps something is there? The forest had some evidence of light fire, but was not heavily burned in this area.

Brinkley Spring

Survey Summary Report, Site ID 16957

Location: The Brinkley Spring ecosystem is located in Pima County in the Rillito Arizona 15050302 HUC, managed by the US Forest Service. The spring is located in the Santa Catalina RD, Coronado NF at 32.43645, -110.78821 in the Mount Lemmon USGS Quad, measured using a GPS (NAD83, estimated position error 6 meters). The elevation is approximately 2705 meters. Christopher Morris, Eric Bodznick, Elena Martin, Sue Carahan, Curtis Smith, Mike Hughes surveyed the site on 6/29/14 for 00:42 hours, beginning at 11:49, and collected data in 8 of 12 categories.



Fig 1 Brinkley Spring: mike pointing to the spring location

Physical Description: Brinkley Spring is a anthropogenic/hanging garden spring completely encased in concrete and piping, and then conveyed underground. It may have originally been a hanging garden. There is a wet seep emerging from a boulder. The spring is located at the southern base of a large boulder, but the site has no east or west obstructions. The site has 2 microhabitats, including A -- a 0 sqm other, B -- a 0 sqm sloping bedrock. The geomorphic diversity is 0.00, based on the Shannon-Weiner diversity index.

The emergence environment is subaerial. The distance to the nearest spring is 206 meters.

Survey Notes: The probable springbox has been covered up by a tin sheet and then a huge fallen log - surveyors did not find pipes, boxes, etc. after removing the tin sheets. The base of the wall (where the seeps are) are completely covered by vegetation (Ribes, cliffbush, mountain spray). There was a was seep on the rock about 14" by 14."

Flora: The vegetation list is for the plants found in the immediate area. Surveyors identified 20 plant species at the site, with 200 species/sqm. These included 19 native and 0 nonnative species; the native status of 1 species remains unknown.

Table 1 Brinkley Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	8	1
Shrub	3	0
Mid-canopy	1	0
Tall canopy	2	0
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 2 Brinkley Spring Vegetation.

Species	Cover Code	Native Status	Wetland Status
<i>Ceanothus fendleri</i>	GC	N	U
<i>Cirsium wheeleri</i>	GC	N	U
<i>Erigeron oreophilus</i>		N	
<i>Galium aparine</i>	GC	N	WR
<i>Geranium caespitosum</i>	GC	N	F
<i>Glandularia bipinnatifida</i>	GC	N	U
<i>Heuchera sanguinea</i>		N	
<i>Holodiscus dumosus</i>	SC	N	F
<i>Jamesia americana</i>	SC	N	
<i>Macromeria viridiflora</i>	GC	N	U
<i>Pinus ponderosa</i>	TC	N	F
<i>Populus tremuloides</i>	TC	N	U
<i>Pseudotsuga menziesii</i>	MC	N	U
<i>Pteridium aquilinum</i>	GC	N	U
<i>Quercus rugosa</i>		N	
<i>Ribes pinetorum</i>		N	
<i>Scrophularia parviflora</i>		N	
<i>Senecio wootonii</i>	GC	N	
<i>Symphoricarpos oreophilus</i>	SC	N	U
<i>Vicia</i>			WR

Fauna: Surveyors collected or observed 2 terrestrial invertebrates and 10 vertebrate specimens.

Table 3 Brinkley Spring Invertebrates.

Species	Lifestage	Habitat	Method	Species detail
Acarina			Spot	mite
Coleoptera			Spot	
Diptera Syrphidae Milesia bella		T	Spot	
Lepidoptera Lycaenidae Celastrina echo		T	Spot	cinera subspp. (Sue has photo)

Table 4 Brinkley Spring Vertebrates.

Species Common Name	Count	Detection
canyon tree frog	1	obs
greater short-horned lizard	1	
Broad-tailed hummingbird	1	obs
house wren		
yellow-eyed junco		
black-throated gray warbler		
pygmy nuthatch		
spotted towhee		
Common raven		
olive warbler		

Assessment: Assessment scores were compiled in 5 categories and 32 subcategories, with 10 null condition scores, and 11 null risk scores. Aquifer functionality and water quality are excellent with no need for restoration and there is high risk. Geomorphology condition is very poor with very limited restoration potential and there is high risk. Habitat condition is moderate with some restoration potential and there is moderate risk. Biotic integrity is very good with excellent restoration potential and there is low risk. Human influence of site is good with significant restoration potential and there is low risk. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is good with significant restoration potential and there is moderate risk.

Table 5 Brinkley Spring Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	6.8	4
Geomorphology	1.8	4.6
Habitat	3.4	3.4
Biota	5.1	1.9
Human Influence	4.6	2.6
Administrative Context	0	0
Overall Ecological Score	4.4	3.1

Management Recommendations: Where does the buried piping go? It must pre-date establishment of wilderness designation - check water rights records? If the spring water is no longer being utilized for modern humans, maybe the concrete and piping could be removed so wildlife could benefit from the spring.

Broken Arm Spring Survey Summary Report, Site ID 11945

Location: The Broken Arm Spring ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 15050301 HUC, managed by the US Forest Service. The spring is located in the Sierra Vista RD, Coronado NF at 31.40468, -111.10293 in the Pena Blanca Lake USGS Quad (NAD 83). The elevation is approximately 1319 meters. Christopher Morris, Cory Jones, Gus Glaser, Judy Atwell, and Lorrie and Rick Firth surveyed the site on 10/04/14 for 00:32 hours, beginning at 14:08, and collected data in 5 of 12 categories.



Fig 1 Broken Arm Spring: Looking at the seep on the west bank of channel.

Physical Description: Broken Arm Spring is a rheocrene spring. This spring is a wet seep emanating from the bank of a drainage channel bottomed with a combination of bedrock and sandy soils. The site has 1 microhabitat, X -- a 1 sqm backwall.

Broken Arm Spring emerges from a combination rock layer in an unknown unit. The emergence environment is subaerial. The distance to the nearest spring is 1154 meters.

Survey Notes: The site is barely perceptible with only a small wet spot on the westside of the channel's 2 foot high bank. The channel looks to receive a lot of sediment, potentially affecting this spring.

Flora: Surveyors identified 11 plant species at the site. These included 6 native and 0 nonnative species; the native status of 5 species remains unknown.

Table 1 Broken Arm Spring Cover Type.

Cover Type	Species Count
Ground	5
Shrub	2
Mid-canopy	0
Tall canopy	0
Basal	0
Aquatic	0
Non-vascular	0

Table 2 Broken Arm Spring Vegetation.

Species	Cover Code	Native Status	Wetland Status
Acacia greggii	SC	N	F
Agave schottii	GC	N	
Bidens	GC		F
Bouteloua curtipendula	GC	N	U
Dasyllirion			
Erythrina flabelliformis		N	
Muhlenbergia	GC	N	U
Muhlenbergia rigens	GC	N	U
Opuntia			U
Prosopis			
Quercus	SC		U

Fauna: Surveyors collected or observed 1 vertebrate specimens.

Table 3 Broken Arm Spring Vertebrates.

Species Common Name	Count	Detection
White-tailed Deer		sign

Assessment: Assessment scores were compiled in 5 categories and 28 subcategories, with 14 null condition scores, and 14 null risk scores. Aquifer functionality and water quality are poor with limited restoration potential and there is negligible risk. Geomorphology condition is moderate with some restoration potential and there is low risk. Habitat condition is moderate with some restoration potential and there is negligible risk. Biotic integrity is good with significant restoration potential and there is negligible risk. Human influence of site is very good with excellent restoration potential and there is low risk. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is good with significant restoration potential and there is negligible risk.

Table 4 Broken Arm Spring Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	2	1.7
Geomorphology	3.6	2
Habitat	3.2	1.8
Biota	4.8	1.8
Human Influence	5.1	1.9
Administrative Context	0	0
Overall Ecological Score	4.1	1.8

Management Recommendations: The site could be fenced off from cattle and be anchored with rocks to restart the accumulation of soils.

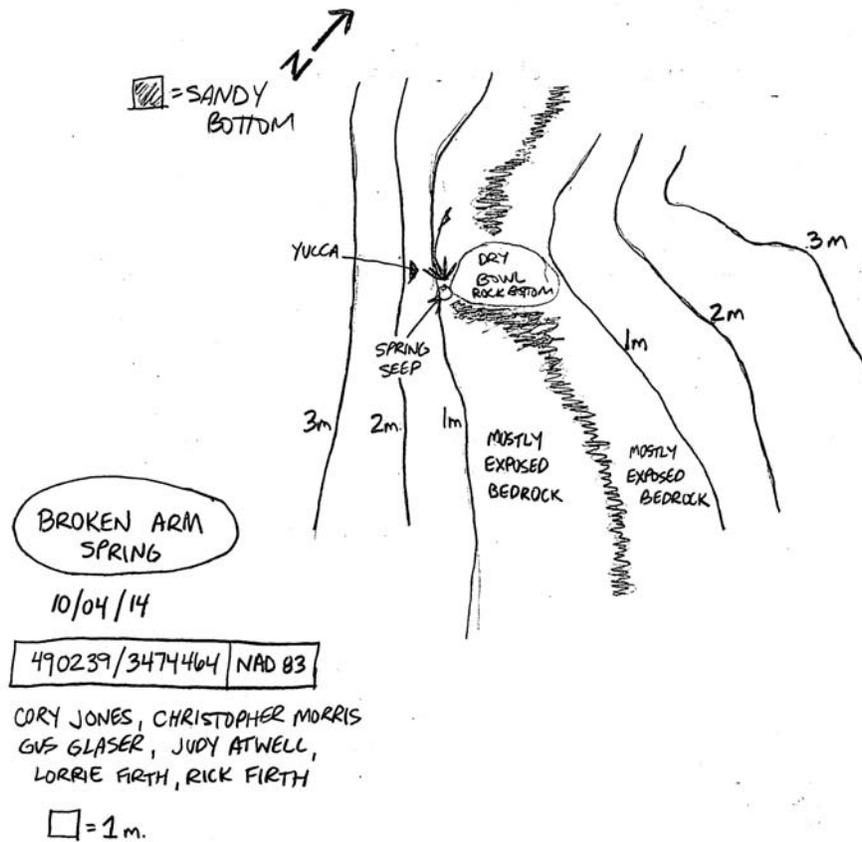


Fig 2 Broken Arm Spring Sketchmap: Sketch map.

Busch Spring Survey Summary Report, Site ID 16956

Location: The Busch Spring ecosystem is located in Pima County in the Rillito Arizona 15050302 HUC, managed by the US Forest Service. The spring is located in the Santa Catalina RD, Coronado NF at 32.43622, -110.76015 in the Mount Lemmon USGS Quad, measured using a GPS (WGS84, estimated position error 4 meters). The elevation is approximately 2357 meters. Sami Hammer, Glenn Furnier, Emily Patterson, Aida Castillo-Flores, Sierrane Gatela, Katy Brown, Kristi Argenbright surveyed the site on 6/13/15 for 01:15 hours, beginning at 12:00, and collected data in 8 of 12 categories.

Physical Description: Busch Spring is a rheocrene spring. According to the Pima Co. GIS layer, this site is used at a rate of 73,000 gallons per year for domestic purposes. It is a boxed spring in a moderate gradient and moderately wide drainage at high elevation. The microhabitats associated with the spring cover 54 sqm. The site has 3 microhabitats, including A -- a 5 sqm other, B -- a 45 sqm channel, C -- a 4 sqm channel. The geomorphic diversity is 0.25, based on the Shannon-Weiner diversity index.

Busch Spring emerges as a seepage or filtration spring from a igneous, granite rock layer in an unknown unit. The emergence environment is subaerial, with a gravity flow force mechanism. The distance to the nearest spring is 631 meters.

Survey Notes: The site is overgrown with ferns and very badly burnt from the Aspen Fire. There is an ancient, decrepit hunting blind by the spring and some deadfall across the stream.

Table 1 Busch Spring Water Quality with multiple readings averaged.

Characteristic Measured	Average Value
pH (field)	7.45
Specific conductance (field) (uS/cm)	98
Temperature, air C	23.9
Temperature, water C	11.2

Flora: Plant list is for site as a whole. Surveyors identified 15 plant species at the site, with 0.2778 species/sqm. These included 10 native and 2 nonnative species; the native status of 3 species remains unknown.

Table 2 Busch Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	11	2
Shrub	0	0
Mid-canopy	2	0
Tall canopy	2	0
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 3 Busch Spring Vegetation.

Species	Cover Code	Native Status	Wetland Status
Achillea millefolium	GC	N	U
Aquilegia chrysantha	GC	N	W
Carex	GC		
Galium	GC	I	F
Mimulus guttatus	GC	N	W
Pinus ponderosa	TC	N	F
Populus tremuloides	MC	N	U
Pseudotsuga menziesii	TC	N	U
Pteridium aquilinum	GC	N	U
Quercus gambelii	MC	N	F
Senecio	GC		F
Smilacina racemosa	GC		
Smilacina stellata	GC		
Toxicodendron rydbergii	GC	N	F
Vicia americana	GC	N	F

Fauna: Surveyors collected or observed 2 terrestrial invertebrates and 11 vertebrate specimens.

Table 4 Busch Spring Invertebrates.

Species	Lifestage	Habitat	Method
Hymenoptera Vespidae Vespula vulgaris	Ad	T	Spot
Lepidoptera Papilionidae	Ad	T	Spot

Table 5 Busch Spring Vertebrates.

Species Common Name	Count	Detection
house wren	1	obs
hummingbirds	1	obs
hairy woodpecker	1	obs
pocket gopher	3	sign
spotted towhee	1	obs
rodent	1	sign
western tanager	1	obs
violet-green swallow	3	obs
American robin	1	obs
western bluebird	1	obs
yellow-eyed junco	1	obs

Assessment: Assessment scores were compiled in 5 categories and 29 subcategories, with 13 null condition scores, and 13 null risk scores. Aquifer functionality and water quality are moderate with some restoration potential and there is low risk. Geomorphology condition is moderate with some restoration potential and there is low risk. Habitat condition is poor with limited restoration potential and there is low risk. Biotic integrity is moderate with some

restoration potential and there is negligible risk. Human influence of site is good with significant restoration potential and there is negligible risk. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is moderate with some restoration potential and there is low risk.

Table 6 Busch Spring Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.4	2.4
Geomorphology	3.4	2.2
Habitat	2.8	2
Biota	3	1.5
Human Influence	4.4	1.8
Administrative Context	0	0
Overall Ecological Score	3.6	1.9

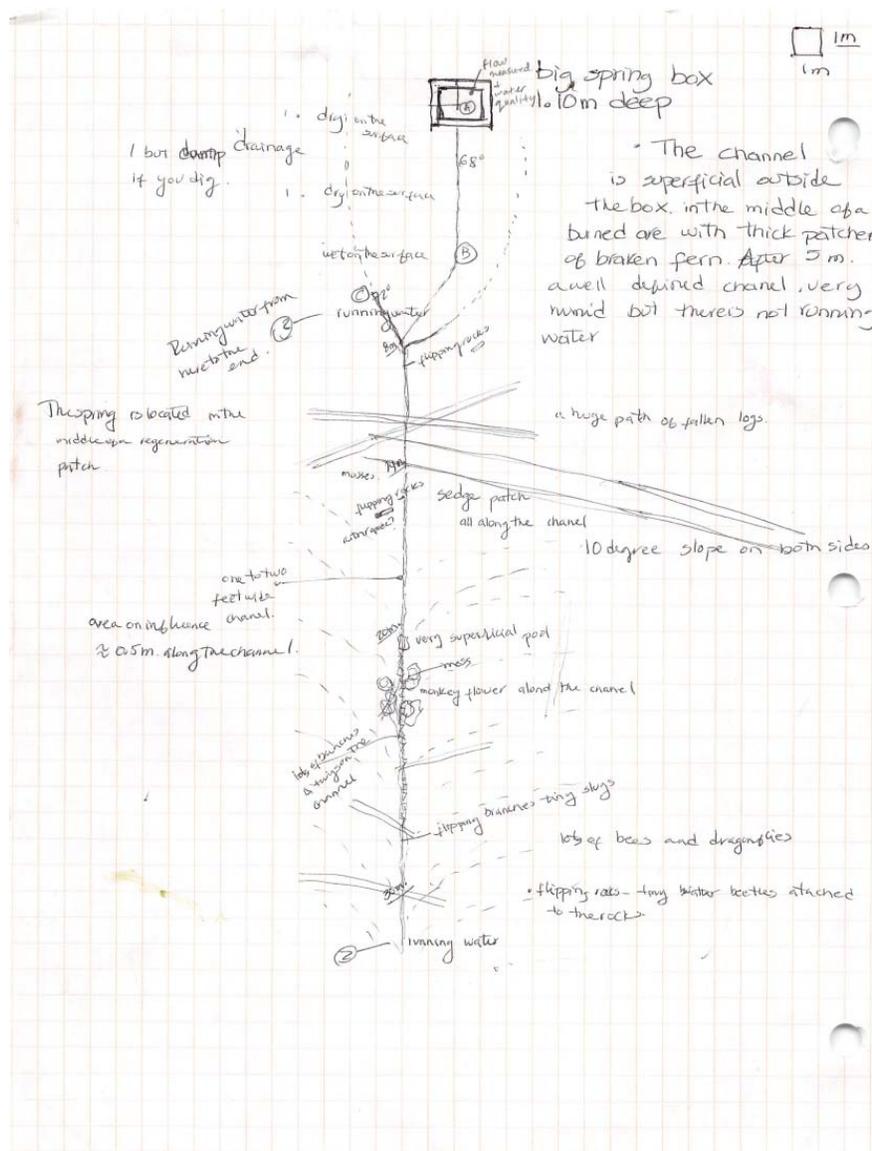


Fig 1 Busch Spring Sketchmap.

Cascade Spring Survey Summary Report, Site ID 12421

Location: The Cascade Spring ecosystem is located in Pima County in the Rillito Arizona 15050302 HUC, managed by the US Forest Service. The spring is located in the Santa Catalina RD, Coronado NF at 32.43788, -110.78927 in the Mount Lemmon USGS Quad, measured using a GPS (NAD83, estimated position error 5 meters). The elevation is approximately 2742 meters. Christopher Morris, Eric Bodznick, Elena Martin, Sue Carahan, Curtis Smith, Mike Hughes surveyed the site on 6/29/14 for 01:57 hours, beginning at 9:00, and collected data in 9 of 12 categories.



Fig 1 Cascade Spring.

Physical Description: Cascade Spring is a rheocrene/anthropogenic spring. It is a totally developed spring with no wetland vegetation or wet soil. There is a well casing, pump station, and lots of infrastructure. No spring habitat exists any longer. It probably would originally have been a rheocrene spring. There is some water in the drainage ~75m from the spring coordinates. The site has 1 microhabitat, A -- a 47 sqm channel.

The emergence environment is subaerial. The distance to the nearest spring is 222 meters.

Survey Notes: The spring has been totally developed. The surveyors followed the drainage down from the original spring coordinates; they found a small puddle, then a dry stretch, and then water at 519771, 3588919, 2708m elevation. This was where the solar pathfinder was used. Road construction and plumbing/piping of the spring has caused erosion and headcutting above the road and potentially caused the spring to migrate downstream.

Table 1 Cascade Spring Water Quality with multiple readings averaged.

Characteristic Measured	Average Value
pH (field)	7.1
Specific conductance (field) (uS/cm)	42
Temperature, air C	26.8
Temperature, water C	12.9

Flora: Surveyors identified 28 plant species at the site, with 0.5957 species/sqm. These included 22 native and 3 nonnative species; the native status of 3 species remains unknown.

Table 2 Cascade Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	19	3
Shrub	2	0
Mid-canopy	1	0
Tall canopy	2	0
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 3 Cascade Spring Vegetation.

Species	Cover Code	Native Status	Wetland Status
Athyrium filix-femina	GC	N	
Carex			
Castilleja austromontana		N	
Cerastium nutans	GC	N	F
Dactylis glomerata	GC	I	W
Deschampsia elongata	GC	N	F
Draba helleriana	GC	N	
Festuca			U
Fragaria vesca	GC	N	U
Galium aparine	GC	N	WR
Geranium richardsonii	GC	N	F
Holodiscus dumosus	SC	N	F
Hymenoxys hoopesii	GC	N	F
Mimulus guttatus	GC	N	W
Pinus ponderosa	TC	N	F
Pinus strobiformis	TC	N	
Pseudocymopterus montanus	GC	N	F
Pseudotsuga menziesii	MC	N	U
Pteridium aquilinum	GC	N	U
Rubus idaeus	GC	NI	F
Rudbeckia laciniata	GC	N	F
Rumex obtusifolius	GC	I	F
Senecio wootonii	GC	N	
Swertia radiata			
Symphoricarpos oreophilus	SC	N	U
Thalictrum fendleri	GC	N	F
Thinopyrum intermedium	GC	I	F
Vicia americana	GC	N	F

Fauna: Surveyors collected or observed 1 aquatic and 2 terrestrial invertebrates and 15 vertebrate specimens.

Table 4 Cascade Spring Invertebrates.

Species	Lifestage	Habitat	Method	Species detail
Annelida Oligochaetae Oligochaeta		A	Spot	
Coleoptera			Spot	
Coleoptera			Spot	orange, same as at Kinglet, Lycus arizonensis?
Hymenoptera Apidae		T	Spot	
Lepidoptera HesperIIDae Poanes taxiles		T	Spot	
Trichoptera			Spot	caddisfly

Table 5 Cascade Spring Vertebrates.

Species Common Name
house wren
Steller's jay
American robin
yellow-eyed junco
Broad-tailed hummingbird
mountain chickadee
northern flicker
hermit thrush
yellow-rumped warbler
wild turkey
western tanager
olive warbler
pygmy nuthatch
Red-faced Warbler
Arizona gray squirrel

Assessment: Assessment scores were compiled in 5 categories and 33 subcategories, with 9 null condition scores, and 9 null risk scores. Aquifer functionality and water quality are moderate with some restoration potential and there is low risk. Geomorphology condition is moderate with some restoration potential and there is low risk. Habitat condition is moderate with some restoration potential and there is low risk. Biotic integrity is very good with excellent restoration potential and there is low risk. Human influence of site is moderate with some restoration potential and there is moderate risk. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is good with significant restoration potential and there is low risk.

Table 6 Cascade Spring Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.8	2.8
Geomorphology	3.6	2.4
Habitat	3.8	2.8
Biota	5	2
Human Influence	3.4	3.2
Administrative Context	0	0
Overall Ecological Score	4	2.7

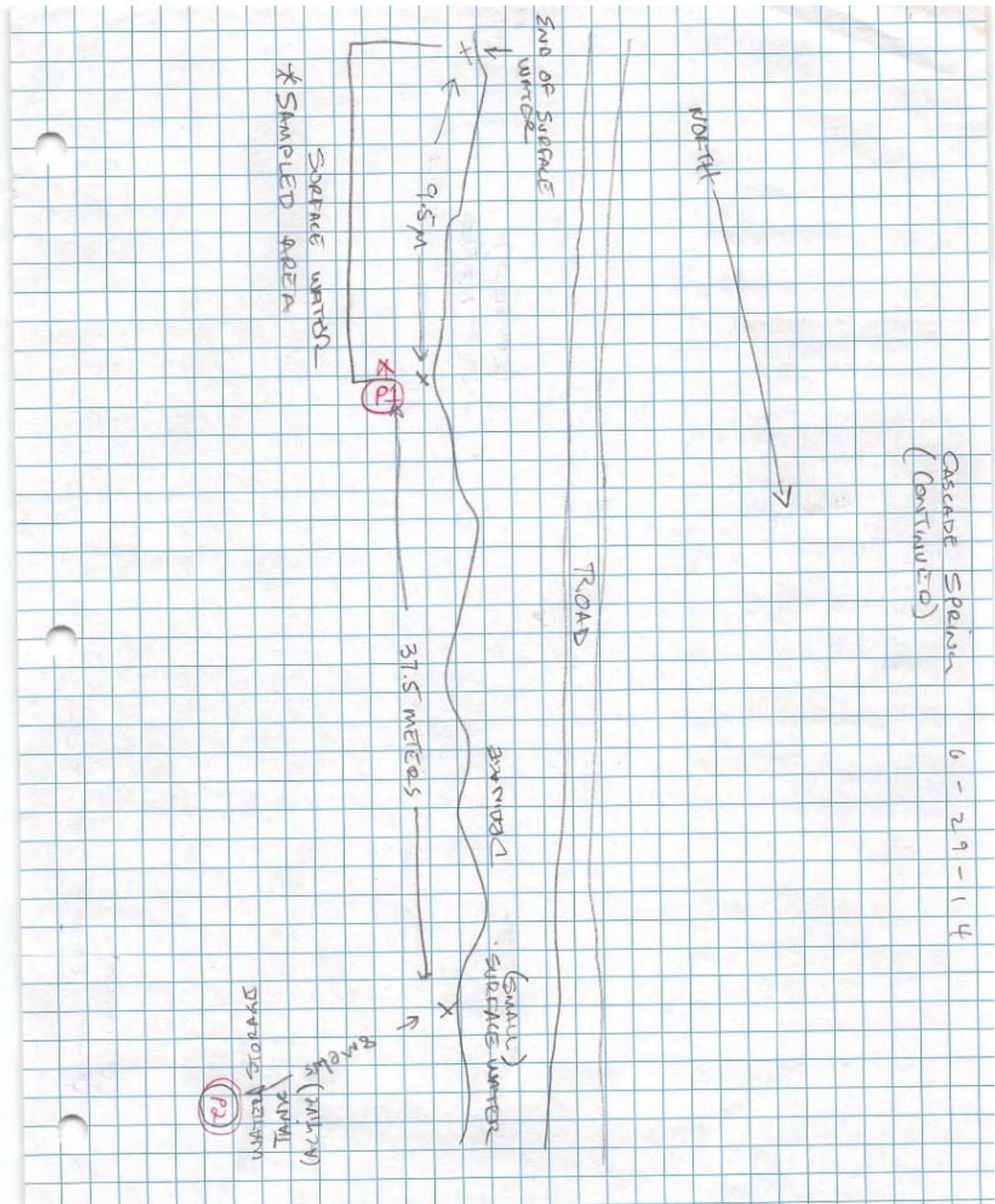


Fig 2 Cascade Spring Sketchmap.



Fig 3 Cascade Spring.



Fig 4 Cascade Spring.



Fig 5 Cascade Spring.



Fig 6 Cascade Spring.

Caseco Spring Survey Summary Report, Site ID 19947

Location: The Caseco Spring ecosystem is located in Pima County in the Rillito Arizona 15050302 HUC, managed by the US Forest Service. The spring is located in the Santa Catalina RD, Coronado NF at 32.40710, -110.70540 in the Mount Bigelow USGS Quad (NAD83, estimated position error 7 meters). The elevation is approximately 2323 meters. Bryon Lichtenhan, Sami Hammer, Michela Wilson, Glenn Furnier, Emily Patterson, Leocadie Haguma, Paola Rocha, Christian Galindo, Michael Parker, Aida Castillo-Flores, Joe Black, Sierrane Gatela surveyed the site on 6/28/15 for 02:00 hours, beginning at 9:00, and collected data in 9 of 12 categories.

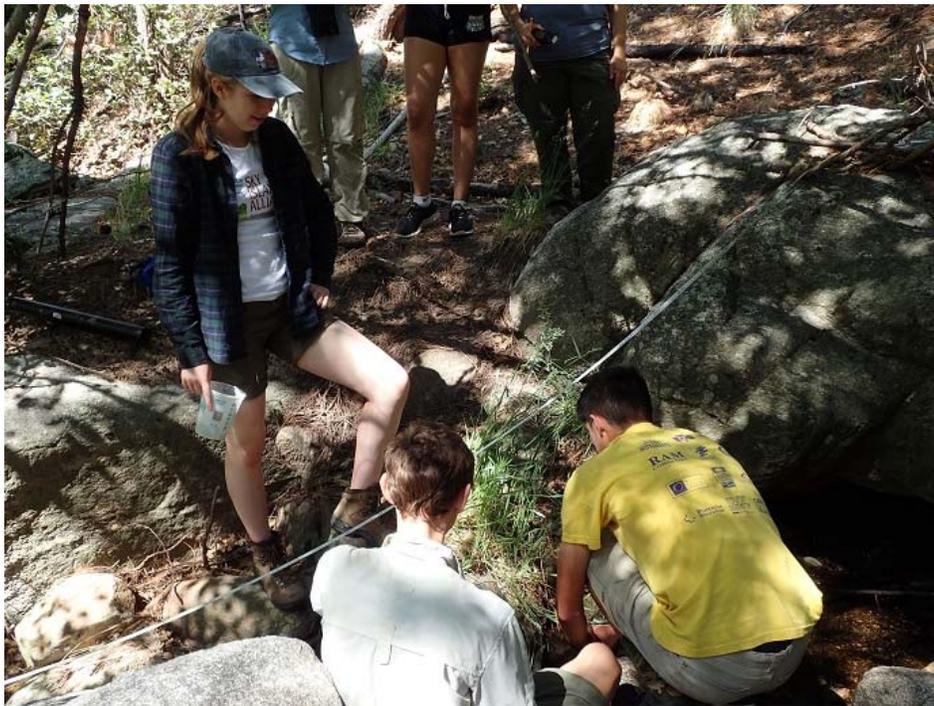


Fig 1 Caseco Spring.

Physical Description: Caseco Spring is a rheocrene spring. This site came from the Pima Co. Springs GIS layer. According to the data source it is used at a rate of 7.0 acre-feet per year for domestic purposes. The spring is a rheocrene spring emerging in two parallel channels with evidence of fairly consistent flow, in a shaded drainage. In June 2015, there was no evidence of infrastructure at the spring site that would indicate it was being used for domestic use, though there were signs indicating a water pipe along the road in to the spring. The microhabitats associated with the spring cover 179 sqm. The site has 5 microhabitats, including A -- a 10 sqm channel, B -- a 13 sqm channel, D -- a 4 sqm channel, E -- a 120 sqm terrace. The geomorphic diversity is 0.44, based on the Shannon-Weiner diversity index.

Caseco Spring emerges as a seepage or filtration spring from a metamorphic rock layer in an unknown unit. The emergence environment is subaerial, with a gravity flow force mechanism. The distance to the nearest spring is 1062 meters.

Survey Notes: The site was in good condition. There was only a few small pieces of trash from the road. The area does not seem to get much traffic/use. There was some incision in the channel, probably some invasive grass species, and some trees had been cut in the past (not recently). It had substantial flow even in late June.

Table 1 Caseco Spring Water Quality with multiple readings averaged.

Characteristic Measured	Average Value
pH (field)	8.1
Specific conductance (field) (uS/cm)	113
Temperature, air C	21.1
Temperature, water C	13.5

Flora: Species list is for site as a whole - not identified by polygon. Surveyors identified 24 plant species at the site, with 0.1341 species/sqm. These included 22 native and 0 nonnative species; the native status of 2 species remains unknown.

Table 2 Caseco Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	10	1
Shrub	5	2
Mid-canopy	1	0
Tall canopy	4	1
Basal	0	0
Aquatic	1	0
Non-vascular	1	0

Table 3 Caseco Spring Vegetation.

Species	Cover Code	Native Status	Wetland Status
<i>Acer negundo</i>	TC	N	R
<i>Achillea millefolium</i>	GC	N	U
<i>Alnus</i>	SC		WR
<i>Aquilegia chrysantha</i>	GC	N	W
<i>Bouvardia ternifolia</i>	SC	N	
<i>Ceanothus fendleri</i>	GC	N	U
<i>Cirsium wheeleri</i>	GC	N	U
<i>Geranium caespitosum</i>	GC	N	F
<i>Juncus</i>	AQ		WR
<i>Lathyrus graminifolius</i>	GC	N	
moss	NV	N	F
<i>Oxalis alpina</i>		N	
<i>Penstemon barbatus</i>	GC	N	U
<i>Pinus ponderosa</i>	TC	N	F
<i>Pinus strobiformis</i>	TC	N	
<i>Pseudotsuga menziesii</i>	TC	N	U
<i>Quercus gambelii</i>	MC	N	F
<i>Rubus neomexicanus</i>	SC	N	F
<i>Rumex obtusifolius</i>	GC	N	F
<i>Salix</i>	SC	N	WR
<i>Salvia arizonica</i>		N	
<i>Symphoricarpos oreophilus</i>	SC	N	U
<i>Thalictrum fendleri</i>	GC	N	F
<i>Vicia pulchella</i>	GC	N	F

Fauna: Surveyors collected or observed 1 aquatic and 5 terrestrial invertebrates and 26 vertebrate specimens.

Table 4 Caseco Spring Invertebrates.

Species	Lifestage	Habitat	Method	Count	Species detail
arachnid	Ad	T	Spot	1	
Coleoptera Coccinellidae	Ad	T	Spot	1	
Coleoptera Erotylidae <i>Megalodacne heros</i>	Ad	T	Spot	1	
Coleoptera Scarabaeidae	Ad	T	Spot	1	
Lepidoptera	L	T	Spot	1	black
Trichoptera	L	A	Spot	10	

Table 5 Caseco Spring Vertebrates.

Species Common Name	Count	Detection
white-tailed Deer		sign
Red-faced Warbler	1	obs
Sonoran mountain kingsnake	1	obs
house wren	1	obs
western tanager	1	obs
hummingbirds	1	obs
American robin	1	obs
hairy woodpecker	1	obs
spotted towhee	1	obs
yellow-eyed junco	1	obs
chipmunk	1	obs
Common raven	1	obs
Grace's warbler	1	obs
red-breasted nuthatch	1	obs
mountain chickadee	1	obs
Hutton's vireo	1	call
white-throated swift	1	call
violet-green swallow	1	obs
black-headed grosbeak	1	obs
western bluebird	1	obs
pygmy nuthatch	1	obs
Zone-tailed Hawk	1	obs
Steller's jay	1	obs
painted redstart	1	obs
black-throated gray warbler	1	obs
cooper's hawk	1	obs

Assessment: Assessment scores were compiled in 5 categories and 30 subcategories, with 12 null condition scores, and 12 null risk scores. Aquifer functionality and water quality are good with significant restoration potential and there is low risk. Geomorphology condition is good with significant restoration potential and there is low risk. Habitat condition is good with significant restoration potential and there is low risk. Biotic integrity is good with significant restoration potential and there is low risk. Human influence of site is good with significant restoration potential and there is low risk. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is good with significant restoration potential and there is low risk.

Table 6 Caseco Spring Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	4.2	2.4
Geomorphology	4.6	2.2
Habitat	4	2.6
Biota	4.5	2.5
Human Influence	4.8	2.2
Administrative Context	0	0
Overall Ecological Score	4.5	2.4

Management Recommendations: The road looping around the site poses a risk to the spring - there is some incision in the channel that may be due to road influence. There is also the helipad in close proximity. We saw a few pieces of trash. Ideally, the site should be monitored for any problems due to the road, particularly erosion-related issues, and any issues that occur should be addressed. The road does have a locked gate, so that is helpful.

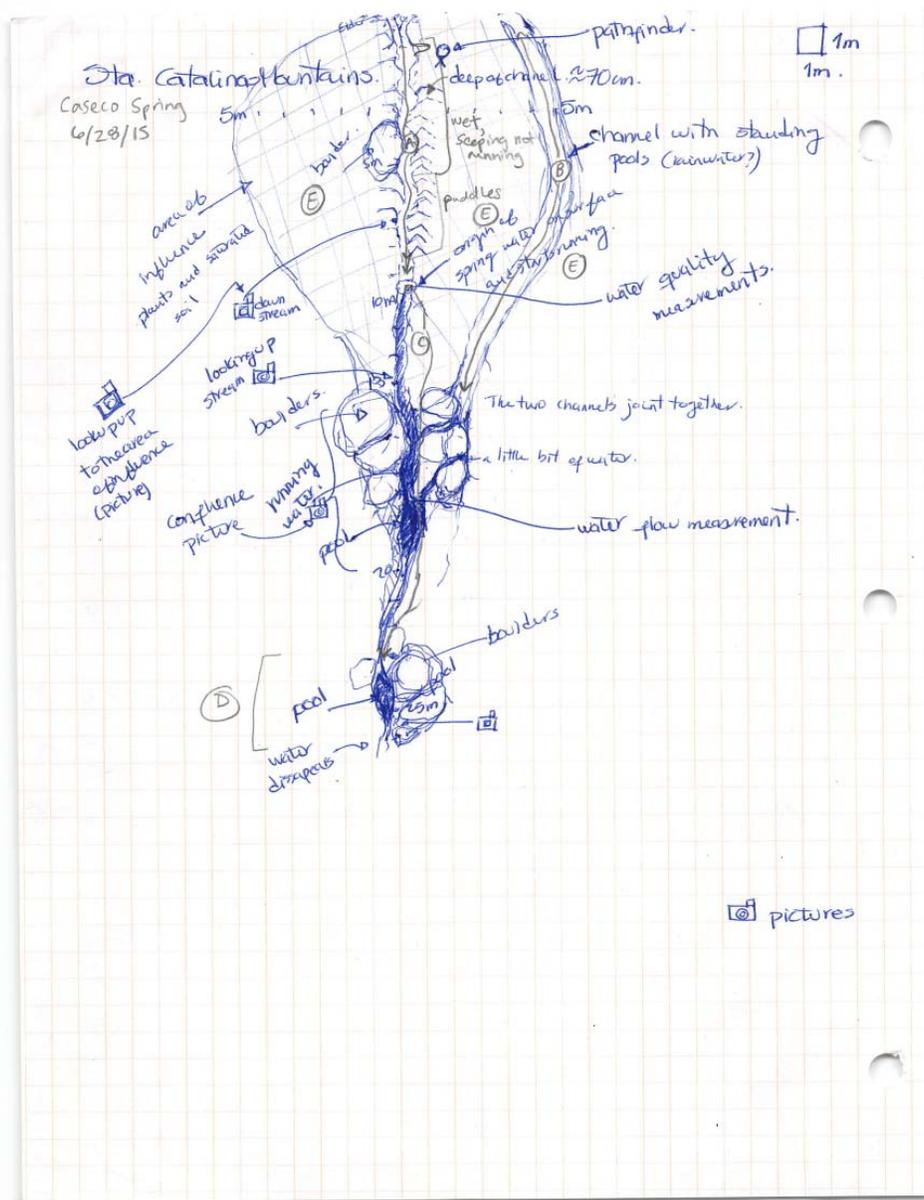


Fig 2 Caseco Spring Sketchmap.

Chiva Falls

Survey Summary Report, Site ID 179839

Location: The Chiva Falls ecosystem is located in Pima County in the Rillito Arizona 15050302 HUC, managed by the US Forest Service. The spring is located in the Santa Catalina RD, Coronado NF at 32.25663, -110.59485 in the USGS Quad, measured using a GPS (NAD83, estimated position error 7 meters). The elevation is approximately 1204 meters. Louise Misztal, Christopher Morris, Cyndi Tuell surveyed the site on 9/03/14 for 01:53 hours, beginning at 11:27, and collected data in 9 of 12 categories.



Fig 1 Chiva Falls.

Physical Description: Chiva Falls is a hanging garden spring. It has a steep cliff face with a waterfall and areas of water seeping from the rock face. The site has 7 microhabitats, including A -- a 510 sqm pool, B -- a 120 sqm sloping bedrock.

Chiva Falls emerges as a contact spring from a combination rock layer in an unknown unit. The emergence environment is subaerial, with a gravity flow force mechanism. The distance to the nearest spring is 3000 meters.

Survey Notes: In good condition, though there is quite a lot of trash scattered around. There is evidence of recent flooding events and significant flow in Tanque Verde Creek above and below the spring. The pool below the spring has been silted in due to fire erosion effects - it is still functioning, but is much smaller than it used to be. There is a badly eroded, illegally constructed, road coming almost all the way to the spring.

Table 1 Chiva Falls Water Quality with multiple readings averaged.

Characteristic Measured	Average Value
pH (field)	7.44
Specific conductance (field) (uS/cm)	136
Temperature, air C	28
Temperature, water C	24.2

Flora: This list is for the entire site. Surveyors identified 18 plant species at the site, with 0.0186 species/sqm. These included 17 native and 1 nonnative species.

Table 2 Chiva Falls Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	1	0
Shrub	7	2
Mid-canopy	3	1
Tall canopy	2	2
Basal	0	0
Aquatic	0	0
Non-vascular	1	0

Table 3 Chiva Falls Vegetation.

Species	Cover Code	Native Status	Wetland Status
<i>Aloysia wrightii</i>	SC	N	U
<i>Anisacanthus thurberi</i>	SC	N	
<i>Bouvardia ternifolia</i>	SC	N	
<i>Carex</i>			
<i>Celtis reticulata</i>	MC	N	
<i>Erythrina flabelliformis</i>		N	
<i>Fraxinus velutina</i>	TC	N	R
<i>Heuchera sanguinea</i>		N	
<i>Juglans major</i>	TC	N	R
<i>Mirabilis longiflora</i>		N	
moss	NV	N	F
<i>Muhlenbergia rigens</i>	GC	N	U
<i>Platanus wrightii</i>	MC	N	R
<i>Robinia neomexicana</i>	MC	N	F
<i>Salix gooddingii</i>	SC	N	R
<i>Sphaeralcea ambigua</i>	SC	N	F
<i>Toxicodendron rydbergii</i>	SC	N	F
<i>Vitis arizonica</i>	SC	N	R

Fauna: Surveyors collected or observed 4 aquatic and 3 terrestrial invertebrates and 10 vertebrate specimens.

Table 4 Chiva Falls Invertebrates.

Species	Lifestage	Habitat	Method
Coleoptera Dytiscidae Thermonectus marmoratus	Ad	A	Spot
Coleoptera Gyrinidae	Ad	A	Spot
Ephemeroptera			Spot
Hemiptera Belostomatidae Abedus	Ad	A	Spot
Hemiptera Gerridae	Ad	A	Spot
Hymenoptera Pompilidae Pepsis formosa	Ad	T	Spot
Lepidoptera Sphingidae		T	Spot
Odonata Libellulidae Libellula			Spot
Orthoptera Tettigoniidae	Ad	T	Spot

Table 5 Chiva Falls Vertebrates.

Species Common Name	Count	Detection
black-necked gartersnake	1	
summer tanager	1	call
canyon wren	1	call
white-tailed Deer	1	obs
rock squirrel	2	obs
Clarks spiny lizard	1	
canyon tree frog	1	
Domestic cow	1	sign
red-spotted toad	1	
Sonoran whipsnake	1	

Assessment: Assessment scores were compiled in 5 categories and 31 subcategories, with 11 null condition scores, and 11 null risk scores. Aquifer functionality and water quality are very good with excellent restoration potential and there is low risk. Geomorphology condition is good with significant restoration potential and there is low risk. Habitat condition is very good with excellent restoration potential and there is low risk. Biotic integrity is very good with excellent restoration potential and there is low risk. Human influence of site is good with significant restoration potential and there is low risk. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is good with significant restoration potential and there is low risk.

Table 6 Chiva Falls Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	5	2
Geomorphology	4.4	2
Habitat	5	2
Biota	5.1	2
Human Influence	4.2	2.2
Administrative Context	0	0
Overall Ecological Score	4.7	2.1

Management Recommendations: Close the illegally constructed road that comes almost all the way to the spring.

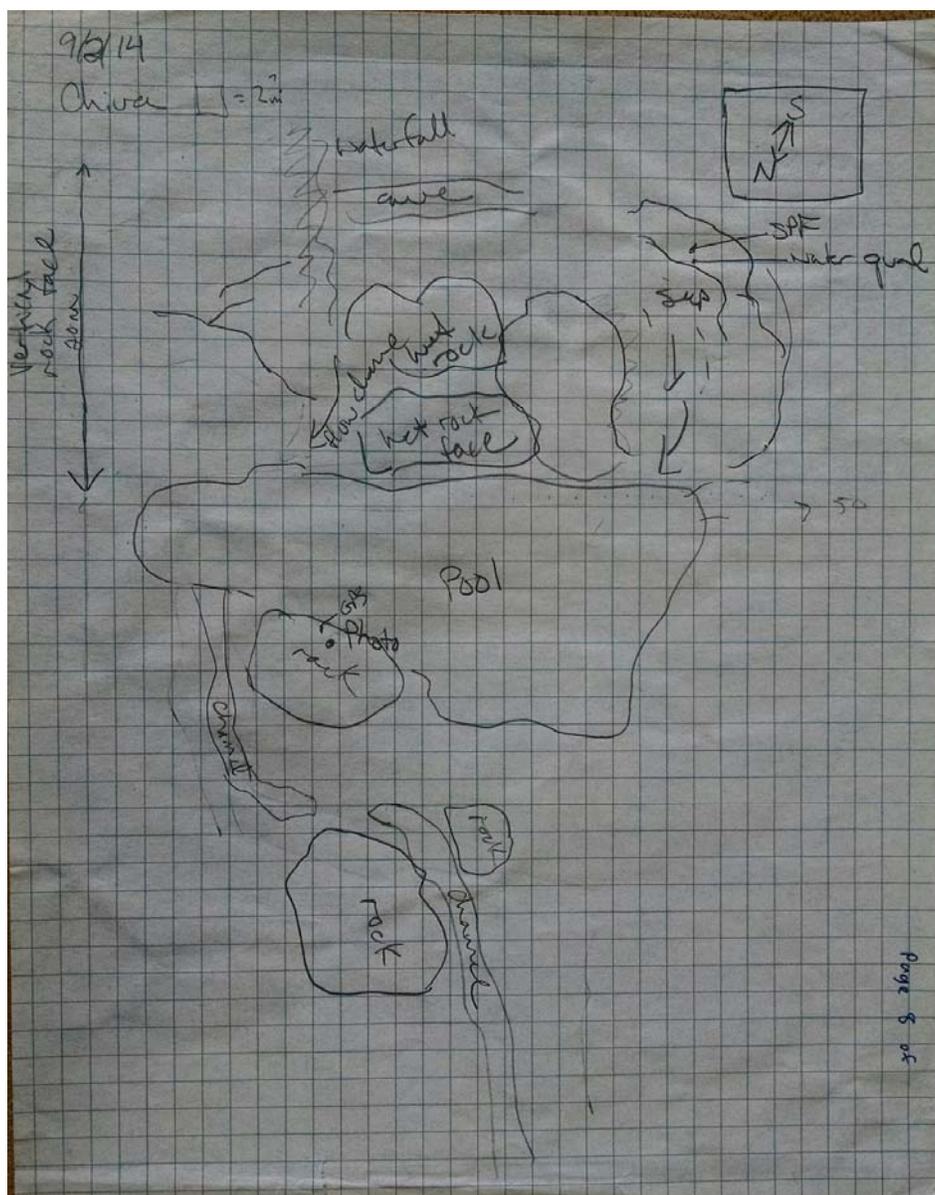


Fig 2 Chiva Falls Sketchmap.

Crescent Spring Survey Summary Report, Site ID 16522

Location: The Crescent Spring ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 15050301 HUC, managed by the US Forest Service. The spring is located in the Sierra Vista RD, Coronado NF at 31.37963, -110.75220 in the Cumero Canyon USGS Quad, measured using a GPS (NAD83, estimated position error 6 meters). The elevation is approximately 1454 meters. Louise Misztal, Randy Seraglio, Nick Pacini, Karen Lowry surveyed the site on 4/20/14 for 01:45 hours, beginning at 10:15, and collected data in 7 of 12 categories.



Fig 1 Crescent Spring.

Physical Description: Crescent Spring is a hanging garden/anthropogenic spring, now mostly infl. The site has 6 microhabitats.

The emergence environment is subaerial, with a gravity flow force mechanism. The distance to the nearest spring is 1563 meters.

Survey Notes: There is water in what appears to be a mine shaft. The site is in good condition. Plastic piping leaves the adit and goes to the southwest along the creek. It seems that the mine shaft has probably altered flow at what used to be a hanging garden site, and there is a nearby well that is also negatively affecting the water quantity. The riparian habitat in the channel still looks very healthy right around the site. There is garbage in the water in the mine shaft.

Table 1 Crescent Spring Water Quality with multiple readings averaged.

Characteristic Measured	Average Value
pH (field)	7.56
Specific conductance (field) (uS/cm)	1086
Temperature, air C	22.2
Temperature, water C	13.6

Flora: Surveyors identified 16 plant species at the site, with 0.0784 species/sqm. These included 14 native and 0 nonnative species; the native status of 2 species remains unknown.

Table 2 Crescent Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	5	1
Shrub	5	2
Mid-canopy	3	1
Tall canopy	1	1
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 3 Crescent Spring Vegetation.

Species	Cover Code	Native Status	Wetland Status
Acacia greggii	SC	N	F
Agave parryi	GC	N	
Anisacanthus		N	
Baccharis	GC	N	R
Cylindropuntia versicolor	SC	N	U
Eragrostis intermedia	GC	N	
Fraxinus			R
Fraxinus velutina	TC	N	R
Muhlenbergia rigens	GC	N	U
Populus fremontii	MC	N	R
Prosopis	MC	N	F
Quercus emoryi	MC	N	
Salix exigua	SC	N	WR
Toxicodendron rydbergii	SC	N	F
unknown Moss	GC		
Vitis arizonica	SC	N	R

Fauna: This list is combined for all microhabitats. Surveyors collected or observed 2 terrestrial invertebrates and 13 vertebrate specimens.

Table 4 Crescent Spring Invertebrates.

Species	Lifestage	Habitat	Method	Count	Species detail
Lepidoptera	Ad	T	Spot	10	at least 10 different species
Lepidoptera Nymphalidae Vanessa virginiensis	Ad	T	Spot	1	

Table 5 Crescent Spring Vertebrates.

Species Common Name	Count	Detection
Bewick's wren	1	call
Zone-tailed Hawk	1	obs
Lucy's warbler	5	call
domestic cow	10	sign
ladder-backed woodpecker	1	
common bushtit	1	
vireo	1	obs
Bridled Titmouse	1	
rufous-crowned sparrow	1	
western tanager	2	obs
Cordilleran Flycatcher	1	call
Wilson's warbler	1	
ash-throated flycatcher	1	call

Assessment: Assessment scores were compiled in 5 categories and 23 subcategories, with 19 null condition scores, and 20 null risk scores. Aquifer functionality and water quality are poor with limited restoration potential and there is high risk. Geomorphology condition is good with significant restoration potential and there is low risk. Habitat condition is good with significant restoration potential and there is low risk. Biotic integrity is very good with excellent restoration potential and there is low risk. Human influence of site is good with significant restoration potential and there is moderate risk. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is good with significant restoration potential and there is low risk.

Table 6 Crescent Spring Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	2	4
Geomorphology	4.6	2.2
Habitat	4.3	2.7
Biota	5.1	2.1
Human Influence	4.2	3
Administrative Context	0	0
Overall Ecological Score	4.5	2.5

Management Recommendations: This spring is very rich with birds and invertebrates. Protect this site - keep cows out to preserve the microhabitats and diversity. Close the spur road that leads to the spring.

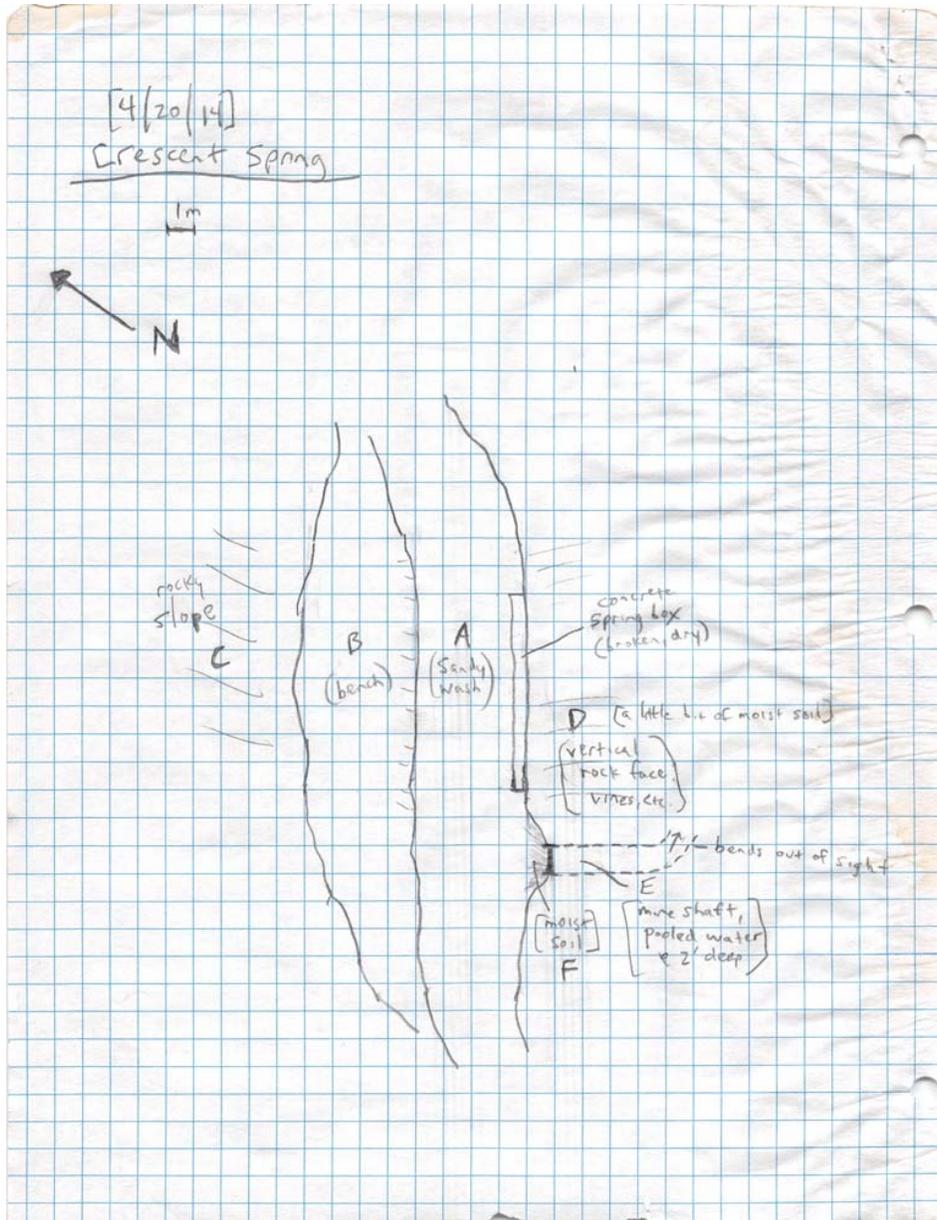


Fig 2 Crescent Spring Sketchmap.



Fig 3 Crescent Spring.



Fig 4 Crescent Spring.

D-13-12 20DCB1
Survey Summary Report, Site ID 20172

Location: The D-13-12 20DCB1 ecosystem is located in Pima County in the Upper Santa Cruz Arizona 15050301 HUC, managed by the National Park Service. The spring is located in the Saguaro NP at 32.28272, -111.13964 in the Avra USGS Quad (NAD83). The elevation is approximately 991 meters. Sami Hammer, Sierrane Gatela, Houston Harris, Emily Patterson surveyed the site on 7/17/15 for 00:45 hours, beginning at 7:30, and collected data in 1 of 12 categories.



Fig 1 D-13-12 20DCB1: view of point from below, dark stains visible

Physical Description:

The distance to the nearest spring is 26971 meters.

Survey Notes: We did not find a spring. There is a mine adit within 100m. There are black stains on the rocks near the point - perhaps indication of water in the past? The coordinates were on a hillside, a bit below a rock outcrop. After returning from the field, Sami noticed a strange bare area on Google Earth about 100m to the ESE that may be related to a spring.



Fig 2 D-13-12 20DCB1: hillside by point - more dark marks

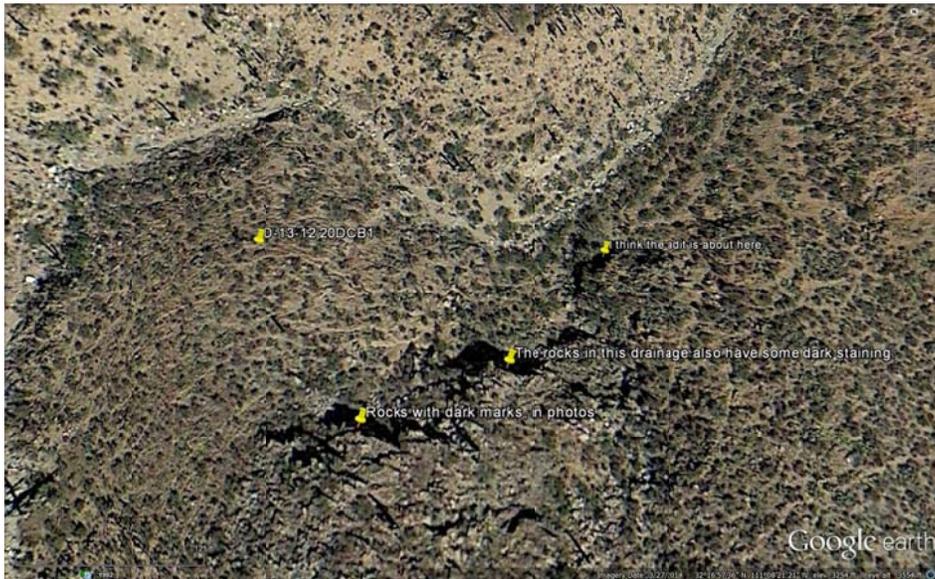


Fig 3 D-13-12 20DCB1: map of vicinity, but not bare area



Fig 4 D-13-12 20DCB1: possible water stains close up



Fig 5 D-13-12 20DCB1: another view with dark stains

Deering Spring Survey Summary Report, Site ID 12918

Location: The Deering Spring ecosystem is located in Pima County in the Upper Santa Cruz Arizona 15050301 HUC, managed by the US Forest Service. The spring is located in the Nogales RD, Coronado NF at 31.80886, -110.76111 in the Helvetia USGS Quad. The elevation is approximately 1726 meters. Louise Misztal, Sami Hammer, Randy Seraglio, Tim Cook surveyed the site on 8/09/15 for 00:30 hours, beginning at 13:00, and collected data in 6 of 12 categories.



Fig 1 Deering Spring: spring origin, adit to left

Physical Description: Deering Spring is a rheocene/anthropogenic spring now emerging from a mine adit with extensive travertine deposits in the adjacent drainage. The water is piped to stock tanks. The first stock tank is at 31.808722, -110.759976. The site has 4 microhabitats, including A -- a 0 sqm pool, B -- a 0 sqm pool, C -- a 0 sqm wet hillslope, D -- a 0 sqm other.

Deering Spring emerges as a fracture spring from a sedimentary rock layer in an unknown unit. The emergence environment is subaerial, with a gravity flow force mechanism. The distance to the nearest spring is 263 meters.

Survey Notes: Survey was not finished due to a storm.

Table 1 Deering Spring Water Quality with multiple readings averaged.

Characteristic Measured	Average Value
pH (field)	6.72
Specific conductance (field) (uS/cm)	596
Temperature, water C	27.3

Fauna: Surveyors collected or observed 3 aquatic and 1 terrestrial invertebrates and 2 vertebrate specimens.

Table 2 Deering Spring Invertebrates.

Species	Lifestage	Habitat	Method	Count
Hemiptera Corixidae	Ad	A	Spot	10
Hemiptera Nepidae	Ad	A	Spot	1
Odonata	L	A	Spot	1
Odonata Libellulidae Libellula saturata	Ad	T	Spot	1

Table 3 Deering Spring Vertebrates.

Species Common Name	Count	Detection
lesser goldfinch	2	call
cordilleran flycatcher	1	call



Fig 2 Deering Spring: leak from tank creating spring habitat



Fig 3 Deering Spring: fall in stream, covered in travertine deposits

Devil's Bathtub Spring Survey 1 Survey Summary Report, Site ID 12859

Location: The Devil's Bathtub Spring ecosystem is located in Pima County in the Rillito Arizona 15050302 HUC, managed by the National Park Service. The spring is located in the Saguaro NP at 32.19642, -110.54536 in the Mica Mountain USGS Quad (NAD 83). The elevation is approximately 2328 meters. DMB, ECW, DCB, SMB surveyed the site on 9/14/14 for 01:45 hours, beginning at 14:30, and collected data in 2 of 12 categories.

Physical Description: Devil's Bathtub Spring is a rheocrene spring. Devil's Bathtub is a small spring. There are two distinct orifices. The spring consists of two minor channels feeding madiculous flow that runs down to a 2.5m diameter pool in the bedrock. The bulk of the spring consists of water flowing across the bedrock. The spring emerges from colluvium in the middle of a run-off channel that trends to the northeast.

Devil's Bathtub Spring emerges as a seepage or filtration spring from a igneous rock layer in an unknown unit. The emergence environment is subaqueous-lotic freshwater, with a gravity flow force mechanism. The distance to the nearest spring is 1747 meters.

Survey Notes: Site overstory has been reshaped by tree fall in the center above the orifice. The stream above the orifice is now running and the plunge pool below the orifice has been scoured of nearly all vegetation, which previously was all aquatic veg. Only a few small remnants of *Jeneus saximontonus* remain. The debris pile above the "orifice" is very large and water moves beneath it.

Table 1 Devil's Bathtub Spring Water Quality with multiple readings averaged.

Characteristic Measured	Average Value
pH (field)	6
Specific conductance (field) (uS/cm)	35
Temperature, sample	14.8

Assessment: Assessment scores were compiled in 2 categories and 9 subcategories, with 33 null condition scores, and 42 null risk scores. Aquifer functionality and water quality are undetermined due to null scores and there is undetermined risk due to null scores. Geomorphology condition is poor with limited restoration potential and there is undetermined risk due to null scores. Habitat condition is undetermined due to null scores and there is undetermined risk due to null scores. Biotic integrity is undetermined due to null scores and there is undetermined risk due to null scores. Human influence of site is very good with excellent restoration potential and there is undetermined risk due to null scores. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is very good with excellent restoration potential and there is undetermined risk due to null scores.

Table 2 Devil's Bathtub Spring Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	0	0
Geomorphology	2	0
Habitat	0	0
Biota	0	0
Human Influence	5.8	0
Administrative Context	0	0
Overall Ecological Score	5.3	0

Devil's Bathtub Spring Survey 2 Survey Summary Report, Site ID 12859

Location: The Devil's Bathtub Spring ecosystem is located in Pima County in the Rillito Arizona 15050302 HUC, managed by the National Park Service. The spring is located in the Saguaro NP at 32.19642, -110.54536 in the Mica Mountain USGS Quad (NAD 83). The elevation is approximately 2328 meters. The surveyors surveyed the site on 9/09/12 for 00:50 hours, beginning at 15:55, and collected data in 2 of 12 categories.

Physical Description: Devil's Bathtub Spring is a rheocene spring. Devil's Bathtub is a small spring. There are two distinct orifices. The spring consists of two minor channels feeding madicolous flow that runs down to a 2.5m diameter pool in the bedrock. The bulk of the spring consists of water flowing across the bedrock. The spring emerges from colluvium in the middle of a run-off channel that trends to the northeast. The site has 6 microhabitats, including A -- a 0 sqm pool, B -- a 0 sqm sloping bedrock, C -- a 0 sqm madicolous flow, D -- a 0 sqm channel, E -- a 0 sqm other, F -- a 0 sqm colluvial slope. The geomorphic diversity is 0.00, based on the Shannon-Weiner diversity index.

Devil's Bathtub Spring emerges as a seepage or filtration spring from a igneous rock layer in an unknown unit. The emergence environment is subaqueous-lotic freshwater, with a gravity flow force mechanism. The distance to the nearest spring is 1747 meters.

Flora: Surveyors identified 55 plant species at the site. These included 50 native and 3 nonnative species; the native status of 2 species remains unknown.

Table 1 Devil's Bathtub Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	33	10
Shrub	6	0
Mid-canopy	1	0
Tall canopy	0	0
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 2 Devil's Bathub Spring Vegetation % Cover in Microhabitats.

Species	Cover Code	Native Status	Wetland Status	A	B	C	D	E	F
Agrostis	GC	I	W	0	0	0	0	0	0
Agrostis stolonifera	GC	I	W	1	0	0	1	0	0
Allium geeyeri	GC	N		0	0	0	1	0	0
Bromus ciliatus	GC	N	F	0	0	0	5	0	1
Castilleja austromontana		N		0	0	0	1	0	1
Drymaria leptophylla		N		0	0	0	0	0	0
Elymus	GC		F	0	0	0	1	0	1
Elymus canadensis	GC	N	F	0	0	0	5	0	0
Erigeron oreophilus		N		0	0	0	1	0	1
Frangula californica	SC	N	U	0	0	0	0	0	5
Gamochaeta purpurea	GC	N		0	0	0	1	0	1
Gentianella microcalyx		N		0	0	0	0	0	0
Hypericum scouleri	GC	N	WR	0	0	0	1	0	1
Juniperus deppeana	MC	N	U	0	0	0	5	5	0
Koeleria macrantha	GC	N	F	0	0	0	1	0	1
Laennecia sophiifolia		N		0	0	0	0	0	1
Lipocarpha micrantha	GC	N		0	0	0	1	0	1
Lobelia anatina	GC	N	WR	0	0	0	1	0	0
Muhlenbergia	GC	N	U	0	0	0	0	0	1
Muhlenbergia emersleyi	GC	N		0	0	0	1	1	0
Muhlenbergia minutissima	GC	N	U	0	0	0	1	0	0
Muhlenbergia montana	GC	N	U	0	0	0	1	5	5
Muhlenbergia pauciflora		N		0	1	0	1	0	1
Oxalis alpina		N		0	0	0	1	0	1
Packera quercetorum		N		0	0	0	1	0	0
Penstemon linarioides	SC	N	U	0	0	0	1	0	1
Perityle coronopifolia		N		0	0	0	0	0	0
Pinus arizonica		N		0	0	0	5	35	0
Pinus ponderosa	SC	N	F	0	1	0	1	1	0
Piptochaetium fimbriatum	GC	N		0	0	0	1	1	0
Pseudognaphalium canescens		N		0	0	0	2	0	0
Pseudognaphalium stramineum	GC	N		0	0	0	0	0	1
Salvia reflexa		N		0	0	0	5	0	0
Sisyrinchium	GC		WR	0	0	0	1	0	0
Stevia serrata		N		0	0	0	0	0	5
Trifolium	GC	I	WR	0	0	0	0	0	0

Devil's Bathtub Spring Survey 3

Survey Summary Report, Site ID 12859

Location: The Devil's Bathtub Spring ecosystem is located in Pima County in the Rillito Arizona 15050302 HUC, managed by the National Park Service. The spring is located in the Saguaro NP at 32.19642, -110.54536 in the Mica Mountain USGS Quad (NAD 83). The elevation is approximately 2328 meters. Nicole Sullivan, Liz Guinessey, Kara Raymond, Shannon McCloskey surveyed the site on 10/01/11 for 03:15 hours, beginning at 8:45, and collected data in 4 of 12 categories.

Physical Description: Devil's Bathtub Spring is a rheocrene spring. Devil's Bathtub is a small spring. There are two distinct orifices. The spring consists of two minor channels feeding madiculous flow that runs down to a 2.5m diameter pool in the bedrock. The bulk of the spring consists of water flowing across the bedrock. The spring emerges from colluvium in the middle of a run-off channel that trends to the northeast. The site has 6 microhabitats, including A -- a 0 sqm pool, B -- a 0 sqm sloping bedrock, C -- a 0 sqm madicolous flow, D -- a 0 sqm channel, E -- a 0 sqm other, F -- a 0 sqm colluvial slope. The geomorphic diversity is 0.00, based on the Shannon-Weiner diversity index.

Devil's Bathtub Spring emerges as a seepage or filtration spring from a igneous rock layer in an unknown unit. The emergence environment is subaqueous-lotic freshwater, with a gravity flow force mechanism. The distance to the nearest spring is 1747 meters.

Table 1 Devil's Bathtub Spring Water Quality with multiple readings averaged.

Characteristic Measured	Average Value	Comments
Alkalinity, Total (mg/L)	97.5	orifice 1
Calcium (Ca) (mg/L)	25	O1
Chloride (CL-) (mg/L)	9.1	O2
Iron (Fe) (mg/L)	0.01	O1
Magnesium (Mg) (mg/L)	14	O1
Nitrogen, Nitrite (NO2) as NO2 (mg/L)	0.005	O1
pH (field)	6.725	Orifice 1
Phosphate (PO4) (mg/L)	0.07	O1
Phosphorus as P (mg/L)	0.02	O1
Specific conductance (field) (uS/cm)	50.5	O1
Sulfur, sulfite (SO4) as SO4 (mg/L)	12	O1

Fauna: Surveyors collected or observed 1 vertebrate specimens.

Table 2 Devil's Bathtub Spring Vertebrates.

Species Common Name	Count
canyon tree frog	2

Devil's Bathtub Spring Survey 4 Survey Summary Report, Site ID 12859

Location: The Devil's Bathtub Spring ecosystem is located in Pima County in the Rillito Arizona 15050302 HUC, managed by the National Park Service. The spring is located in the Saguaro NP at 32.19642, -110.54536 in the Mica Mountain USGS Quad (NAD 83). The elevation is approximately 2328 meters. Besty Vance, Laura Tennant surveyed the site on 6/12/10 for 02:45 hours, beginning at 8:45, and collected data in 4 of 12 categories.

Physical Description: Devil's Bathtub Spring is a rheocrene spring. Devil's Bathtub is a small spring. There are two distinct orifices. The spring consists of two minor channels feeding madicolous flow that runs down to a 2.5m diameter pool in the bedrock. The bulk of the spring consists of water flowing across the bedrock. The spring emerges from colluvium in the middle of a run-off channel that trends to the northeast. The microhabitats associated with the spring cover 183 sqm. The site has 6 microhabitats, including A -- a 5 sqm pool, B -- a 108 sqm sloping bedrock, C -- a 17 sqm madicolous flow, D -- a 5 sqm channel, E -- a 49 sqm other. The geomorphic diversity is 0.00, based on the Shannon-Weiner diversity index.

Devil's Bathtub Spring emerges as a seepage or filtration spring from a igneous rock layer in an unknown unit. The emergence environment is subaqueous-lotic freshwater, with a gravity flow force mechanism. The distance to the nearest spring is 1747 meters.

Table 1 Devil's Bathtub Spring Water Quality with multiple readings averaged.

Characteristic Measured	Average Value	Comments
Dissolved oxygen (field) % saturation	81.1	average of five measurement
pH (field)	7.86	average of five measurements
Specific conductance (field) (uS/cm)	43.1	average of five values
Temperature, air C	14.7	
Temperature, water C	11.1	average of five measurements

Flora: Surveyors identified 36 plant species at the site, with 0.1967 species/sqm. These included 30 native and 0 nonnative species; the native status of 6 species remains unknown.

Table 2 Devil's Bathtub Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	21	8
Shrub	4	0
Mid-canopy	0	0
Tall canopy	1	0
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 3 Devil's Bath Spring Vegetation % Cover in Microhabitats.

Species	Cover Code	Native Status	Wetland Status	A	B	C	D	E	F
<i>Aquilegia chrysantha</i>	GC	N	W	16	0	0	20	15	30
<i>Berberis wilcoxii</i>	SC	N		0	0	0	0	5	15
<i>Bromus</i>	GC		F	15	0	0	1	1	0
<i>Carex</i>				0	0	0	0	1	0
<i>Carex geophila</i>	GC	N	W	0	0	0	0	5	1
<i>Carex siccata</i>	GC	N	W	0	0	0	1	0	1
<i>Elymus glaucus</i>	GC	N	WR	0	0	0	0	0	0
<i>Frangula betulifolia</i>	SC	N	U	0	0	0	0	15	0
<i>Galium aparine</i>	GC	N	WR	0	0	0	1	5	2
<i>Geranium caespitosum</i>	GC	N	F	0	0	0	0	1	1
<i>Heuchera</i>	GC	N	F	0	0	0	0	0	1
<i>Hypericum scouleri</i> ssp. <i>scouleri</i>		N		0	0	0	0	1	1
<i>Juncus interior</i>	GC	N	U	0	0	0	1	1	0
<i>Juncus xiphioides</i>	GC	N	W	16	0	0	6	0	0
<i>Luzula multiflora</i>	GC	N		0	0	0	1	0	1
<i>Lycurus</i>				0	0	0	0	0	0
<i>Mimulus floribundus</i>	GC	N	WR	0	0	0	0	0	0
<i>Muhlenbergia rigens</i>	GC	N	U	0	0	0	1	5	0
<i>Muhlenbergia straminea</i>		N		0	0	0	0	5	5
<i>Packera neomexicana</i>	GC	N	U	0	0	0	0	0	0
<i>Perityle</i>				0	0	0	0	0	0
<i>Pinus arizonica</i>	TC	N		0	0	0	0	0	0
<i>Poa fendleriana</i>	GC	N	F	0	0	0	1	5	2
<i>Potentilla</i>	GC	N	F	0	0	0	0	0	0
<i>Pseudocymopterus montanus</i>	GC	N	F	0	0	0	0	1	2
<i>Quercus hypoleucoides</i>		N		0	0	0	1	1	1
<i>Quercus rugosa</i>		N		0	0	0	0	0	5
<i>Rubus neomexicanus</i>	SC	N	F	0	0	0	0	15	5
<i>Rudbeckia laciniata</i>	GC	N	F	0	0	0	16	0	0
<i>Senecio quercetorum</i>				0	0	0	0	0	0
<i>Sisyrinchium demissum</i>	GC	N	W	0	0	0	1	1	1
<i>Solidago velutina</i>	GC	N	U	0	0	0	0	2	1
<i>Symphoricarpos oreophilus</i>	SC	N	U	0	0	0	5	15	16
<i>Tagetes lemmonii</i>		N		0	0	0	0	0	0
<i>Thalictrum fendleri</i>	GC	N	F	0	0	0	1	1	1
<i>Vicia</i>			WR	0	0	0	0	1	0

Assessment: Assessment scores were compiled in 4 categories and 11 subcategories, with 31 null condition scores, and 42 null risk scores. Aquifer functionality and water quality are very poor with very limited restoration potential and there is undetermined risk due to null scores. Geomorphology condition is good with significant restoration potential and there is undetermined risk due to null scores. Habitat condition is good with significant restoration potential and there is undetermined risk due to null scores. Biotic integrity is undetermined due to null scores and there is undetermined risk due to null scores. Human influence of site is very good with excellent restoration potential and there is undetermined risk due to null

scores. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is good with significant restoration potential and there is undetermined risk due to null scores.

Table 4 Devil's Bathtub Spring Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	1	0
Geomorphology	4	0
Habitat	4	0
Biota	0	0
Human Influence	5.5	0
Administrative Context	0	0
Overall Ecological Score	4.5	0

Flicker Spring Survey Summary Report, Site ID 12405

Location: The Flicker Spring ecosystem is located in Pima County in the Upper Santa Cruz Arizona 15050301 HUC, managed by the US Forest Service. The spring is located in the Santa Catalina RD, Coronado NF at 32.44410, -110.77805 in the Mount Lemmon USGS Quad, measured using a GPS (NAD83, estimated position error 6 meters). The elevation is approximately 2624 meters. Christopher Morris, Eric Bodznick, Elena Martin, Sue Carahan, Curtis Smith, Mike Hughes, Robin West surveyed the site on 6/28/14 for 01:2 hours, beginning at 12:53, and collected data in 9 of 12 categories.



Fig 1 Flicker Spring.

Physical Description: Flicker Spring is a rheocrene/hillslope spring with flow coming out along a similar contour for about 30m, from three points. The site is in a north-facing, steep (~45 degrees), and steep-sided forest drainage with 100' tall conifers. The site has 1 microhabitat, A -- a 90 sqm wet hillslope.

The emergence environment is subaerial. The distance to the nearest spring is 302 meters.

Survey Notes: The spring is in an unburned area, in the middle of a patch of ferns and grass. It is apparently in fully functioning condition and has not been developed by humans.

Table 1 Flicker Spring Water Quality with multiple readings averaged.

Characteristic Measured	Average Value
pH (field)	7.01
Specific conductance (field) (uS/cm)	254
Temperature, water C	13.3

Flora: Surveyors identified 26 plant species at the site, with 0.2889 species/sqm. These included 21 native and 1 nonnative species; the native status of 4 species remains unknown.

Table 2 Flicker Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	14	5
Shrub	2	0
Mid-canopy	1	0
Tall canopy	4	1
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 3 Flicker Spring Vegetation.

Species	Cover Code	Native Status	Wetland Status
<i>Abies concolor</i>	TC	N	U
<i>Acer glabrum</i>	TC	N	F
<i>Acer grandidentatum</i>	TC	N	F
<i>Acer negundo</i>	TC	N	R
<i>Actaea rubra</i>	GC	N	F
<i>Agrostis exarata</i>	GC	N	W
<i>Aquilegia chrysantha</i>	GC	N	W
<i>Corallorhiza maculata</i>	GC	N	U
<i>Cystopteris reevesiana</i>	GC	N	U
<i>Dactylis glomerata</i>	GC	I	W
<i>Dryopteris</i>			
<i>Geranium</i>	GC	N	F
<i>Glyceria elata</i>		N	W
<i>Jamesia americana</i>	SC	N	
<i>Maianthemum racemosum</i>	GC	N	U
<i>Mimulus cardinalis</i>	GC	N	W
<i>Mimulus guttatus</i>	GC	N	W
<i>Piptochaetium</i>			
<i>Pseudotsuga menziesii</i>	MC	N	U
<i>Pteridium aquilinum</i>	GC	N	U
<i>Ribes pinetorum</i>		N	
<i>Rubus idaeus</i>	GC	NI	F
<i>Sambucus</i>	GC		F
<i>Symphoricarpos oreophilus</i>	SC	N	U
<i>Thalictrum fendleri</i>	GC	N	F
<i>Woodsia</i>			

Fauna: Surveyors collected or observed 1 aquatic and 1 terrestrial invertebrates and 8 vertebrate specimens.

Table 4 Flicker Spring Invertebrates.

Species	Lifestage	Habitat	Method	Species detail
arachnid	Ad	T	Spot	"wood spider"
Coleoptera Dytiscidae		A	Spot	
Trombidiformes Erythraeidae Balaustium				

Table 5 Flicker Spring Vertebrates.

Species Common Name	Detection
western tanager	
house wren	
spotted towhee	
cordilleran flycatcher	
hairy woodpecker	
dark-eyed junco	
wild turkey	sign
deer	sign

Assessment: Assessment scores were compiled in 5 categories and 33 subcategories, with 9 null condition scores, and 9 null risk scores. Aquifer functionality and water quality are good with significant restoration potential and there is low risk. Geomorphology condition is very good with excellent restoration potential and there is negligible risk. Habitat condition is good with significant restoration potential and there is low risk. Biotic integrity is very good with excellent restoration potential and there is negligible risk. Human influence of site is very good with excellent restoration potential and there is low risk. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is very good with excellent restoration potential and there is low risk.

Table 6 Flicker Spring Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	4.7	2
Geomorphology	5.2	1.8
Habitat	4.2	2.6
Biota	5.3	1.8
Human Influence	5.1	1.9
Administrative Context	0	0
Overall Ecological Score	4.9	2

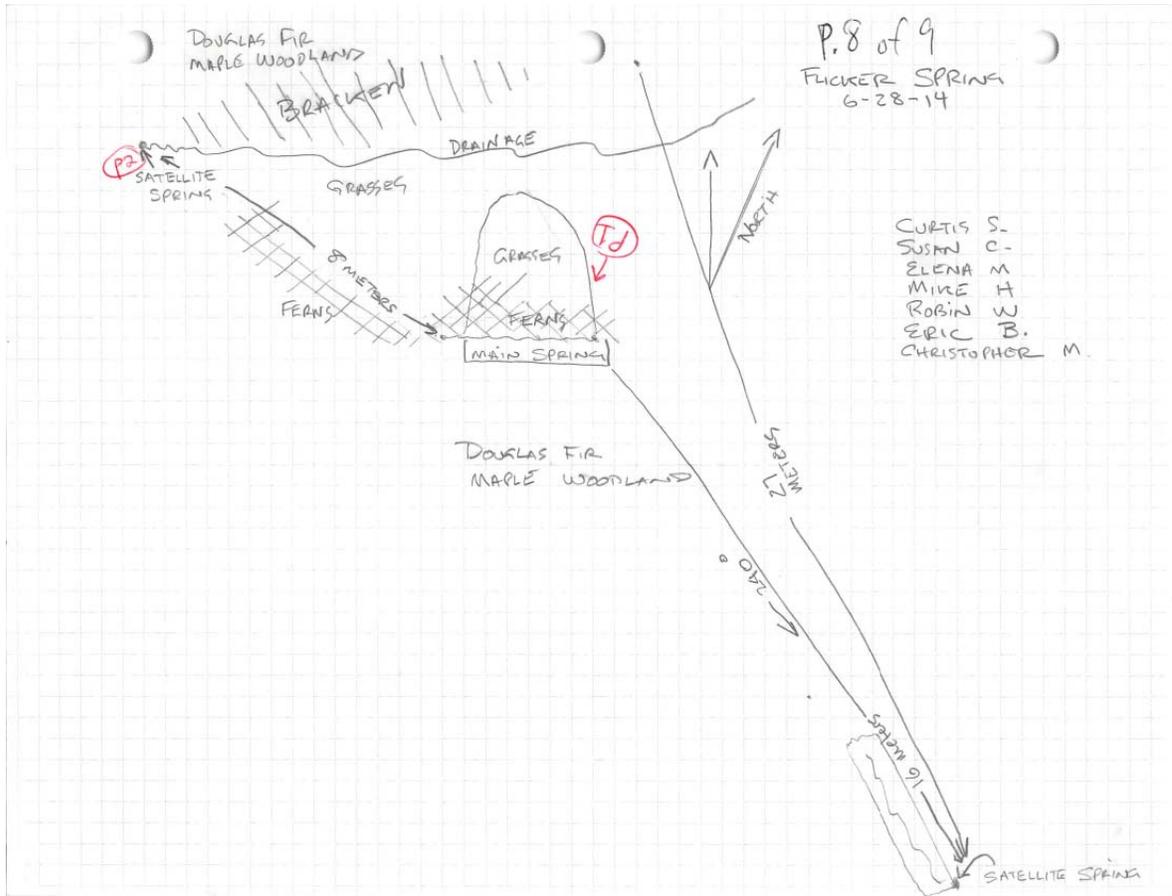


Fig 2 Flicker Spring Sketchmap.



Fig 3 Flicker Spring.



Fig 4 Flicker Spring.

Florida Spring Survey Summary Report, Site ID 12974

Location: The Florida Spring ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 15050301 HUC, managed by the US Forest Service. The spring is located in the Sierra Vista RD, Coronado NF at 31.72990, -110.83816 in the Mount Wrightson USGS Quad, measured using a GPS (NAD83, estimated position error 7 meters). The elevation is approximately 2125 meters. Christopher Morris, Rick Mick, Allie Leach, Sidney Coon, Barbara Coon surveyed the site on 11/15/14 for 02:00 hours, beginning at 12:50, and collected data in 8 of 12 categories.



Fig 1 Florida Spring.

Physical Description: Florida Spring is a rheocrene spring. Florida Spring is a wet pocket captured by a spring box and piped all the way down the canyon. On its shaded northern aspect, the morning sun does not hit it at all in the dead of winter. The site has 1 microhabitat, A -- a 23 sqm channel.

Florida Spring emerges from a igneous, rhyolite rock layer in an unknown unit. The emergence environment is subaerial, with a gravity flow force mechanism. The distance to the nearest spring is 1166 meters.

Survey Notes: There was not much blooming. No grazing or adverse road or recreation effects were observed. We have emailed a scientist at the Santa Rita Experimental Range research station to see where this spring water goes and if some could be returned to the streambed.

Table 1 Florida Spring Water Quality with multiple readings averaged.

Characteristic Measured	Average Value
pH (field)	7.03
Specific conductance (field) (uS/cm)	250
Temperature, air C	10.9
Temperature, water C	10.4

Flora: Surveyors identified 6 plant species at the site, with 0.2655 species/sqm. These included 4 native and 0 nonnative species; the native status of 2 species remains unknown.

Table 2 Florida Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	1	0
Shrub	0	0
Mid-canopy	0	0
Tall canopy	4	1
Basal	0	0
Aquatic	0	0
Non-vascular	1	0

Table 3 Florida Spring Vegetation.

Species	Cover Code	Native Status	Wetland Status
Juglans major	TC	N	R
Pinus ponderosa	TC	N	F
Pinus strobiformis	TC	N	
Poaceae	GC		
Pseudotsuga menziesii	TC	N	U
unknown Bryophyte (moss, liverwort, hornwort)	NV		

Fauna: Fauna records are combined for both the spring polygon (A) and the uplands. Surveyors collected or observed 2 terrestrial invertebrates and 14 vertebrate specimens.

Table 4 Florida Spring Invertebrates.

Species	Lifestage	Habitat	Method	Count	Species detail
Hymenoptera Formicidae	Ad	T	Spot	1	
Lepidoptera Geometridae	L	T	Spot	1	"brown inchworm"

Table 5 Florida Spring Vertebrates.

Species Common Name	Count	Detection
red-tailed hawk	2	obs
grey-breasted jay	1	obs
common raven	5	obs
Montezuma Quail	10	obs
dark-eyed junco	6	obs
band-tailed pigeon	20	obs
cooper's hawk	1	obs
wild turkey	1	sign
American black bear	1	sign
Gray fox	1	sign
Arizona gray squirrel	1	obs
striped skunk	1	obs
Western Diamond-backed Rattlesnake	1	obs
greater short-horned lizard	1	obs

Assessment: Assessment scores were compiled in 5 categories and 30 subcategories, with 12 null condition scores, and 12 null risk scores. Aquifer functionality and water quality are good with significant restoration potential and there is low risk. Geomorphology condition is moderate with some restoration potential and there is moderate risk. Habitat condition is good with significant restoration potential and there is low risk. Biotic integrity is very good with excellent restoration potential and there is low risk. Human influence of site is good with significant restoration potential and there is low risk. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is good with significant restoration potential and there is low risk.

Table 6 Florida Spring Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	4.7	2
Geomorphology	3.4	3
Habitat	4	2.8
Biota	5	2
Human Influence	4.7	2.1
Administrative Context	0	0
Overall Ecological Score	4.4	2.3

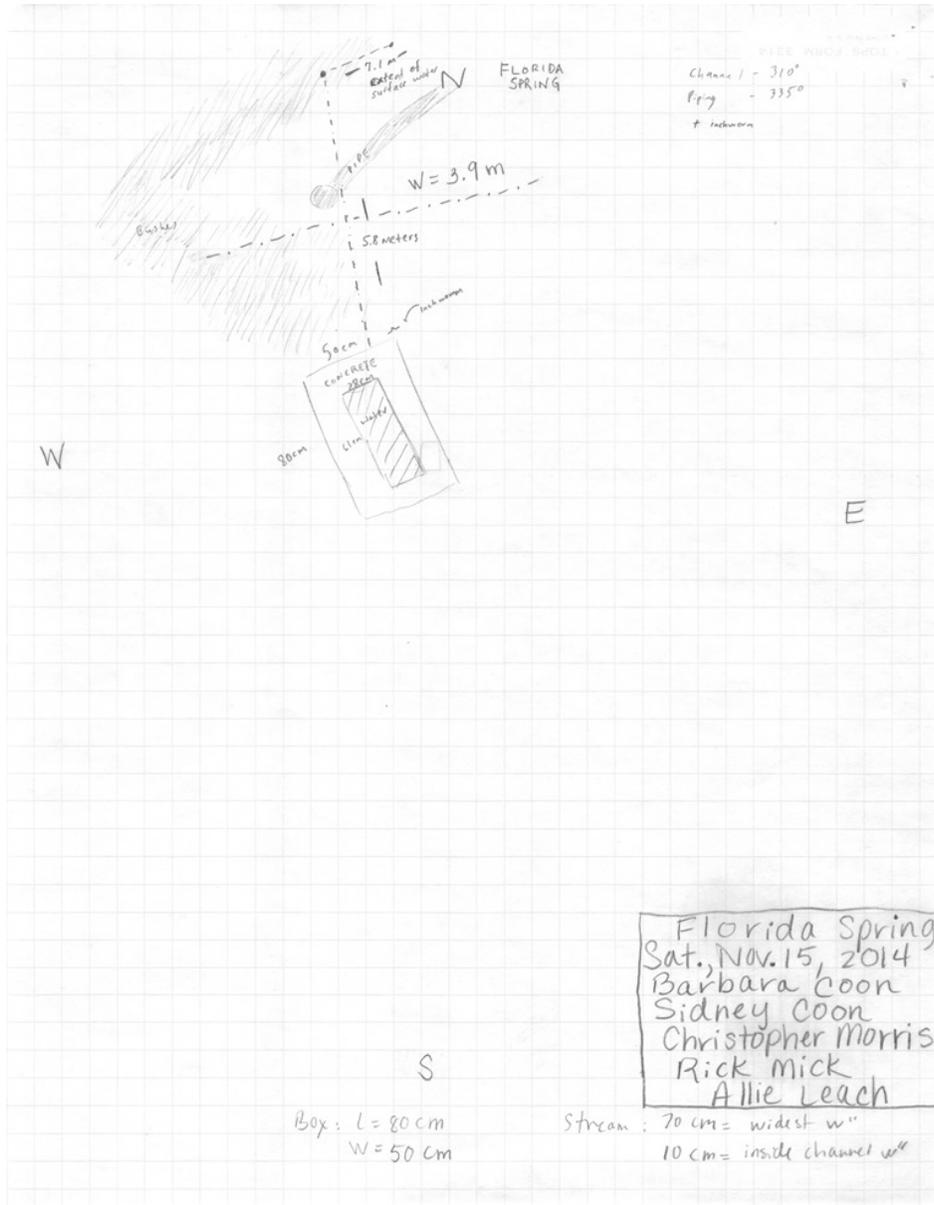


Fig 2 Florida Spring Sketchmap.

Gibbon Springs Survey Summary Report, Site ID 17011

Location: The Gibbon Springs ecosystem is located in Pima County in the Rillito Arizona 15050302 HUC, managed by the private US owner. The spring is located at 32.30420, - 110.77338 in the Sabino Canyon USGS Quad, measured using a GPS (WGS84, estimated position error 0.8 meters). The elevation is approximately 859 meters. Samantha Hammer, Mirna Manteca surveyed the site on 9/11/15 for 00:30 hours, beginning at 12:30, and collected data in 7 of 12 categories.

Physical Description: Gibbon Springs is a helocrene/hypocrene spring. Probably a helocrene spring at one point, this site is dry currently. It has been developed, with a dam forming a stock tank ~100m below it. This spring and several others in the immediate area appear to emerge at a detachment fault at the base of the Catalinas. The site has 3 microhabitats.

The emergence environment is subaerial. The distance to the nearest spring is 767 meters.

Survey Notes: The site was dry. Near what was probably the source, there was lots of leaf litter with some soil moisture. There was a bare flat area that may have been an old pond or wet meadow - the soil was somewhat spongy or peaty. There was old, fallen-down fencing that looked like it was an enclosure. The stock tank area had lots of invasive grasses and forbs. There were palm trees and other riparian-associated trees, but most were dead or dying. Note: The topo map shows this as a complex of springs. Since the database only had a single point, we did not search the site extensively. In general, there was no standing water in the area, but it would be beneficial to explore the site more thoroughly - perhaps in the springtime.

Flora: Surveyors identified 7 plant species at the site, with 0.001 species/sqm. These included 3 native and 1 nonnative species; the native status of 3 species remains unknown.

Table 1 Gibbon Springs Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	3	0
Shrub	3	2
Mid-canopy	0	0
Tall canopy	0	0
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 2 Gibbon Springs Vegetation.

Species	Cover Code	Native Status	Wetland Status
Arecaceae			
Baccharis sarothroides	SC	N	R
Pennisetum	GC	I	
Poaceae	GC		
Prosopis velutina	SC	N	F
Salix	SC	N	WR
unknown Fungus, fleshy (mushroom)	GC		

Fauna: Surveyors collected or observed 4 terrestrial invertebrates and 5 vertebrate specimens.

Table 3 Gibbon Springs Invertebrates.

Species	Lifestage	Habitat	Method
Lepidoptera Libytheidae Libytheana carineta	Ad	T	Spot
Lepidoptera Nymphalidae Junonia	Ad	T	Spot
Lepidoptera Papilionidae Papilio cressphontes	Ad	T	Spot
Lepidoptera Pieridae Zerene cesonia	Ad	T	Spot

Table 4 Gibbon Springs Vertebrates.

Species Common Name	Detection
hummingbirds	
cactus wren	
deer	sign
desert spiny lizard	obs
Garter snake	obs

Assessment: Assessment scores were compiled in 4 categories and 30 subcategories, with 12 null condition scores, and 12 null risk scores. Aquifer functionality and water quality are undetermined due to null scores and there is extreme risk. Geomorphology condition is moderate with some restoration potential and there is moderate risk. Habitat condition is moderate with some restoration potential and there is high risk. Biotic integrity is poor with limited restoration potential and there is very high risk. Human influence of site is moderate with some restoration potential and there is high risk. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is poor with limited restoration potential and there is high risk.

Table 5 Gibbon Springs Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	0	6
Geomorphology	3.6	3.2
Habitat	3.5	4.8
Biota	2.5	5.5
Human Influence	3	4
Administrative Context	0	0
Overall Ecological Score	2.5	4.7

Management Recommendations: The human influence scores really depend on whether the residential development and the golf course caused the spring to dry up, or if it was due to climate alterations and natural processes in the detachment fault that the spring emerges from. These scores assume it had more to do with the human causes.



Fig 1 Gibbon Springs Sketchmap: The topo map shows other springs in the immediate vicinity which we didn't check for.

Huntsman Spring Survey Summary Report, Site ID 12420

Location: The Huntsman Spring ecosystem is located in Pima County in the Rillito Arizona 15050302 HUC, managed by the US Forest Service. The spring is located in the Santa Catalina RD, Coronado NF at 32.42727, -110.75896 in the Mount Lemmon USGS Quad (WGS84). The elevation is approximately 2462 meters. Sami Hammer, Glenn Furnier, Emily Patterson, Aida Castillo-Flores, Sierrane Gatela, Katy Brown, Kristi Argenbright surveyed the site on 6/13/15 for 00:45 hours, beginning at 8:15, and collected data in 0 of 12 categories.

Physical Description: Huntsman Spring is a rheocrene spring. This spring is not obvious as such, but it is apparently a rheocrene spring that maintains a perennial stretch of Marshall Gulch, even in very dry years. There is a stream gage not far below it.

Huntsman Spring emerges from a igneous, granite rock layer in an unknown unit. The emergence environment is subaerial. The distance to the nearest spring is 568 meters.

Survey Notes: The surveyors searched around the original coordinates for ~45 minutes. There was no spring on the hillside within 100m or so of the original coordinates. The spring must be in the creek (as shown on topos), which is perennial here, as remembered by some members of the survey team. There are use trails and lots of foot traffic, but otherwise the area is in good shape.

Iron Spring Survey Summary Report, Site ID 17062

Location: The Iron Spring ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 15050301 HUC, managed by the US Forest Service. The spring is located in the Sierra Vista RD, Coronado NF at 31.67325, -110.90446 in the Mount Hopkins USGS Quad, measured using a GPS (NAD83, estimated position error 7 meters). The elevation is approximately 1762 meters. Christopher Morris, R. Gillespie, Sara Murphy, John Murphy, Karen Lowery, Bill Knight, and Melis Arik surveyed the site on 2/07/15 for 01:45 hours, beginning at 14:15, and collected data in 9 of 12 categories.



Fig 1 Iron Spring.

Physical Description: Iron Spring is a rheocrene spring. The spring site is perched 30m above a road crossing and is surrounded by deer grass, bush muhly, mosses, and seep willow. The site has 1 microhabitat, A -- a 150 sqm channel.

Iron Spring emerges from a metamorphic rock layer in an unknown unit. The emergence environment is subaerial, with a gravity flow force mechanism. The distance to the nearest spring is 987 meters.

Survey Notes: This site is apparently pristine; there is no evidence of cattle presence around the spring. Despite its proximity to the road, this spring does not show any adverse effects.

Table 1 Iron Spring Water Quality with multiple readings averaged.

Characteristic Measured	Average Value
pH (field)	7.46
Specific conductance (field) (uS/cm)	337
Temperature, air C	26.7
Temperature, water C	11.4

Flora: Plant list includes both species in the spring-influenced area, and the adjacent uplands. Surveyors identified 20 plant species at the site, with 0.1333 species/sqm. These included 19 native and 1 nonnative species.

Table 2 Iron Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	8	0
Shrub	8	3
Mid-canopy	2	1
Tall canopy	0	0
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 3 Iron Spring Vegetation.

Species	Cover Code	Native Status	Wetland Status
<i>Artemisia ludoviciana</i>	GC	N	F
<i>Baccharis salicifolia</i>	SC	N	R
<i>Baccharis sarothroides</i>	SC	N	R
<i>Cercocarpus montanus</i>	SC	N	U
<i>Dasylyrion wheeleri</i>		N	
<i>Eriogonum wrightii</i>		N	
<i>Erythrina flabelliformis</i>	SC	N	
<i>Galium</i>	GC	I	F
<i>Juniperus deppeana</i>	MC	N	U
<i>Mammillaria</i>	GC	N	
<i>Muhlenbergia emersleyi</i>	GC	N	
<i>Muhlenbergia rigens</i>	GC	N	U
<i>Nolina microcarpa</i>	SC	N	U
<i>Pinus</i>	GC	N	U
<i>Populus fremontii</i>	MC	N	R
<i>Quercus</i>	SC	N	U
<i>Rhus trilobata</i>	SC	N	F
<i>Salix gooddingii</i>	SC	N	R
<i>Selaginella</i>	GC	N?	
<i>Yucca madrensis</i>	GC	N	

Fauna: Surveyors collected or observed 2 aquatic and 1 terrestrial invertebrates and 10 vertebrate specimens.

Table 4 Iron Spring Invertebrates.

Species	Lifestage	Habitat	Method	Species detail
Diptera Culicidae	L	A	Spot	
Mollusca	Ad	A	Spot	Physid? (8-10mm)
Odonata	Ad	T	Spot	small, blue

Table 5 Iron Spring Vertebrates.

Species Common Name	Count	Detection
yellow-rumped warbler	1	obs
red-tailed hawk	1	obs
common bushtit	1	obs
acorn woodpecker	1	obs
Bewick's wren	1	obs
dark-eyed junco	1	obs
rufous-crowned sparrow	1	call
red-naped sapsucker	1	obs
Hutton's Vireo	1	call
Bridled Titmouse	1	call

Assessment: Assessment scores were compiled in 5 categories and 30 subcategories, with 12 null condition scores, and 12 null risk scores. Aquifer functionality and water quality are very good with excellent restoration potential and there is negligible risk. Geomorphology condition is good with significant restoration potential and there is low risk. Habitat condition is good with significant restoration potential and there is negligible risk. Biotic integrity is very good with excellent restoration potential and there is low risk. Human influence of site is very good with excellent restoration potential and there is negligible risk. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is very good with excellent restoration potential and there is low risk.

Table 6 Iron Spring Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	5.3	1.8
Geomorphology	4.8	2.2
Habitat	4.4	1.6
Biota	5.1	2.1
Human Influence	5.1	1.7
Administrative Context	0	0
Overall Ecological Score	5	1.9

Italian Spring Survey 1 Survey Summary Report, Site ID 17018

Location: The Italian Spring ecosystem is located in Pima County in the Rillito Arizona 15050302 HUC, managed by the National Park Service. The spring is located in the Saguaro NP at 32.22908, -110.53590 in the Mica Mountain USGS Quad, measured using a GPS (NAD83). The elevation is approximately 2298 meters. DCB, DMB, ECW surveyed the site on 9/13/14 for 02:5 hours, beginning at 13:45, and collected data in 2 of 12 categories.

Physical Description: Italian Spring is a rheocrene spring. Italian spring is a small spring on the north slope. The orifice is difficult to distinguish, with an excavated pool accumulating water from another 3m of very mucky, thickly vegetated seep. There was difficulty pinpointing the precise orifice in the midst of this nine square meter area. The spring has a very low discharge that then descends down a thickly vegetated slope which narrows from 7-10m wide to less than a meter. The lower end of the channel is more deeply incised and covered deeply in litter, although still wetted. The channel off of the spring appears to not be influenced by the spring, but rather by the runoff coming down the slope. The vegetation outside of the narrow wetted band is generally Pteridium aquilinum with significant pine needle and duff accumulation. There are some shrubs in the lower end, but the overstory is diverse. Overall, the spring is situated on an open hillslope with a large rock outcrop to the west. There is evidence of significant burns in either directions, with while slopes destroyed by fire. There is also significant dead and down with evidence of numerous recent windfalls. The site has 2 microhabitats, including A -- a 0 sqm pool, B -- a 0 sqm channel. The geomorphic diversity is 0.00, based on the Shannon-Weiner diversity index.

Italian Spring emerges as a seepage or filtration spring from a igneous rock layer in an unknown unit. The emergence environment is subaqueous-lotic freshwater, with a gravity flow force mechanism. The distance to the nearest spring is 920 meters.

Survey Notes: No observed discharge. Wetted extent downslope is less than observed in 2010. It is at the junction of Italian Spring and North Slope trails. Human social trails and game trails are evident for spring access. Burned tree bases and logs in area. Spring relatively dry compared to evidence of past extent.

Table 1 Italian Spring Water Quality with multiple readings averaged.

Characteristic Measured	Average Value
pH (field)	6.3
Specific conductance (field) (uS/cm)	12.1
Temperature, water C	11.9

Assessment: Assessment scores were compiled in 1 category and 8 subcategories, with 34 null condition scores, and 42 null risk scores. Aquifer functionality and water quality are undetermined due to null scores and there is undetermined risk due to null scores. Geomorphology condition is undetermined due to null scores and there is undetermined risk due to null scores. Habitat condition is undetermined due to null scores and there is

undetermined risk due to null scores. Biotic integrity is undetermined due to null scores and there is undetermined risk due to null scores. Human influence of site is good with significant restoration potential and there is undetermined risk due to null scores. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is good with significant restoration potential and there is undetermined risk due to null scores.

Table 2 Italian Spring Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	0	0
Geomorphology	0	0
Habitat	0	0
Biota	0	0
Human Influence	4.6	0
Administrative Context	0	0
Overall Ecological Score	4.6	0

Italian Spring Survey 2

Survey Summary Report, Site ID 17018

Location: The Italian Spring ecosystem is located in Pima County in the Rillito Arizona 15050302 HUC, managed by the National Park Service. The spring is located in the Saguaro NP at 32.22908, -110.53590 in the Mica Mountain USGS Quad, measured using a GPS (NAD83). The elevation is approximately 2298 meters. The surveyors surveyed the site on 9/09/12 for 00:45 hours, beginning at 11:10, and collected data in 2 of 12 categories.

Physical Description: Italian Spring is a rheocrene spring. Italian spring is a small spring on the north slope. The orifice is difficult to distinguish, with an excavated pool accumulating water from another 3m of very mucky, thickly vegetated seep. There was difficulty pinpointing the precise orifice in the midst of this nine square meter area. The spring has a very low discharge that then descends down a thickly vegetated slope which narrows from 7-10m wide to less than a meter. The lower end of the channel is more deeply incised and covered deeply in litter, although still wetted. The channel off of the spring appears to not be influenced by the spring, but rather by the runoff coming down the slope. The vegetation outside of the narrow wetted band is generally Pteridium aquilinum with significant pine needle and duff accumulation. There are some shrubs in the lower end, but the overstory is diverse. Overall, the spring is situated on an open hillslope with a large rock outcrop to the west. There is evidence of significant burns in either directions, with while slopes destroyed by fire. There is also significant dead and down with evidence of numerous recent windfalls. The site has 5 microhabitats, including A -- a 0 sqm pool, B -- a 0 sqm channel, C -- a 0 sqm madicolous flow, D -- a 0 sqm high gradient cienega, E -- a 0 sqm other. The geomorphic diversity is 0.00, based on the Shannon-Weiner diversity index.

Italian Spring emerges as a seepage or filtration spring from a igneous rock layer in an unknown unit. The emergence environment is subaqueous-lotic freshwater, with a gravity flow force mechanism. The distance to the nearest spring is 920 meters.

Survey Notes: No notes taken for 2012

Flora: Surveyors identified 33 plant species at the site. These included 28 native and 2 nonnative species; the native status of 3 species remains unknown.

Table 1 Italian Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	22	9
Shrub	2	0
Mid-canopy	1	0
Tall canopy	2	0
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 2 Italian Spring Vegetation % Cover in Microhabitats.

Species	Cover Code	Native Status	Wetland Status	A	B	C	D	E
<i>Agrostis stolonifera</i>	GC	I	W	1	1	1	5	0
<i>Bromus anaticus</i>				0	0	0	0	0
<i>Carex</i>				0	0	1	1	0
<i>Carex geophila</i>	GC	N	W	0	0	0	0	1
<i>Castilleja austromontana</i>		N		0	0	0	0	1
<i>Cirsium undulatum</i>	GC	N	F	0	0	0	0	0
<i>Gamochaeta purpurea</i>	GC	N		0	0	0	0	0
<i>Geranium richardsonii</i>	GC	N	F	0	0	0	1	5
<i>Hypericum scouleri</i>	GC	N	WR	0	0	0	1	20
<i>Koeleria macrantha</i>	GC	N	F	0	0	0	0	1
<i>Oxalis alpina</i>		N		0	1	0	0	0
<i>Penstemon barbatus</i>	GC	N	U	0	0	0	0	1
<i>Pinus ponderosa</i>	SC	N	F	0	0	0	1	20
<i>Pseudognaphalium stramineum</i>	GC	N		0	0	0	1	1
<i>Symphoricarpos oreophilus</i>	SC	N	U	0	0	0	1	5
<i>Trifolium</i>	GC	I	WR	0	1	0	5	1
<i>Vicia pulchella</i>	GC	N	F	0	0	0	1	1

Italian Spring Survey 3

Survey Summary Report, Site ID 17018

Location: The Italian Spring ecosystem is located in Pima County in the Rillito Arizona 15050302 HUC, managed by the National Park Service. The spring is located in the Saguaro NP at 32.22908, -110.53590 in the Mica Mountain USGS Quad, measured using a GPS (NAD83). The elevation is approximately 2298 meters. Nicole Sullivan, Liz Guinessey, Shannon McCloskey surveyed the site on 10/04/11 for 01:18 hours, beginning at 8:30, and collected data in 3 of 12 categories.

Physical Description: Italian Spring is a rheocrene spring. Italian spring is a small spring on the north slope. The orifice is difficult to distinguish, with an excavated pool accumulating water from another 3m of very mucky, thickly vegetated seep. There was difficulty pinpointing the precise orifice in the midst of this nine square meter area. The spring has a very low discharge that then descends down a thickly vegetated slope which narrows from 7-10m wide to less than a meter. The lower end of the channel is more deeply incised and covered deeply in litter, although still wetted. The channel off of the spring appears to not be influenced by the spring, but rather by the runoff coming down the slope. The vegetation outside of the narrow wetted band is generally Pteridium aquilinum with significant pine needle and duff accumulation. There are some shrubs in the lower end, but the overstory is diverse. Overall, the spring is situated on an open hillslope with a large rock outcrop to the west. There is evidence of significant burns in either directions, with while slopes destroyed by fire. There is also significant dead and down with evidence of numerous recent windfalls. The site has 5 microhabitats, including A -- a 0 sqm pool, B -- a 0 sqm channel, C -- a 0 sqm madicolous flow, D -- a 0 sqm high gradient cienega, E -- a 0 sqm other.

Italian Spring emerges as a seepage or filtration spring from a igneous rock layer in an unknown unit. The emergence environment is subaqueous-lotic freshwater, with a gravity flow force mechanism. The distance to the nearest spring is 920 meters.

Survey Notes: This is a perennial spring that is heavily used by hikers, stock and wildlife. A hiking trail follows just next to the spring and several game trails lead to the spring so it is highly impacted. The spring pool has been excavated and there was a fire prior to the 2010 survey.

Table 1 Italian Spring Water Quality with multiple readings averaged.

Characteristic Measured	Average Value	Comments
Missing parameter	36.3	EC value (uS/cm)
pH (field)	6.28	average of 3 measurements
Temperature, water C	10.8	average of 3 measurements

Flora: No polygon data entered in survey notes. Assigned all vegetation to "E" OTHER category. Surveyors identified 7 plant species at the site. These included 6 native and 0 nonnative species; the native status of 1 species remains unknown.

Table 2 Italian Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	3	1
Shrub	0	0
Mid-canopy	0	0
Tall canopy	1	0
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 3 Italian Spring Vegetation % Cover in Microhabitats.

Species	Cover Code	Native Status	Wetland Status	A	B	C	D	E
Eustachys				0	0	0	0	50
Pinus palustris		N		0	0	0	0	5
Senecio bigelovii	GC	N	F	0	0	0	20	11
Simmondsia chinensis		N		0	0	0	0	50

Italian Spring Survey 4

Survey Summary Report, Site ID 17018

Location: The Italian Spring ecosystem is located in Pima County in the Rillito Arizona 15050302 HUC, managed by the National Park Service. The spring is located in the Saguaro NP at 32.22908, -110.53590 in the Mica Mountain USGS Quad, measured using a GPS (NAD83). The elevation is approximately 2298 meters. Steve Buckley, Laura Tennant, Becky Vance surveyed the site on 6/10/10 for 03:20 hours, beginning at 10:45, and collected data in 5 of 12 categories.

Physical Description: Italian Spring is a rheocrene spring. Italian spring is a small spring on the north slope. The orifice is difficult to distinguish, with an excavated pool accumulating water from another 3m of very mucky, thickly vegetated seep. There was difficulty pinpointing the precise orifice in the midst of this nine square meter area. The spring has a very low discharge that then descends down a thickly vegetated slope which narrows from 7-10m wide to less than a meter. The lower end of the channel is more deeply incised and covered deeply in litter, although still wetted. The channel off of the spring appears to not be influenced by the spring, but rather by the runoff coming down the slope. The vegetation outside of the narrow wetted band is generally Pteridium aquilinum with significant pine needle and duff accumulation. There are some shrubs in the lower end, but the overstory is diverse. Overall, the spring is situated on an open hillslope with a large rock outcrop to the west. There is evidence of significant burns in either directions, with while slopes destroyed by fire. There is also significant dead and down with evidence of numerous recent windfalls. The microhabitats associated with the spring cover 39.11 sqm. The site has 5 microhabitats, including A -- a 2 sqm pool, B -- a 13 sqm channel, C -- a 7 sqm madicolous flow, D -- a 13 sqm high gradient cienega, E -- a 5 sqm other. The geomorphic diversity is 0.62, based on the Shannon-Weiner diversity index.

Italian Spring emerges as a seepage or filtration spring from a igneous rock layer in an unknown unit. The emergence environment is subaqueous-lotic freshwater, with a gravity flow force mechanism. The distance to the nearest spring is 920 meters.

Survey Notes: This site is considered moderately disturbed due to the close proximity to the trail, which creates disturbance around the spring from both wildlife and human activity. The spring is surrounded on the west, south and southeast sides by a trail. The pool shows signs of excavation by hikers and backpackers as a water source.

Table 1 Italian Spring Water Quality with multiple readings averaged.

Characteristic Measured	Average Value	Comments
pH (field)	6.84	averaged from 4 measurements

Flora: Surveyors identified 23 plant species at the site, with 0.5881 species/sqm. These included 20 native and 0 nonnative species; the native status of 3 species remains unknown.

Table 2 Italian Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	15	6
Shrub	1	0
Mid-canopy	1	0
Tall canopy	2	0
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 3 Italian Spring Vegetation % Cover in Microhabitats.

Species	Cover Code	Native Status	Wetland Status	A	B	C	D	E
Bromus	GC		F	0	0	0	1	1
Carex siccata	GC	N	W	1	0	5	5	0
Cirsium	GC		F	0	0	0	0	0
Elymus	GC		F	0	0	0	0	0
Galium aparine	GC	N	WR	0	1	1	10	10
Geranium	GC	N	F	0	0	0	0	0
Glyceria striata	GC	N	W	21	36	1	36	0
Hymenoxys hoopesii	GC	N	F	0	1	1	6	1
Hypericum scouleri ssp. scouleri		N		0	20	1	0	0
Juncus effusus	GC	N	W	55	40	1	2	50
Juncus marginatus	GC	N	F	0	1	0	0	0
Juncus xiphioides	GC	N	W	0	6	1	1	0
Packera quercetorum		N		0	0	0	0	1
Pinus arizonica		N		0	25	5	0	15
Pinus strobiformis	TC	N		0	5	20	100	70
Pseudotsuga menziesii	MC	N	U	20	6	0	5	40
Pteridium aquilinum	GC	N	U	0	5	5	10	180
Quercus gambelii	TC	N	F	0	0	0	0	1
Scrophularia parviflora		N		0	0	0	5	0
Symphoricarpos palmeri	SC	N	U	0	0	0	0	5
Thalictrum fendleri	GC	N	F	0	0	0	1	2
Vicia americana	GC	N	F	0	0	0	1	6
Viola nephrophylla	GC	N	WR	5	35	15	6	1

Jackalo Mine Spring Survey Summary Report, Site ID 177501

Location: The Jackalo Mine Spring ecosystem is located in Santa Cruz County in the HUC, managed by the US Forest Service. The spring is located in the Sierra Vista RD, Coronado NF at 31.40355, -110.74742 in the USGS Quad, measured using a GPS (NAD83). The elevation is approximately 1659 meters. Louise Misztal, Randy Seraglio, Gooch Goodwin, Time Cook, Steve Buckley surveyed the site on 4/19/14 for 01:00 hours, beginning at 13:00, and collected data in 8 of 12 categories.



Fig 1 Jackalo Mine Spring.

Physical Description: Jackalo Mine Spring is an anthropogenic spring. There is an old mine shaft site that now has a constant water flow in a very steep rocky canyon that shows no signs of natural water presence. The mine shaft is dammed by dirt and rock with two pipes leading out of it. The microhabitats associated with the spring cover 185 sqm. The site has 4 microhabitats, including A -- a 3 sqm pool, B -- a 82 sqm other, C -- a 80 sqm adjacent uplands, D -- a 20 sqm channel. The geomorphic diversity is 0.45, based on the Shannon-Weiner diversity index.

Jackalo Mine Spring emerges from an igneous rock layer in an unknown unit. The emergence environment is subaerial.

Survey Notes: At the time of the visit, there were two water pipes leading from the spring.

Table 1 Jackalo Mine Spring Water Quality with multiple readings averaged.

Characteristic Measured	Average Value	Comments
pH (field)	7.48	in the exposed pool
Specific conductance (field) (uS/cm)	1916	in the exposed pool
Temperature, air C	23.3	
Temperature, water C	16.95	in the exposed pool

Flora: Surveyors identified 28 plant species at the site, with 0.1514 species/sqm. These included 28 native and 0 nonnative species.

Table 2 Jackalo Mine Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	18	1
Shrub	8	1
Mid-canopy	3	1
Tall canopy	2	1
Basal	0	0
Aquatic	0	0
Non-vascular	1	0

Table 3 Jackalo Mine Spring Vegetation % Cover in Microhabitats.

Species	Cover Code	Native Status	Wetland Status	A	B	C	D
Agave palmeri	GC	N		0	0	2	0
Artemisia ludoviciana	GC	N	F	0	0	2	0
Astrolepis	GC	N		0	0	1	0
Bothriochloa barbinodis	GC	N	F	0	1	0	0
Brickellia californica	SC	N	F	0	0	10	0
Castilleja	GC	N	U	0	0	1	0
Coreocarpus arizonicus	GC	N		0	0	2	1
Dasyilirion wheeleri	SC	N		0	0	2	0
Datura wrightii	GC	N	F	0	1	0	0
Garrya wrightii	SC	N	F	0	0	2	0
Gymnosperma glutinosum	SC	N		0	0	1	0
Hedeoma dentata	GC	N		0	0	2	0
Hesperidanthus linearifolius	GC	N		0	0	1	1
Hymenothrix wislizeni	GC	N		0	1	0	0
Juniperus deppeana	GC	N	U	0	1	0	0
Juniperus deppeana	MC	N	U	0	1	0	0
Lotus greenei	GC	N		0	1	0	0
Mimosa biuncifera	SC	N		0	2	0	0
Muhlenbergia emersleyi	GC	N		0	0	8	3
Nolina microcarpa	SC	N	U	0	0	2	0
Pellaea truncata	GC	N		0	0	1	0
Physalis crassifolia	GC	N	F	0	0	1	0
Populus fremontii	GC	N	R	0	1	0	0
Quercus arizonica	MC	N	R	0	0	10	0
Quercus arizonica	TC	N	R	0	0	10	0
Quercus emoryi	MC	N		0	0	10	0
Quercus emoryi	NV	N		0	0	0	2
Quercus emoryi	TC	N		0	0	10	0
Rhus aromatica var. trilobata	SC	N		0	0	2	0
Silene antirrhina	GC	N		0	1	0	0
Stachys coccinea	GC	N		0	0	1	0
Vitis arizonica	SC	N	R	0	0	1	0

Fauna: Surveyors collected or observed 6 vertebrate specimens.

Table 4 Jackalo Mine Spring Vertebrates.

Species Common Name	Count	Detection
Mountain lion	1	sign
javelina	1	
deer	1	
Bewick's wren	1	
Canyon Towhee	1	
canyon wren	1	

Management Recommendations: Confirm water rights and enforce them. We believe it is currently being used for watering cattle but has also been used for supplying water to exploratory mining.

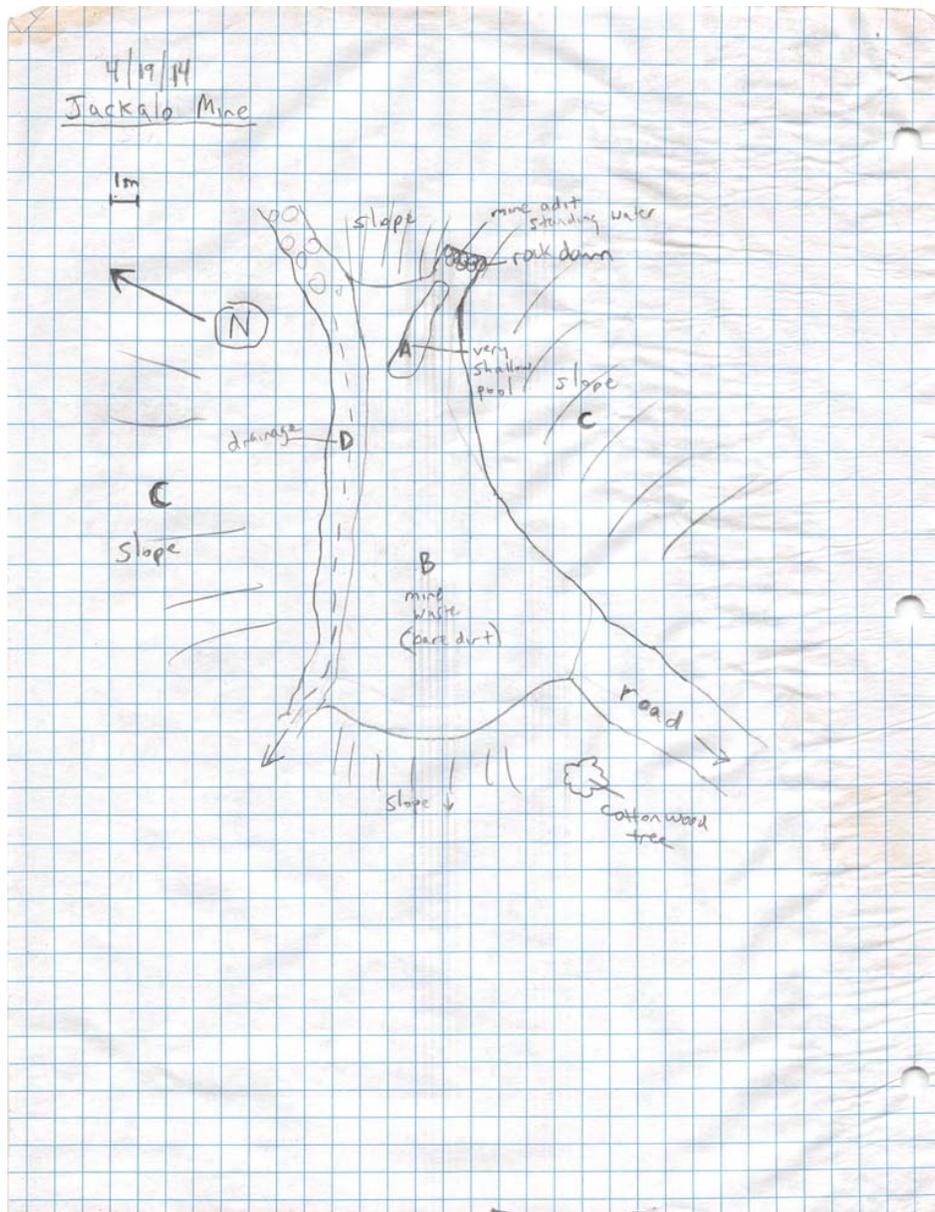


Fig 2 Jackalo Mine Spring Sketchmap.

Kent Spring Survey Summary Report, Site ID 17069

Location: The Kent Spring ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 15050301 HUC, managed by the US Forest Service. The spring is located in the Nogales RD, Coronado NF at 31.71247, -110.85619 in the Mount Wrightson USGS Quad (NAD 83). The elevation is approximately 2063 meters. Louise Misztal, Randy Seraglio, John Pachita, Barbara Coon, Sydney Coen, Chris Hefner surveyed the site on 11/16/14 for 01:30 hours, beginning at 13:50, and collected data in 6 of 12 categories.



Fig 1 Kent Spring.

Physical Description: Kent Spring is a hillslope spring. Kent Spring is to the southeast of Bog Springs and is also on the eastern slope of Madera Canyon. It is a hillslope spring emerging to the side of a main channel.

Kent Spring emerges from a igneous, rhyolite rock layer in an unknown unit. The emergence environment is subaerial. The distance to the nearest spring is 834 meters.

Table 1 Kent Spring Water Quality with multiple readings averaged.

Characteristic Measured	Average Value
pH (field)	7.5
Specific conductance (field) (uS/cm)	120
Temperature, air C	12
Temperature, water C	11.2

Flora: Surveyors identified 5 plant species at the site, with 0.25 species/sqm. These included 1 native and 0 nonnative species; the native status of 4 species remains unknown.

Table .2 Kent Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	1	1
Shrub	1	0
Mid-canopy	0	0
Tall canopy	0	0
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 3 Kent Spring Vegetation.

Species	Cover Code	Native Status	Wetland Status
Aquilegia chrysantha	GC	N	W
Carex			
Dasyllirion			
Juncus			
Quercus	SC		U

Assessment: Assessment scores were compiled in 5 categories and 22 subcategories, with 20 null condition scores, and 20 null risk scores. Aquifer functionality and water quality are good with significant restoration potential and there is negligible risk. Geomorphology condition is good with significant restoration potential and there is low risk. Habitat condition is good with significant restoration potential and there is low risk. Biotic integrity is good with significant restoration potential and there is low risk. Human influence of site is very good with excellent restoration potential and there is negligible risk. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is good with significant restoration potential and there is low risk.

Table 4 Kent Spring Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	4.4	1.8
Geomorphology	4.5	2.5
Habitat	4.5	2.5
Biota	4.7	2.7
Human Influence	5	1.6
Administrative Context	0	0
Overall Ecological Score	4.7	2

Management Recommendations: This is a small spring in good condition on a steep slope in a narrow channel. It looks like it may have been developed/piped at some point in time but was free flowing at this visit due to an old tank below. It is located close to a popular hiking trail but does not appear to get much use from hikers. Near a much large channel that has been severely eroded by post-fire flooding.

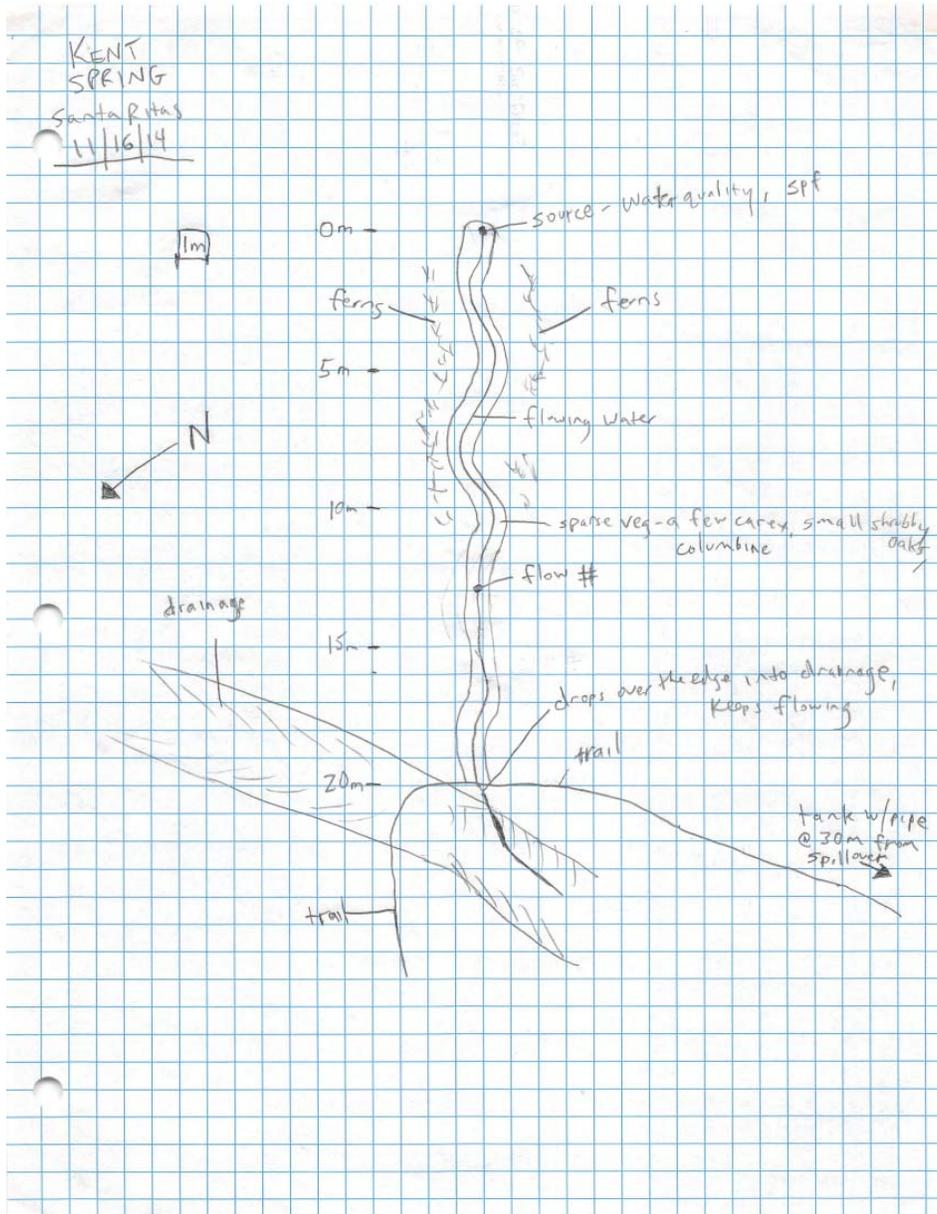


Fig 2 Kent Spring Sketchmap.

Kinglet Spring Survey Summary Report, Site ID 12406

Location: The Kinglet Spring ecosystem is located in Pima County in the Upper Santa Cruz Arizona 15050301 HUC, managed by the US Forest Service. The spring is located in the Santa Catalina RD, Coronado NF at 32.44701, -110.77849 in the Mount Lemmon USGS Quad, measured using a GPS (NAD83, estimated position error 14 meters). The elevation is approximately 2535 meters. Christopher Morris, Eric Bodznick, Elena Martin, Sue Carahan, Curtis Smith, Mike Hughes, Robin West surveyed the site on 6/28/14 for 01:20 hours, beginning at 9:45, and collected data in 10 of 12 categories.



Fig 1 Kinglet Spring.

Physical Description: Kinglet Spring is a hillslope spring. It has a NNE trending spring run located on the edge of a ski run. The site has 1 microhabitat, A -- a 50 sqm wet hillslope.

The emergence environment is subaerial. The distance to the nearest spring is 302 meters.

Survey Notes: The site is in very good condition - it supports a sedge and fern-lined run. There was some human trash (plastic, paper). The solar pathfinder was left behind at the vehicle, but the spring is at the NE side of the root ball of a Douglas fir, so it only receives limited sunlight in the afternoon. Also, in the morning, the sunlight is blocked by tall conifers.

Table 1 Kinglet Spring Water Quality with multiple readings averaged.

Characteristic Measured	Average Value
pH (field)	7.8
Specific conductance (field) (uS/cm)	178
Temperature, water C	8.6

Flora: Surveyors identified 24 plant species at the site, with 0.48 species/sqm. These included 17 native and 3 nonnative species; the native status of 4 species remains unknown.

Table 2 Kinglet Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	11	4
Shrub	3	0
Mid-canopy	1	0
Tall canopy	4	0
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 3 Kinglet Spring Vegetation.

Species	Cover Code	Native Status	Wetland Status
<i>Abies concolor</i>	TC	N	U
<i>Acer grandidentatum</i>	TC	N	F
<i>Agrostis</i>	GC	I	W
<i>Carex</i>			
<i>Dactylis glomerata</i>	GC	I	W
<i>Fragaria vesca</i>	GC	N	U
<i>Galium aparine</i>	GC	N	WR
<i>Geranium richardsonii</i>	GC	N	F
<i>Glyceria elata</i>		N	W
<i>Jamesia americana</i>	SC	N	
<i>Mimulus guttatus</i>	GC	N	W
<i>Pinus strobiformis</i>	TC	N	
<i>Populus tremuloides</i>	TC	N	U
<i>Pseudotsuga menziesii</i>	MC	N	U
<i>Pteridium aquilinum</i>	GC	N	U
<i>Robinia</i>			F
<i>Rubus idaeus</i>	GC	NI	F
<i>Rubus neomexicanus</i>	SC	N	F
<i>Rumex obtusifolius</i>	GC	I	F
<i>Symphoricarpos oreophilus</i>	SC	N	U
<i>Thalictrum fendleri</i>	GC	N	F
unknown Lichen, fruticose			
<i>Vicia</i>			WR
<i>Viola</i>	GC	N	F

Fauna: Surveyors collected or observed 2 aquatic and 10 terrestrial invertebrates and 14 vertebrate specimens.

Table 4 Kinglet Spring Invertebrates.

Species	Lifestage	Habitat	Method	Species detail
Acarina			Spot	mite
Chilopoda		T	Spot	
Coleoptera Lycidae Lycus arizonensis		T	Spot	
Diplopoda		T	Spot	
Diptera Syrphidae Milesia bella		T	Spot	
Hirudinea	Ad	A	Spot	many
Homoptera Cicadellidae		T	Spot	
Hymenoptera Apidae		T	Spot	
Isopoda Asellidae Asellus aquaticus		A	Spot	many
Lepidoptera HesperIIDae Epargyreus clarus		T	Spot	
Lepidoptera Lasiocampidae Malacosoma incurvum		T	Spot	
Lepidoptera Papilionidae Papilio multicaudata		T	Spot	
Lepidoptera Psychidae		T	Spot	

Table 5 Kinglet Spring Vertebrates.

Species Common Name	Count	Detection
yellow-eyed junco		
turkey vulture		
wild turkey		sign
Steller's jay		
Common raven		
Warbling Vireo		
house wren		
hermit thrush		
Broad-tailed hummingbird		
mountain chickadee		
Arizona gray squirrel		
violet-green swallow		
cordilleran flycatcher		
western tanager	2	

Assessment: Assessment scores were compiled in 5 categories and 33 subcategories, with 9 null condition scores, and 9 null risk scores. Aquifer functionality and water quality are good with significant restoration potential and there is low risk. Geomorphology condition is good with significant restoration potential and there is low risk. Habitat condition is moderate with some restoration potential and there is moderate risk. Biotic integrity is very good with excellent restoration potential and there is low risk. Human influence of site is good with significant restoration potential and there is low risk. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is good with significant restoration potential and there is low risk.

Table 6 Kinglet Spring Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	4.5	2
Geomorphology	4.4	2.2
Habitat	3.8	3
Biota	5	2
Human Influence	4.2	2.2
Administrative Context	0	0
Overall Ecological Score	4.4	2.2

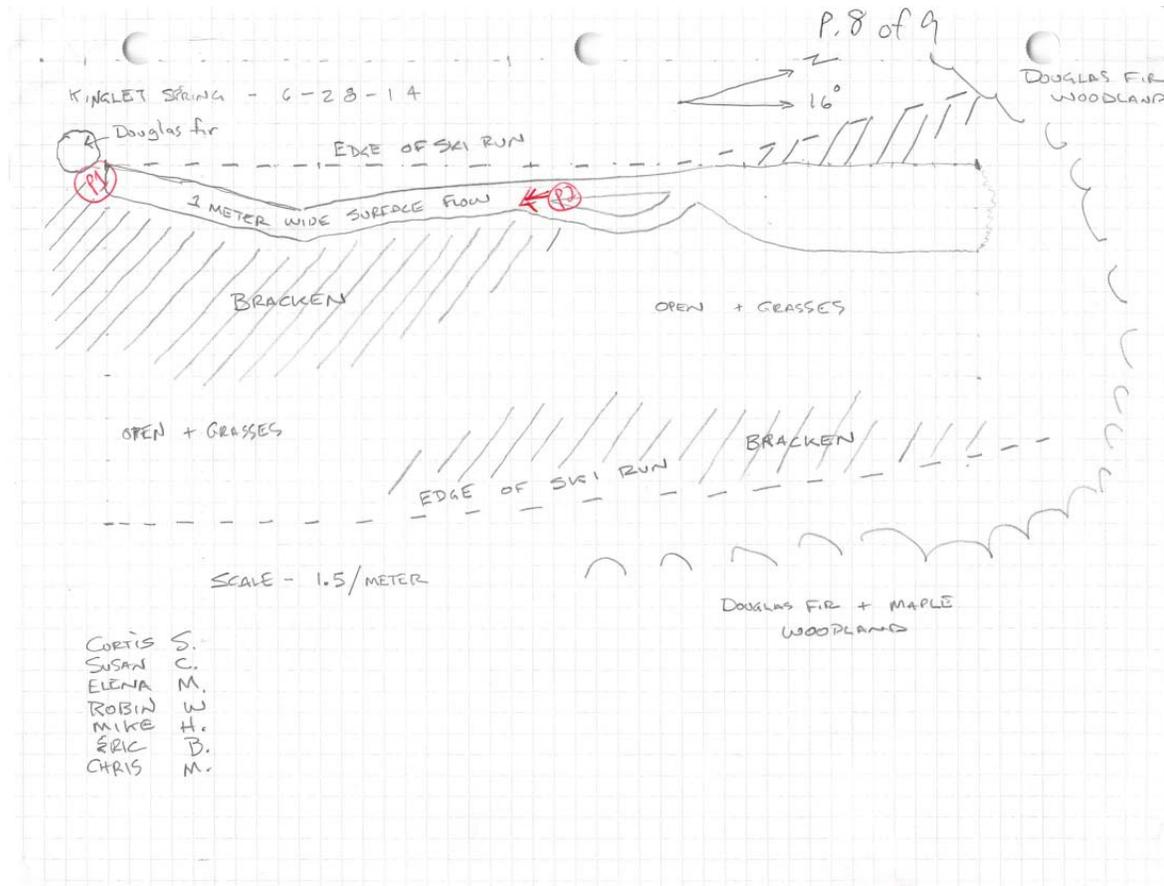


Fig 2 Kinglet Spring Sketchmap.

La Cebadilla Cienega

Survey Summary Report, Site ID 19158

Location: The La Cebadilla Cienega ecosystem is located in Pima County in the Rillito Arizona 15050302 HUC, managed by the private US owner. The spring is located in the La Cebadilla Estate at 32 14' 40.305", -110 41' 18.468" in the Tanque Verde Peak USGS Quad, measured using a GPS (NAD83). The elevation is approximately 826 meters. Larry Stevens, and Sky Islands Workshop Participants surveyed the site on 4/22/12 for 01:15 hours, beginning at 10:30, and collected data in 8 of 12 categories.



Fig 1 La Cebadilla Cienega.

Physical Description: La Cebadilla Cienega is a helocrene spring. It is a large (several hectare) cienega that is surrounded by private homes and is well-protected by the home owner's association. Discharge from the cienega is piped to a one-acre pond at which Rich Bailowitz has detected 44 dragonfly species, the highest point diversity of Odonata in Arizona. The microhabitats associated with the spring cover 43695 sqm. The site has 2 microhabitats, including A -- a 10671 sqm pool, B -- a 33024 sqm low gradient cienega. The geomorphic diversity is 0.24, based on the Shannon-Weiner diversity index.

La Cebadilla Cienega emerges as a seepage or filtration spring from a sedimentary, unconsolidated rock layer in an unknown unit. The emergence environment is subaerial, with a gravity flow force mechanism. The distance to the nearest spring is 3716 meters.

Survey Notes: This is a large perched cienega on the north side of Tanque Verde Wash on the northeast side of Tucson. The groundwater source is apparently well-protected foothills terrain to the north.

Flora: Some of the species listed were from a 2001 report of the area found at this location <http://www.pima.gov/cmo/sdcp/reports%5Cd8%5C023WET.PDF> Surveyors identified 18 plant species at the site, with 0.0004 species/sqm. These included 15 native and 1 nonnative species; the native status of 2 species remains unknown.

Table 1 La Cebadilla Cienega Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	14	10
Shrub	3	2
Mid-canopy	1	1
Tall canopy	0	0
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 2 La Cebadilla Cienega Vegetation.

Species	Cover Code	Native Status	Wetland Status
<i>Almutaster pauciflorus</i>	GC	N	
<i>Anemopsis californica</i>	GC	N	W
<i>Baccharis sarothroides</i>	SC	N	R
<i>Distichlis spicata</i>	GC	N	WR
<i>Eleocharis parishii</i>	GC	N	W
<i>Eleocharis rostellata</i>	GC	N	W
<i>Eryngium sparganophyllum</i>	GC	N	
<i>Eustoma exaltatum</i>	GC	N	
<i>Isocoma tenuisecta</i>	GC	N	F
<i>Muhlenbergia asperifolia</i>	GC	N	WR
<i>Populus fremontii</i>	MC	N	R
<i>Prosopis velutina</i>	SC	N	F
<i>Schoenoplectus americanus</i>	GC	N	A
<i>Sisyrinchium</i>	GC		WR
<i>Sisyrinchium demissum</i>	GC	N	W
<i>Sporobolus airoides</i>	GC	N	WR
<i>Tamarix</i>	SC	I	WR
<i>Typha</i>	GC		A

Fauna: Rich Bailowitz reported 44 species of Odonata at Lago La Cebadilla. Need to obtain a bird species list for the site. Surveyors collected or observed 6 vertebrate specimens.

Table 3 La Cebadilla Cienega Vertebrates.

Species Common Name	Detection
javelina	obs
bobcat	obs
coyote	obs
Mountain lion	obs
bird	obs
mosquito fish	obs

Assessment: Assessment scores were compiled in 6 categories and 39 subcategories, with 3 null condition scores, and 3 null risk scores. Aquifer functionality and water quality are good with significant restoration potential and there is low risk. Geomorphology condition is moderate with some restoration potential and there is low risk. Habitat condition is good with significant restoration potential and there is low risk. Biotic integrity is very good with excellent restoration potential and there is low risk. Human influence of site is good with significant restoration potential and there is negligible risk. Administrative context status is good with significant restoration potential and there is low risk. Overall, the site condition is good with significant restoration potential and there is low risk.

Table 4 La Cebadilla Cienega Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	4.4	2.33
Geomorphology	3.6	2.6
Habitat	4.8	2
Biota	5	2.33
Human Influence	4.22	1.75
Administrative Context	4.67	1.88
Overall Ecological Score	4.45	2.32

Management Recommendations: Site is on private land and is well protected.

Encroachment of phreatophytic native arborescent shrubs indicates potential risk to open wet meadow habitat. Control of shrub invasion can be accomplished with controlled burns or mechanical removal. Cienega water table is high but is diverted to support large, dragonfly rich pond. Maintaining both the cienega and the pond may require trade-offs during dry years as regional groundwater levels decline. There is evidence of historic terracing that may influence plant community structure. We recommend development of a detailed land survey, soil analysis, several monitoring wells, and more detailed inventory and vegetation mapping of this extraordinarily healthy cienega.



Fig 2 La Cebadilla Ciénega Sketchmap.

Mercer Spring Survey Summary Report, Site ID 12824

Location: The Mercer Spring ecosystem is located in Pima County in the Rillito Arizona 15050302 HUC, managed by the US Forest Service. The spring is located in the Santa Catalina RD, Coronado NF at 32.33648, -110.70324 in the Agua Caliente Hill USGS Quad, measured using a GPS (NAD83, estimated position error 6 meters). The elevation is approximately 1371 meters. Bryon Lichtenhan, Sami Hammer, Michela Wilson, Glenn Furnier, Emily Patterson, Aida Castillo-Flores, Joe Black, Sierrane Gatela surveyed the site on 6/28/15 for 00:45 hours, beginning at 14:00, and collected data in 6 of 12 categories.



Fig 1 Mercer Spring.

Physical Description: Mercer Spring is a rheocrene spring. A mid-elevation, rheocrene spring in a sandy wash surrounded by riparian-associated trees that was used historically, as evidenced by two spring boxes. The microhabitats associated with the spring cover 69.7 sqm. The site has 3 microhabitats, including A -- a 10 sqm other, B -- a 30 sqm channel, C -- a 30 sqm terrace. The geomorphic diversity is 0.43, based on the Shannon-Weiner diversity index.

Mercer Spring emerges as a seepage or filtration spring from a metamorphic, gneiss rock layer in an unknown unit. The emergence environment is subaerial, with a gravity flow force mechanism. The distance to the nearest spring is 1707 meters.

Survey Notes: The site was dry, with two old concrete spring boxes. There were lots of riparian woody plants, and water stains on the rocks, suggesting the spring flows regularly, if not year-round. It would be interesting to check in spring or monsoon season.

Flora: Plant list is for all polygons combined. Surveyors identified 19 plant species at the site, with 0.2726 species/sqm. These included 18 native and 1 nonnative species.

Table 1 Mercer Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	8	1
Shrub	8	2
Mid-canopy	3	1
Tall canopy	0	0
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 2 Mercer Spring Vegetation.

Species	Cover Code	Native Status	Wetland Status
Artemisia	SC	N	F
Avena fatua	GC	I	
Baccharis sarothroides	SC	N	R
Cylindropuntia	SC	N	
Dasyilirion wheeleri	GC	N	
Garrya wrightii	SC	N	F
Gossypium thurberi	SC	N	
Hyptis emoryi	SC	N	
Juncus	GC	N?	R
Mimosa biuncifera	SC	N	
Mimulus	GC	N	W
Muhlenbergia rigens	GC	N	U
Nolina	GC	N	F
Opuntia	GC	N	U
Populus fremontii	MC	N	R
Quercus emoryi	MC	N	
Quercus oblongifolia	MC	N	
Salix gooddingii	SC	N	R
Sphaeralcea fendleri	GC	N	

Fauna: It was 95-100 degrees F at the time of the observations, and the middle of the afternoon. Surveyors collected or observed 8 terrestrial invertebrates and 8 vertebrate specimens.

Table 3 Mercer Spring Invertebrates.

Species	Lifestage	Habitat	Method	Count	Species detail
Chilopoda Scolopendridae Scolopendra polymorpha	Ad	T	Spot	1	
Hemiptera Cicadidae	Ad	T	Spot	20	
Hymenoptera Apidae Xylocopa	Ad	T	Spot	1	
Hymenoptera Vespidae	Ad	T	Spot	2	
Lepidoptera Hesperiiidae Staphylus ceos	Ad	T	Spot	1	
Lepidoptera Papilionidae Battus philenor	Ad	T	Spot	1	
Odonata	Ad	T	Spot	3	dragonflies
Orthoptera	Ad	T	Spot	1	grasshopper

Table 4 Mercer Spring Vertebrates.

Species Common Name	Count	Detection
white-tailed Deer	2	obs
blue-gray gnatcatcher	2	obs
cassin's kingbird	1	obs
ash-throated flycatcher	1	obs
mourning dove	1	sign
ornate tree lizard	1	obs
house finch	1	obs
broad-billed Hummingbird	1	obs

Assessment: Assessment scores were compiled in 4 categories and 30 subcategories, with 12 null condition scores, and 12 null risk scores. Aquifer functionality and water quality are undetermined due to null scores and there is extreme risk. Geomorphology condition is good with significant restoration potential and there is negligible risk. Habitat condition is good with significant restoration potential and there is moderate risk. Biotic integrity is good with significant restoration potential and there is moderate risk. Human influence of site is good with significant restoration potential and there is low risk. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is moderate with some restoration potential and there is moderate risk.

Table 5 Mercer Spring Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	0	6
Geomorphology	4.4	1.6
Habitat	4	3
Biota	4	3
Human Influence	3.9	2
Administrative Context	0	0
Overall Ecological Score	3.2	3.1

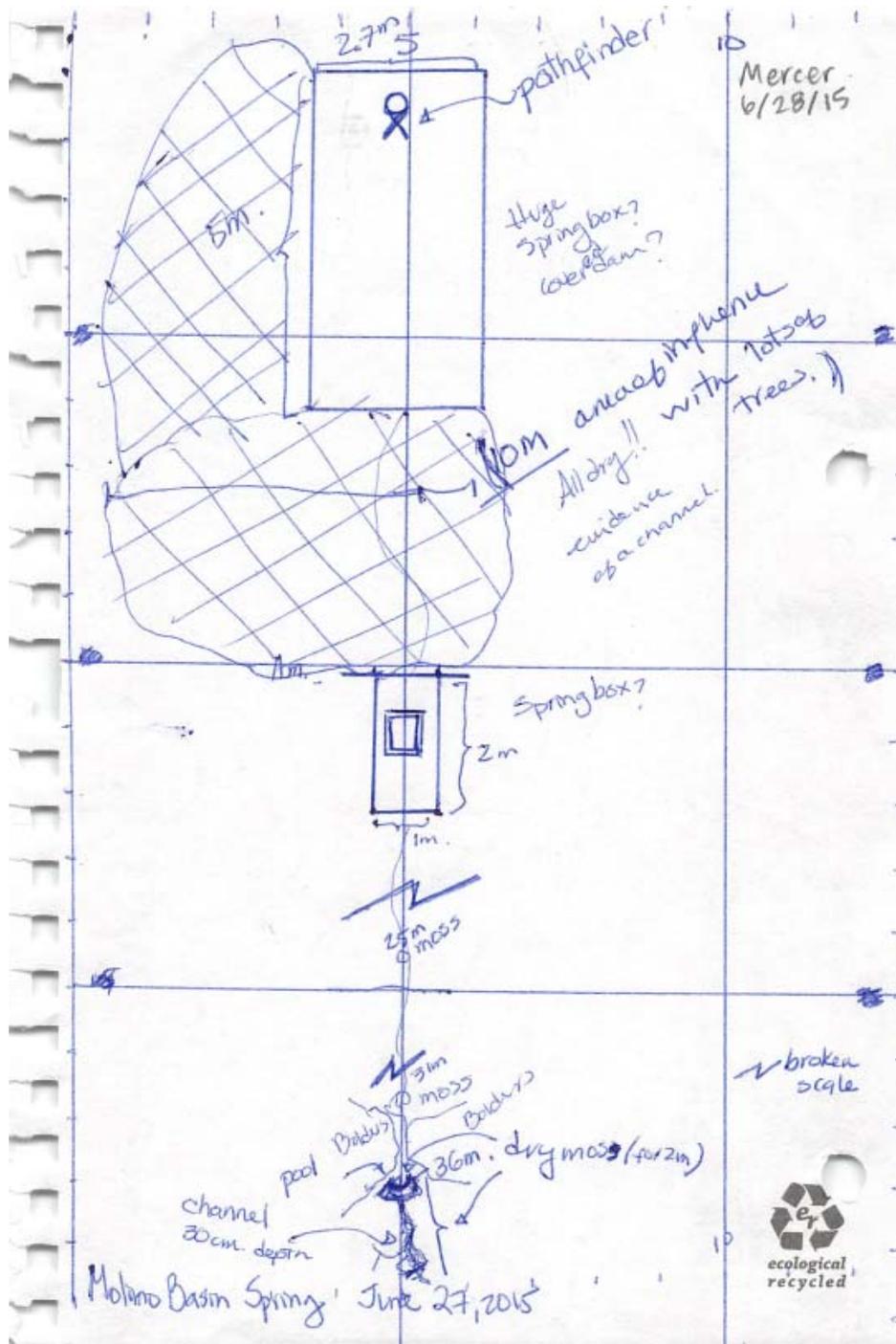


Fig 2 Mercer Spring Sketchmap.

Mine Shaft unnamed north Survey Summary Report, Site ID 11970

Location: The Mine Shaft unnamed north ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 15050301 HUC, managed by the US Forest Service. The spring is located in the Sierra Vista RD, Coronado NF at 31.37264, -111.10388 in the Pajarito Peak USGS Quad. The elevation is approximately 1257 meters. Christopher Morris, Cory Jones, Gus Glaser, Judy Atwell, and Lorrie and Rick Firth surveyed the site on 10/05/14 for 01:12 hours, beginning at 13:02, and collected data in 8 of 12 categories.



Fig 1 Mine Shaft unnamed north: Looking upstream. Source of spring is at base of ash tree on the left side of channel.

Physical Description: Mine Shaft unnamed north is a rheocrene spring. This rheocrene spring emerges at the edge of a channel just below a young ash tree. Flow from the spring continues downstream intermittently for 1/2 mile. The site has 1 microhabitat, X -- a 100 sqm channel. The geomorphic diversity is 0.00, based on the Shannon-Weiner diversity index.

The emergence environment is subaerial. The distance to the nearest spring is 450 meters.

Survey Notes: A consistent flow of water was emerging from the side of the wash channel. The area had few signs of negative grazing impacts. The spring is flushed pretty regularly as it exists within a gravelly cobble bed.

Table 1 Mine Shaft unnamed north Water Quality with multiple readings averaged.

Characteristic Measured	Average Value
pH (field)	7.1
Specific conductance (field) (uS/cm)	299
Temperature, water C	20.9

Flora: Surveyors identified 13 plant species at the site. These included 8 native and 0 nonnative species; the native status of 5 species remains unknown.

Table 2 Mine Shaft unnamed north Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	3	0
Shrub	2	1
Mid-canopy	2	1
Tall canopy	1	1
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 3 Mine Shaft unnamed north Vegetation.

Species	Cover Code	Native Status	Wetland Status
Abildgaardia			
Agave			
Baccharis salicifolia	SC	N	R
Celtis			R
Fraxinus velutina	TC	N	R
Juniperus deppeana	MC	N	U
Leptochloa dubia	GC	N	
Muhlenbergia	GC	N	U
Muhlenbergia rigens	GC	N	U
Platanus wrightii	MC	N	R
Quercus	SC		U
Rhus toxicodendron			
Rhus virens		N	

Fauna: Surveyors collected or observed 6 terrestrial invertebrates and 5 vertebrate specimens.

Table 4 Mine Shaft unnamed north Invertebrates.

Species	Lifestage	Habitat	Species detail
Aranea Agelenidae Hololena hola		T	
Coleoptera Erotylidae		T	fungus beetle
Coleoptera Tenebrionidae Eleodes		T	
Homoptera Cicadellidae		T	
Lepidoptera Heliconiidae Agraulis vanillae			
Lepidoptera Nymphalidae Vanessa		T	
Lepidoptera Pieridae Zerene cesonia		T	

Table 5 Mine Shaft unnamed north Vertebrates.

Species Common Name	Count	Detection
Red-spotted Toad		obs
Sonoran whipsnake	1	obs
White-tailed Deer		sign
Gray fox		sign
coyote		sign

Assessment: Assessment scores were compiled in 5 categories and 26 subcategories, with 16 null condition scores, and 16 null risk scores. Aquifer functionality and water quality are good with significant restoration potential and there is negligible risk. Geomorphology condition is very good with excellent restoration potential and there is negligible risk. Habitat condition is good with significant restoration potential and there is negligible risk. Biotic integrity is very good with excellent restoration potential and there is negligible risk. Human influence of site is very good with excellent restoration potential and there is negligible risk. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is very good with excellent restoration potential and there is negligible risk.

Table 6 Mine Shaft unnamed north Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	4	1.7
Geomorphology	5.3	1.8
Habitat	4.5	1.8
Biota	5.2	1.8
Human Influence	5.2	1.8
Administrative Context	0	0
Overall Ecological Score	5	1.8

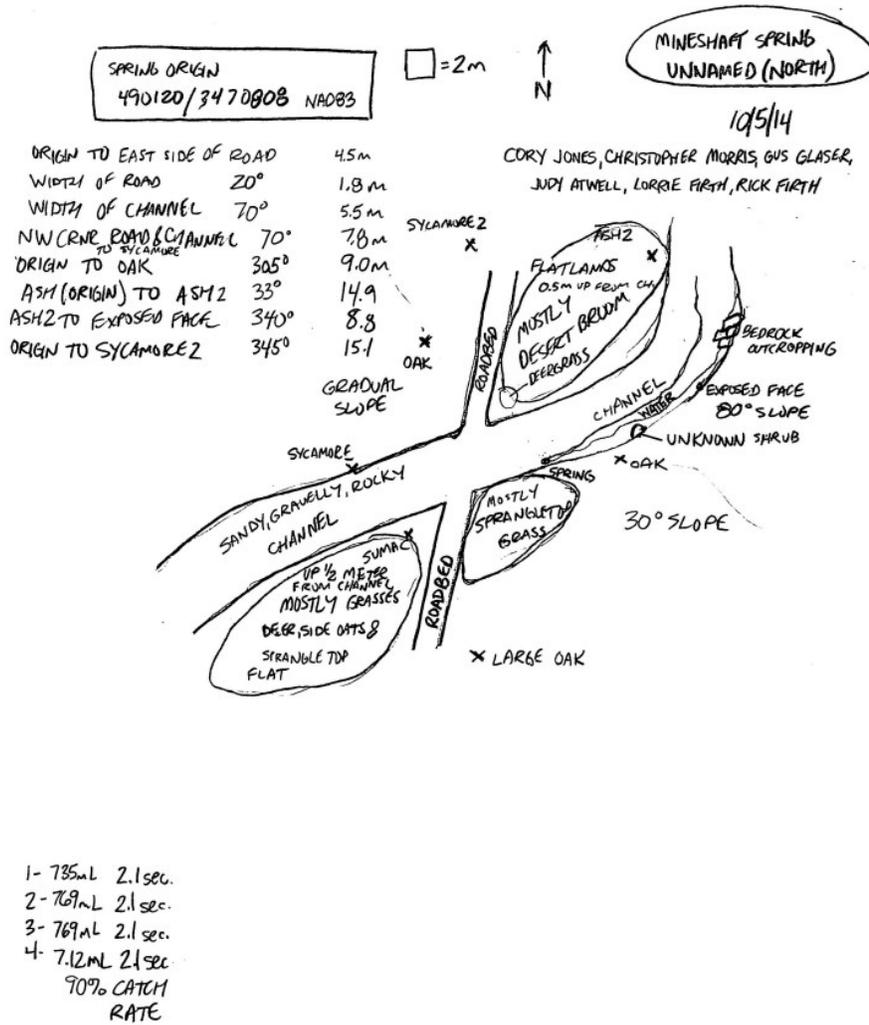


Fig 2 Mine Shaft unnamed north Sketchmap: Sketch map.

Observatory unnamed Survey Summary Report, Site ID 16958

Location: The Observatory unnamed ecosystem is located in Pima County in the Lower San Pedro Arizona 15050203 HUC, managed by the US Forest Service. The spring is located in the Santa Catalina RD, Coronado NF at 32.41538, -110.72761 in the Mount Bigelow USGS Quad, measured using a GPS (NAD83, estimated position error 13 meters). The elevation is approximately 2529 meters. Sami Hammer, Glenn Furnier, Emily Patterson, Aida Castillo-Flores, Sierrane Gatela, Katy Brown, Kristi Argenbright surveyed the site on 6/14/15 for 01:00 hours, beginning at 8:15, and collected data in 8 of 12 categories.



Fig 1 Observatory unnamed.

Physical Description: Observatory unnamed is a rheocrene spring. A small concrete dam in a drainage captures the flow from this spring near a road and trail. The dam is full of sediment, and water flows from a pipe in the base of the dam. The microhabitats associated with the spring cover 25 sqm. The site has 2 microhabitats, including A -- a 10 sqm channel, B -- a 15 sqm channel. The geomorphic diversity is 0.29, based on the Shannon-Weiner diversity index.

Observatory unnamed emerges as a seepage or filtration spring from an igneous, granite rock layer in an unknown unit. The emergence environment is subaerial, with a gravity flow force mechanism. The distance to the nearest spring is 669 meters.

Survey Notes: The spring is in an unburned area of forest with some large trees. The pipe is broken just after it exits the dam. The dam is completely filled in with sediments, ferns, and

other vegetation. The bottom edge of the dam is exposed, and the sediment is eroding out from below the dam.

Table 1 Observatory unnamed Water Quality with multiple readings averaged.

Characteristic Measured	Average Value
pH (field)	6.93
Specific conductance (field) (uS/cm)	110
Temperature, air C	12.2
Temperature, water C	10.5

Flora: Plant list is for site as a whole. Surveyors identified 11 plant species at the site, with 0.44 species/sqm. These included 10 native and 1 nonnative species.

Table 2 Observatory unnamed Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	6	2
Shrub	1	0
Mid-canopy	0	0
Tall canopy	3	0
Basal	0	0
Aquatic	0	0
Non-vascular	1	0

Table 3 Observatory unnamed Vegetation.

Species	Cover Code	Native Status	Wetland Status
<i>Abies concolor</i>	TC	N	U
<i>Aquilegia chrysantha</i>	GC	N	W
<i>Galium</i>	GC	I	F
moss	NV	N	F
<i>Pinus strobiformis</i>	TC	N	
<i>Pseudotsuga menziesii</i>	TC	N	U
<i>Pteridium aquilinum</i>	GC	N	U
<i>Ribes</i>	SC	N	F
<i>Rubus idaeus</i> ssp. <i>strigosus</i>	GC	N	R
<i>Thalictrum fendleri</i>	GC	N	F
<i>Viola canadensis</i>	GC	N	F

Fauna: Surveyors collected or observed 3 terrestrial invertebrates and 7 vertebrate specimens.

Table 4 Observatory unnamed Invertebrates.

Species	Lifestage	Habitat	Method	Count
Diptera	Ad	T	Spot	50
Diptera Culicidae	Ad	T	Spot	50
Homoptera Aphididae	Ad	T	Spot	50

Table 5 Observatory unnamed Vertebrates.

Species Common Name	Count	Detection
Broad-tailed hummingbird	1	obs
Red-faced Warbler	2	obs
western tanager	1	obs
yellow-eyed junco	1	call
red-breasted nuthatch		call
hermit thrush	1	call
cordilleran flycatcher	1	call

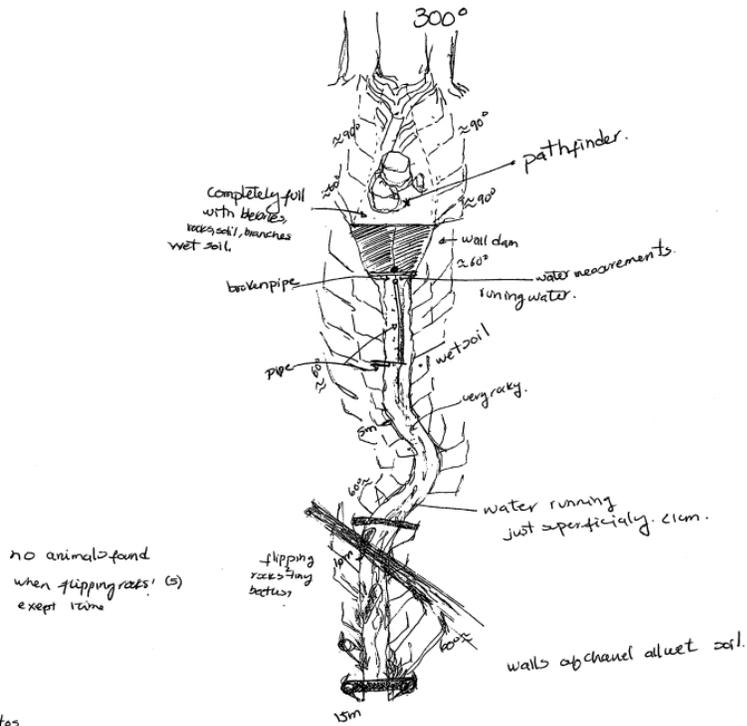
Assessment: Assessment scores were compiled in 5 categories and 30 subcategories, with 12 null condition scores, and 12 null risk scores. Aquifer functionality and water quality are good with significant restoration potential and there is low risk. Geomorphology condition is good with significant restoration potential and there is low risk. Habitat condition is good with significant restoration potential and there is low risk. Biotic integrity is good with significant restoration potential and there is low risk. Human influence of site is good with significant restoration potential and there is low risk. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is good with significant restoration potential and there is low risk.

Table 6 Observatory unnamed Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	4.2	2
Geomorphology	4	2.4
Habitat	4	2.2
Biota	4.7	2
Human Influence	4.8	2.2
Administrative Context	0	0
Overall Ecological Score	4.4	2.2

Management Recommendations: The road above the site may pose some risk. The dam alters the natural physical disturbance regime, obliterated the natural emergence microhabitat, is completely silted in, and is being undermined from the bottom.

June 14, 2015 Sta. Catalina Mountains
Observatory unnamed



no animals found
when flipping rocks! (s)
except worms

- photos
1070110
9m. 1070111
4m. 1070112
5m 1070113
5m 1070114

Fig 2 Observatory unnamed Sketchmap.

Ocotillo Spring Survey Summary Report, Site ID 19949

Location: The Ocotillo Spring ecosystem is located in Pima County in the Upper Santa Cruz Arizona 15050301 HUC, managed by the State. The spring is located in the Unspecified State AZ at 31.60137, -111.26852 in the Arivaca USGS Quad (NAD83). The elevation is approximately 1161 meters. Sami Hammer, Bryon Lichtenhan, Emily Patterson surveyed the site on 7/31/15 for 00:20 hours, beginning at 7:45, and collected data in 1 of 12 categories.



Fig 1 Ocotillo Spring: drainage near coordinates

Physical Description: Data for this site came from the Pima Co GIS layer for springs. According to this data source, the site is used at a rate of 4.0 acre-feet per year for stock and wildlife. Surveyors found no developed spring, only some very moist, slightly muddy soil in a minor drainage at the coordinates, directly below an ocotillo. With recent monsoon season precipitation, the source of the water is uncertain. There was no vegetation indicative of a spring. The Pima Co GIS layer may possibly refer to one of two stock tanks, one 750m away on a bearing of 58 degrees, or one 1200m away on a bearing of 100 degrees.

The distance to the nearest spring is 6218 meters.

Survey Notes: Surveyors found no developed spring, only some very moist, slightly muddy soil in a minor drainage at the coordinates, directly below an ocotillo. With recent monsoon season precipitation, the source of the water is uncertain. There was no vegetation indicative of a spring. The Pima Co GIS layer may possibly refer to one of two stock tanks, one 750m away on a bearing of 58 degrees, or one 1200m away on a bearing of 100 degrees.

Palisade RS Unnamed Survey Summary Report, Site ID 19948

Location: The Palisade RS Unnamed ecosystem is located in Pima County in the Rillito Arizona 15050302 HUC, managed by the US Forest Service. The spring is located in the Santa Catalina RD, Coronado NF at 32.41129, -110.71440 in the Mount Bigelow USGS Quad, measured using a GPS (NAD83, estimated position error 5 meters). The elevation is approximately 2440 meters. Sami Hammer, Glenn Furnier, Emily Patterson, Aida Castillo-Flores, Sierrane Gatela, Katy Brown, Kristi Argenbright surveyed the site on 6/14/15 for 00:30 hours, beginning at 10:00, and collected data in 6 of 12 categories.



Fig 1 Palisade RS Unnamed.

Physical Description: Palisade RS Unnamed is a rheocrene spring. Data from this site came from the Pima Co. Springs GIS layer. It was marked as “;unnamed spring”; on that layer. According to their information it uses an average of 340,000 gallons per year for domestic purposes. It is possible that this location is wrong and it is actually referring to a spring that is about 640 meters to the south. When Sky Island Alliance looked for this spring, they found a small spring <100m to the west from the original coordinates, with no evidence of development for human use. The spring emerges in a bedrock section of a small drainage, very near but upstream of the Mount Lemmon Highway. There is a larger tank another 100m to the west in the next small drainage whose source may be the spring to which the Pima County layer referred. The microhabitats associated with the spring cover 11 sqm. The site has 2 microhabitats, including A -- a 6 sqm channel, B -- a 5 sqm channel. The geomorphic diversity is 0.30, based on the Shannon-Weiner diversity index.

Palisade RS Unnamed emerges as a fracture spring from a igneous, granite rock layer in an unknown unit. The emergence environment is subaerial, with a gravity flow force mechanism. The distance to the nearest spring is 644 meters.

Survey Notes: This spring looked undisturbed.

Flora: Plant list is for the site as a whole. Surveyors identified 13 plant species at the site, with 1.1818 species/sqm. These included 11 native and 1 nonnative species; the native status of 1 species remains unknown.

Table 1 Palisade RS Unnamed Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	4	1
Shrub	2	1
Mid-canopy	3	1
Tall canopy	3	0
Basal	0	0
Aquatic	0	0
Non-vascular	1	0

Table 2 Palisade RS Unnamed Vegetation.

Species	Cover Code	Native Status	Wetland Status
<i>Alnus oblongifolia</i>	MC	N	R
<i>Aquilegia chrysantha</i>	GC	N	W
<i>Galium</i>	GC	I	F
<i>Geranium</i>	GC	N	F
<i>Juncus</i>	GC		
<i>Mahonia fremontii</i>	SC	N	R
moss	NV	N	F
<i>Pinus ponderosa</i>	TC	N	F
<i>Pinus strobiformis</i>	TC	N	
<i>Pseudotsuga menziesii</i>	TC	N	U
<i>Quercus gambelii</i>	MC	N	F
<i>Quercus hypoleucoides</i>	SC	N	
<i>Quercus rugosa</i>	MC	N	

Fauna: Surveyors collected or observed 2 terrestrial invertebrates and 8 vertebrate specimens.

Table 3 Palisade RS Unnamed Invertebrates.

Species	Lifestage	Habitat	Method
Annelida Oligochaetae	Ad	T	Spot
Coleoptera Erotylidae <i>Megalodacne heros</i>	Ad	T	Spot

Table 4 Palisade RS Unnamed Vertebrates.

Species Common Name	Count	Detection
American robin	1	obs
yellow-eyed junco	1	obs
chipmunk	1	obs
western tanager	1	obs
White-breasted nuthatch	1	obs
Red-faced Warbler	1	obs
hermit thrush	1	call
deer	1	sign

Assessment: Assessment scores were compiled in 5 categories and 30 subcategories, with 12 null condition scores, and 12 null risk scores. Aquifer functionality and water quality are very good with excellent restoration potential and there is low risk. Geomorphology condition is very good with excellent restoration potential and there is low risk. Habitat condition is good with significant restoration potential and there is low risk. Biotic integrity is very good with excellent restoration potential and there is low risk. Human influence of site is very good with excellent restoration potential and there is low risk. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is very good with excellent restoration potential and there is low risk.

Table 5 Palisade RS Unnamed Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	5	2
Geomorphology	5.8	2
Habitat	4.4	2
Biota	5.3	2.3
Human Influence	5.7	1.9
Administrative Context	0	0
Overall Ecological Score	5.3	2

June , 2015 Sta. Catalina Mountains Palisade RS.

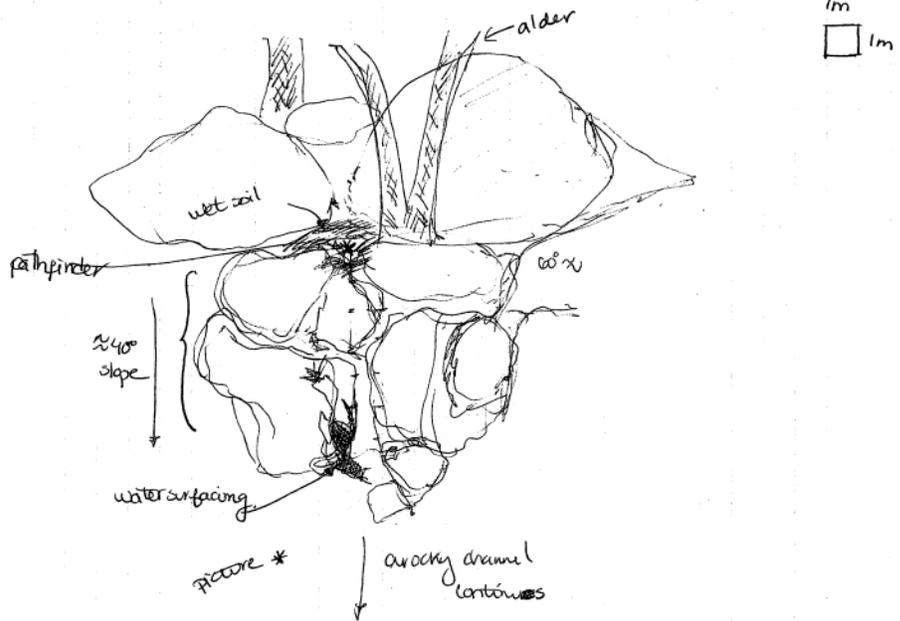


Fig 2 Palisade RS Unnamed Sketchmap.

Papago Spring Survey Summary Report, Site ID 17024

Location: The Papago Spring ecosystem is located in Pima County in the Rillito Arizona 15050302 HUC, managed by the US Forest Service. The spring is located in the Santa Catalina RD, Coronado NF at 32.08179, -110.58400 in the Rincon Peak USGS Quad, measured using a GPS (NAD83, estimated position error 4 meters). The elevation is approximately 1190 meters. Bryon Lichtenhan, Sami Hammer, Bill Binkert, Ramon Rascom, Ruben Rascom surveyed the site on 11/17/15 for 01:30 hours, beginning at 14:30, and collected data in 7 of 12 categories.



Fig 1.1 Papago Spring: the tank/cistern

Physical Description: Papago Spring is a hillslope spring on the bank of an apparently perennial stream that has been boxed, with a windmill pumping it (erected June 1933). The windmill pumps water to a large rusted tank that leaks, and also provides water to a trough. The site has 4 microhabitats, including A -- a 7 sqm other, B -- a 36 sqm pool, C -- a 10 sqm pool, D -- a 45 sqm channel.

Papago Spring emerges from a combination rock layer in an unknown unit. The emergence environment is subaerial. The distance to the nearest spring is 3005 meters

Survey Notes: The tank/cistern is rusted through about halfway up, causing water to cascade out of it in several places - much of the spring habitat is probably here currently. There is a functioning float in the trough, keeping it about half full. The windmill is functioning, with

the water level inside the box about 0.4m above the level of the water in the creek. The creek is running nicely. This is a very nice riparian area.

Table 1 Papago Spring Water Quality with multiple readings averaged.

Characteristic Measured	Average Value
pH (field)	7.16
Specific conductance (field) (uS/cm)	425
Temperature, air C	11
Temperature, water C	18.3

Flora: This plant this is for the site as a whole, not just polygon A. This was a diverse site - many more species likely exist here! Surveyors identified 34 plant species at the site, with 0.3465 species/sqm. These included 19 native and 2 nonnative species; the native status of 13 species remains unknown.

Table 2 Papago Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	10	2
Shrub	7	2
Mid-canopy	3	1
Tall canopy	0	0
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 3 Papago Spring Vegetation.

Species	Cover Code	Native Status	Wetland Status
Acacia greggii	SC	N	F
Agave			
Ambrosia	GC	I?	F
Anisacanthus			
Baccharis sarothroides	SC	N	R
Bothriochloa barbinodis	GC	N	F
Bouteloua curtipendula	GC	N	U
Carex			
Celtis pallida			
Celtis reticulata	MC	N	
Conyza	GC		F
Cucurbita digitata		N	
Cylindropuntia	SC	N	
Cynodon			
Eragrostis lehmanniana	GC	I	U
Ericameria laricifolia	SC	N	U
Erythrina flabelliformis		N	
Ferocactus			
Fraxinus			R
Gossypium thurberi		N	
Juniperus	SC	N	U
Leptochloa dubia	GC	N	
Lycium	SC		U
Mimulus	GC	N	W
Muhlenbergia rigens	GC	N	U
Nicotiana obtusifolia	GC	N	U
Opuntia			U
Populus fremontii	MC	N	R
Prosopis			
Quercus emoryi		N	
Salix gooddingii	SC	N	R
Vauquelinia californica	MC	N	
Xanthium	GC		WR
Ziziphus			

Fauna: Surveyors collected or observed 4 vertebrate specimens.

Table 4 Papago Spring Vertebrates.

Species Common Name
ladder-backed woodpecker
black phoebe
lesser nighthawk
curve-billed thrasher

Assessment: Assessment scores were compiled in 5 categories and 30 subcategories, with 12 null condition scores, and 12 null risk scores. Aquifer functionality and water quality are

excellent with no need for restoration and there is low risk. Geomorphology condition is poor with limited restoration potential and there is low risk. Habitat condition is moderate with some restoration potential and there is low risk. Biotic integrity is good with significant restoration potential and there is low risk. Human influence of site is good with significant restoration potential and there is low risk. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is good with significant restoration potential and there is low risk.

Table 5 Papago Spring Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	6	2.4
Geomorphology	2.6	2
Habitat	3.2	2.2
Biota	4.8	2
Human Influence	4.3	1.9
Administrative Context	0	0
Overall Ecological Score	4.2	2.1

Management Recommendations: The spring is at the end of a gnarly 4WD road, almost at the edge of the wilderness.

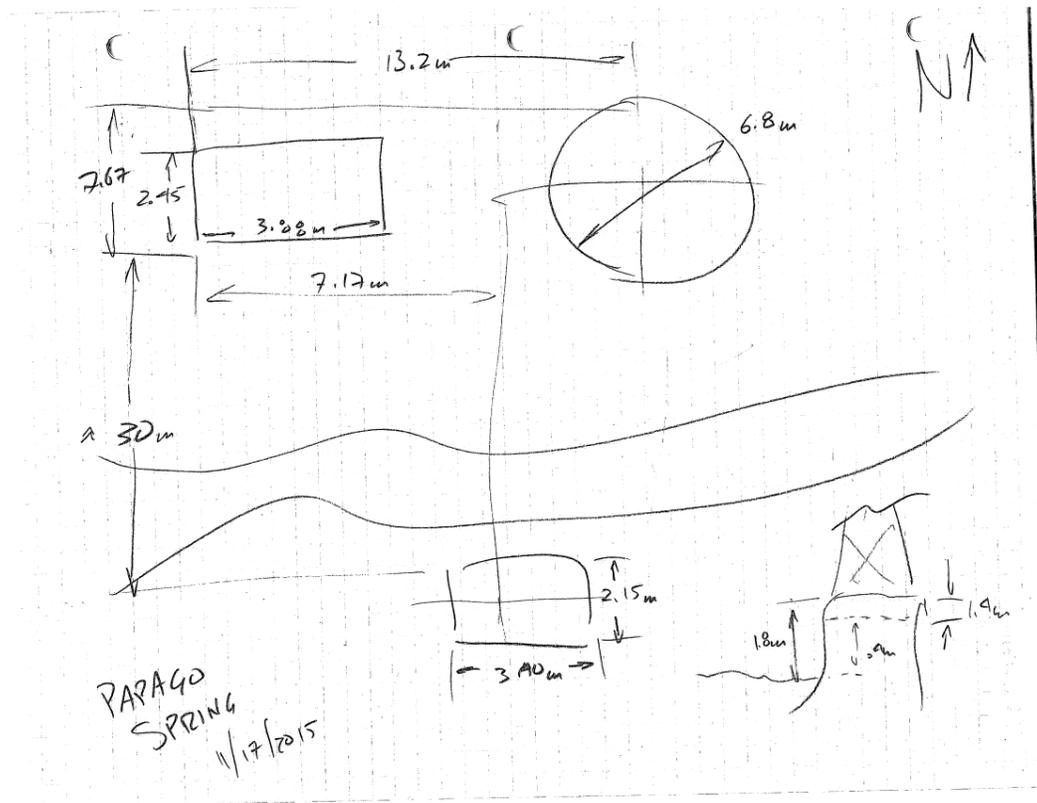


Fig 2 Papago Spring Sketchmap.

Pena Blanca Spring *
Survey Summary Report, Site ID 11941

Location: The Pena Blanca Spring * ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 15050301 HUC, managed by the US Forest Service. The spring is located in the Sierra Vista RD, Coronado NF at 31.38870, -111.09236 in the Pena Blanca Lake USGS Quad. The elevation is approximately 1209 meters. Christopher Morris, Cory Jones, Gus Glaser, Judy Atwell, and Lorrie and Rick Firth surveyed the site on 10/04/14 for 01:17 hours, beginning at 9:23, and collected data in 7 of 12 categories.



Fig 1 Pena Blanca Spring *: Pond site at Pena Blanca. Ruby Road to left. Corral right of photo.

Physical Description: Pena Blanca Spring * is a hillslope spring. The original hillside spring has been heavily altered. Water is now diverted a cattle trough at a well maintained corral and a separately fenced pond for exclusive wildlife use.

The distance to the nearest spring is 1215 meters.

Survey Notes: Two Chiracahua leopard frogs were present at the full water trough. Water spilling over its walls was draining towards the pond. The pond was covered in algae and over 30 CLFs were observed. A vibrant field of rushes were growing in slowly draining water from the shallow banked northern edge of the pond.

Table 1 Pena Blanca Spring * Water Quality with multiple readings averaged.

Characteristic Measured	Average Value
pH (field)	6.71
Specific conductance (field) (uS/cm)	159
Temperature, water C	17.8

Fauna: Surveyors collected or observed 3 terrestrial invertebrates and 2 vertebrate specimens.

Table 2 Pena Blanca Spring * Invertebrates.

Species	Lifestage	Habitat	Species detail
Hemiptera		T	
Hymenoptera Formicidae		T	
Odonata Anisoptera			
Orthoptera		T	grasshopper

Table 3 Pena Blanca Spring * Vertebrates.

Species Common Name	Count	Detection
Chiricahua Leopard frog	30	obs
Gila woodpecker		

Assessment: Assessment scores were compiled in 5 categories and 32 subcategories, with 10 null condition scores, and 10 null risk scores. Aquifer functionality and water quality are good with significant restoration potential and there is negligible risk. Geomorphology condition is good with significant restoration potential and there is low risk. Habitat condition is good with significant restoration potential and there is negligible risk. Biotic integrity is very good with excellent restoration potential and there is negligible risk. Human influence of site is good with significant restoration potential and there is negligible risk. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is good with significant restoration potential and there is negligible risk.

Table 4 Pena Blanca Spring * Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	4.7	1.5
Geomorphology	4.2	2.2
Habitat	4.6	1.2
Biota	5.4	1.6
Human Influence	4.1	1.8
Administrative Context	0	0
Overall Ecological Score	4.6	1.7

Management Recommendations: A water sample was taken and will be analyzed by the University of Arizona. This site provides great habitat for Chiricahua leopard frogs and other wildlife species with the exclusion to cattle. It is recommended to continue monitoring the site.

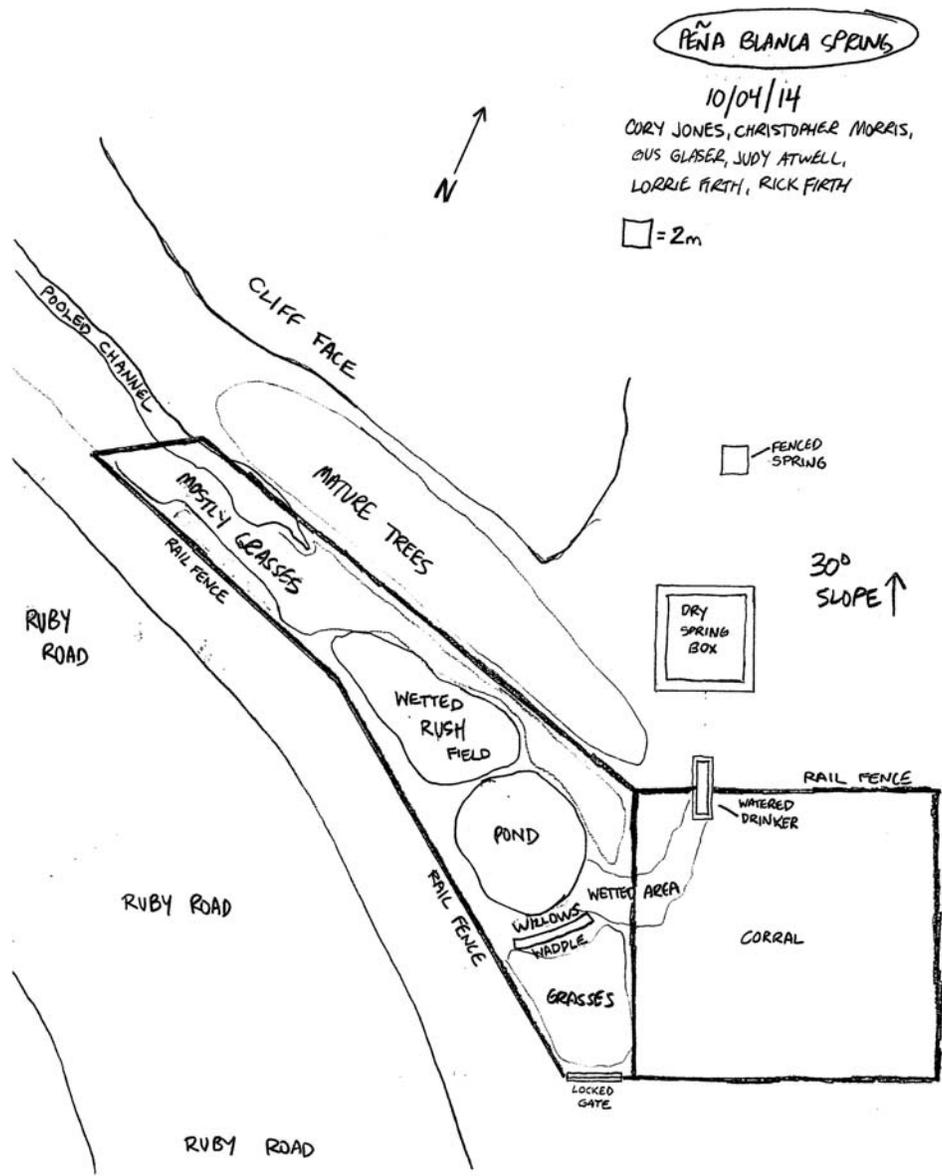


Fig 2 Pena Blanca Spring * Sketchmap: Sketch map.



Fig 3 Pena Blanca Spring *: Diverted spring site. Looking downslope to trough, dry spring box, and corral.

Pidgeon Spring
Survey Summary Report, Site ID 12415

Location: The Pidgeon Spring ecosystem is located in Pima County in the Upper Santa Cruz Arizona 15050301 HUC, managed by the US Forest Service. The spring is located in the Santa Catalina RD, Coronado NF at 32.44554, -110.77419 in the Mount Lemmon USGS Quad (NAD 83). The elevation is approximately 2508 meters. Christopher Morris, Eric Bodznick, Elena Martin, Sue Carahan surveyed the site on 6/28/14 for 00:00 hours, beginning at 12:00, and collected data in 0 of 12 categories.

The distance to the nearest spring is 169 meters.

Survey Notes: This spring was not located. It is unclear how intensively the spring was searched for (could potentially ask Sue Carahan).

Proctor Spring Survey Summary Report, Site ID 12922

Location: The Proctor Spring ecosystem is located in Pima County in the Upper Santa Cruz Arizona 15050301 HUC, managed by the US Forest Service. The spring is located in the Nogales RD, Coronado NF at 31.81126, -110.80211 in the Helvetia USGS Quad, measured using a GPS (NAD83, estimated position error 10 meters). The elevation is approximately 1363 meters. Cory Jones, Teresa de Koker, Julia Fonseca, Eric Bodznick, Karen Lowery, Jesse Silverman, Michael Stock, Ashlee Simpson surveyed the site on 12/20/14 for 01:35 hours, beginning at 10:20, and collected data in 6 of 12 categories.

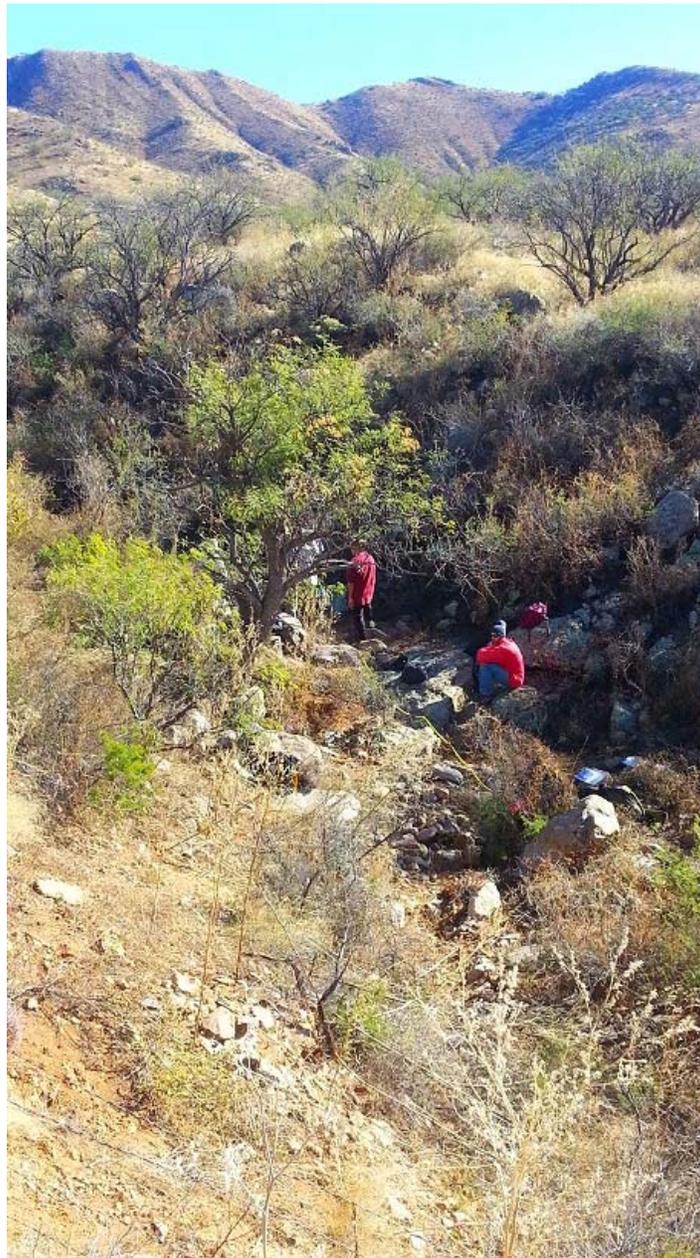


Fig 30.1 Proctor Spring.

Physical Description: Proctor Spring is a rheocene spring. This presumed rheocene site just east of the intersection of the CNF boundary and an unnamed drainage bottom sits at a point where bedrock expresses itself. There is no aquatic vegetation in the area. The site has 1 microhabitat, A -- a 80 sqm channel.

Proctor Spring emerges from a igneous, granite rock layer in an unknown unit. The emergence environment is subaerial. The distance to the nearest spring is 1995 meters.

Survey Notes: The site was dry with no noticeable aquatic vegetation in the area. This spring was not counted as being found.

Flora: Surveyors identified 14 plant species at the site, with 0.175 species/sqm. These included 5 native and 2 nonnative species; the native status of 7 species remains unknown.

Table 1 Proctor Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	5	1
Shrub	3	0
Mid-canopy	0	0
Tall canopy	0	0
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 2 Proctor Spring Vegetation.

Species	Cover Code	Native Status	Wetland Status
Abutilon			
Acacia greggii	SC	N	F
Anisacanthus			
Aristida	GC		U
Bouteloua curtipendula	GC	N	U
Chenopodium	GC		F
Eragrostis	GC	I	
Eragrostis lehmanniana	GC	I	U
Eriogonum wrightii		N	
Ferocactus wislizeni	SC	N	
Ipomoea			
Leptochloa			
Prosopis velutina	SC	N	F
Tetramerium			

Fauna: Surveyors collected or observed 3 terrestrial invertebrates specimens.

Table 3 Proctor Spring Invertebrates.

Species	Lifestage	Habitat	Method	Count	Species detail
Diptera	Ad	T	Spot	2	horsefly
Lepidoptera Nymphalidae Vanessa	Ad	T	Spot	1	
Lepidoptera Pieridae Pieris rapae	Ad	T	Spot	3	2 white, 1 yellow

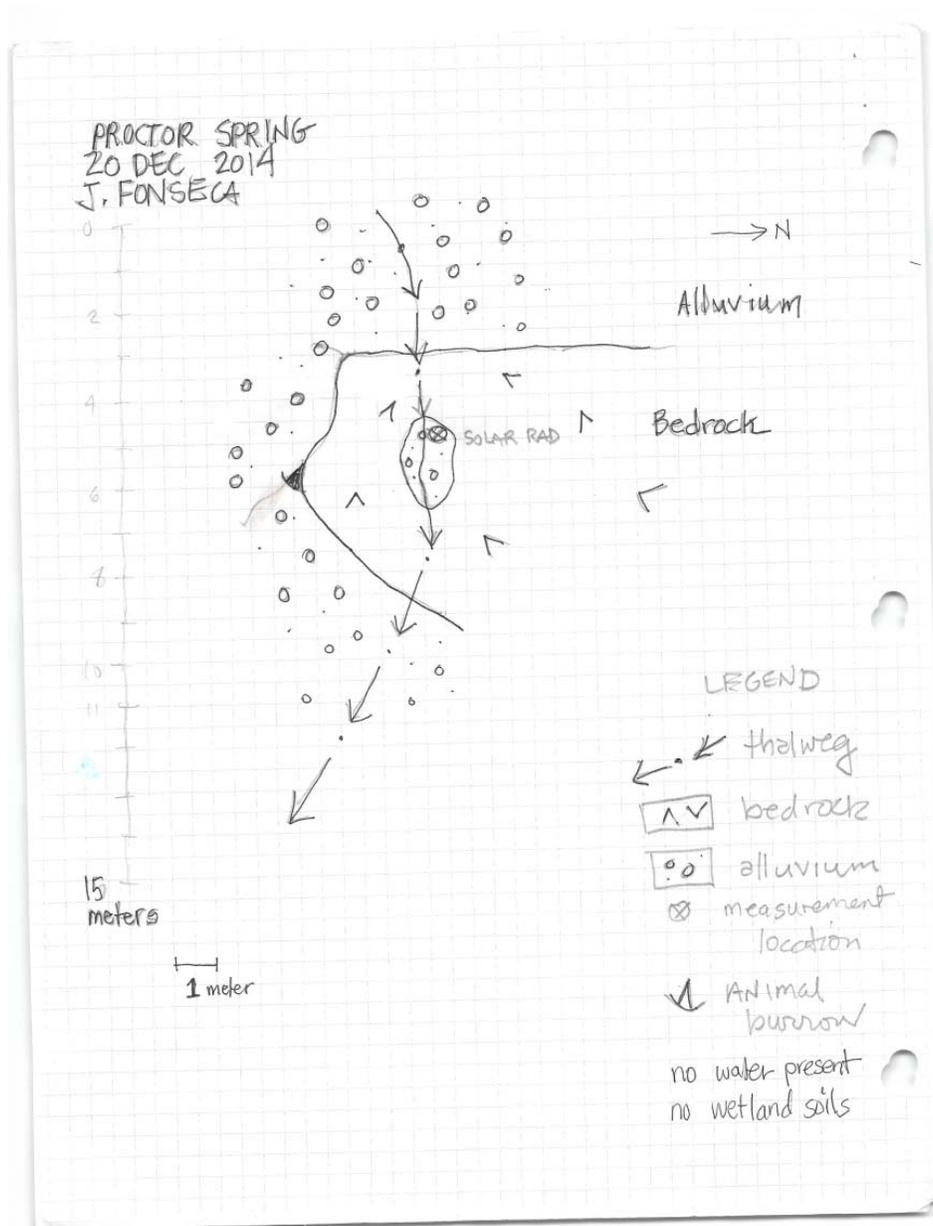


Fig 2 Proctor Spring Sketchmap.

Puerto Spring Survey Summary Report, Site ID 12961

Location: The Puerto Spring ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 15050301 HUC, managed by the US Forest Service. The spring is located in the Nogales RD, Coronado NF at 31.62536, -111.12028 in the Amado USGS Quad, measured using a other (WGS84). The elevation is approximately 1112 meters. Sami Hammer, Bryon Lichtenhan, Emily Patterson surveyed the site on 7/31/15 for 00:45 hours, beginning at 12:30, and collected data in 4 of 12 categories.

Physical Description: Puerto Spring is a rheocrene spring in a major canyon with sycamores and multiple emergence points. The site has 1 microhabitat, A -- a 0 sqm pool. The geomorphic diversity is 0.00, based on the Shannon-Weiner diversity index.

Puerto Spring emerges as a seepage or filtration spring from a rock layer in an unknown unit. The emergence environment is subaerial, with a gravity flow force mechanism. The distance to the nearest spring is 1646 meters.

Survey Notes: There is an old spring box in the northern channel. There are at least 2 emergence points (the box and the southern channel). The exclosure appears to have been around for awhile. The road crosses the drainage just below the spring's emergence. This was an informal survey collected during lunch.

Flora: This includes just a couple species casually observed in the area. Surveyors identified 2 plant species at the site. These included 2 native and 0 nonnative species.

Table 1 Puerto Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	0	0
Shrub	1	1
Mid-canopy	1	1
Tall canopy	0	0
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 2 Puerto Spring Vegetation.

Species	Cover Code	Native Status	Wetland Status
Baccharis salicifolia	SC	N	R
Platanus wrightii	MC	N	R

Fauna: Surveyors collected or observed 8 terrestrial invertebrates and 10 vertebrate specimens.

Table 3 Puerto Spring Invertebrates.

Species	Lifestage	Habitat	Method
Lepidoptera Lycaenidae Celastrina echo	Ad	T	Spot
Lepidoptera Lycaenidae Hemiargus isola	Ad	T	Spot
Lepidoptera Lycaenidae Leptotes marina	Ad	T	Spot
Lepidoptera Nymphalidae Libytheana carinenta	Ad	T	Spot
Lepidoptera Pieridae Eurema mexicana	Ad	T	Spot
Lepidoptera Pieridae Eurema nicippe	Ad	T	Spot
Odonata Libellulidae Libellula croceipennis	Ad	T	Spot
Odonata Libellulidae Libellula saturata	Ad	T	Spot

Table 4 Puerto Spring Vertebrates.

Species Common Name	Count	Detection
ladder-backed woodpecker	1	obs
lesser goldfinch	1	obs
house finch	1	obs
hummingbirds	1	obs
Gila woodpecker	1	obs
javelina	10	sign
northern cardinal	1	obs
bell's vireo	1	obs
cassin's kingbird	1	obs
northern beardless-tyrannulet	1	call

Rancho Fundoshi Spring Survey Summary Report, Site ID 164155

Location: The Rancho Fundoshi Spring ecosystem is located in Pima County in the Upper Santa Cruz Arizona 15050301 HUC, managed by the US Forest Service. The spring is located in the Santa Catalina RD, Coronado NF at 32.30879, -110.79856 in the Sabino Canyon USGS Quad, measured using a GPS (NAD83, estimated position error 9 meters). The elevation is approximately 833 meters. Christopher Morris, Carianne Campbell, Julia Fonseca, and Nick Deyo surveyed the site on 6/12/13 for 02:30 hours, beginning at 9:00, and collected data in 8 of 12 categories.



Fig 1 Rancho Fundoshi Spring: Looking up Bear Canyon at spring source.

Physical Description: Rancho Fundoshi Spring is a rheocrene spring. This rheocrene spring emerges in Bear Canyon, a major drainage of the Catalina Mountains. Riparian vegetation such as cottonwood, willow, and sycamores are present in the area, which is surrounded by typical Sonoran Desert upland vegetation. The source is difficult to identify. The site has 4 microhabitats, including A -- a 156 sqm channel.

The distance to the nearest spring is 508 meters.

Survey Notes: There are problems with invasive plants at this spring including; fountain grass, giant reed, oleander, and rabbitfoot grass. There is a population of rare buttonbush at the site that should be protected during any restoration activities. Water flow was very low at the time of survey.

Table 1 Rancho Fundoshi Spring Water Quality with multiple readings averaged.

Characteristic Measured	Average Value
Dissolved oxygen (field) (mg/L)	2.02
pH (field)	6.2
Specific conductance (field) (uS/cm)	209.9
Temperature, water C	28.2

Flora: Surveyors identified 48 plant species at the site, with 0.0332 species/sqm. These included 33 native and 9 nonnative species; the native status of 6 species remains unknown.

Table 2 Rancho Fundoshi Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	17	6
Shrub	6	3
Mid-canopy	2	2
Tall canopy	2	2
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 3 Rancho Fundoshi Spring Vegetation.

Species	Cover Code	Native Status	Wetland Status
Acacia greggii	SC	N	F
Ambrosia ambrosioides		N	
Artemisia ludoviciana	GC	N	F
Arundo donax		I	F
Baccharis salicifolia	SC	N	R
Brickellia floribunda		N	F
Bromus rubens	GC	I	F
Carlowrightia arizonica		N	
Celtis pallida			
Cephalanthus occidentalis		N	
Conyza canadensis	GC	N	R
Coursetia glandulosa		N	
Cynodon dactylon	GC	I	WR
Cyperaceae			
Datura wrightii	GC	N	F
Descurainia pinnata	GC	N	F
Dodecatheon pulchellum	GC	N	W
Enneapogon cenchroides		I	
Epilobium canum		N	
Eragrostis intermedia	GC	N	
Eragrostis lehmanniana	GC	I	U
Eriogonum	GC		F
Fraxinus velutina	TC	N	R
Gossypium thurberi		N	
Haplophyton crooksii		N	
Juncaceae			
Maurandya antirrhiniflora	GC	N	R
Mimosa biuncifera			
Mimulus guttatus	GC	N	W
Muhlenbergia porteri	GC	N	U
Muhlenbergia rigens	GC	N	U
Nerium oleander		I	
Opuntia phaeacantha	SC	N	U
Parkinsonia florida		N	
Pennisetum setaceum		N	
Penstemon pseudospectabilis		N	
Phacelia distans		N	
Platanus wrightii	MC	N	R
Polypogon monspeliensis	GC	I	WR
Populus fremontii	MC	N	R
Prosopis velutina	SC	N	F
Pseudognaphalium canescens		N	
Salix exigua	SC	N	WR
Salix gooddingii	TC	N	R
Sisymbrium irio	GC	I	F
Stemodia durantifolia		N	

Tamarix	SC	I	WR
Typha	GC		A

Fauna: Surveyors collected or observed 1 aquatic and 1 terrestrial invertebrates and 9 vertebrate specimens.

Table 4 Rancho Fundoshi Spring Invertebrates.

Species	Lifestage	Habitat	Method	Species detail
Hemiptera Corixidae	Ad	A	Spot	water boatman
Hymenoptera Vespidae	Ad	T		paper wasp
Odonata Anisoptera	Ad			blue dragonfly
Odonata Libellulidae Libellula saturata	Ad			

Table 5 Rancho Fundoshi Spring Vertebrates.

Species Common Name	Detection
White-winged dove	obs
hummingbird	
Northern Cardinal	obs
Gambel's quail	obs
Gila woodpecker	obs
javelina	sign
whiptail lizard	obs
Ornate tree lizard	obs
canyon tree frog	obs

Assessment: Assessment scores were compiled in 5 categories and 31 subcategories, with 11 null condition scores, and 11 null risk scores. Aquifer functionality and water quality are moderate with some restoration potential and there is low risk. Geomorphology condition is good with significant restoration potential and there is low risk. Habitat condition is moderate with some restoration potential and there is low risk. Biotic integrity is excellent with no need for restoration and there is very high risk. Human influence of site is good with significant restoration potential and there is low risk. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is good with significant restoration potential and there is low risk.

Table 6 Rancho Fundoshi Spring Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.5	2.2
Geomorphology	4	2
Habitat	3.8	2.6
Biota	5.9	5
Human Influence	4.5	2
Administrative Context	0	0
Overall Ecological Score	4.4	2.8

Management Recommendations: There are problems with invasive plants at this site. Sky Island Alliance will work with volunteers to hand pull fountain grass, giant reed, and oleander saplings. A backhoe may be useful for removing large oleander plants. Removal of oleander may affect the stream hydrology at the site.

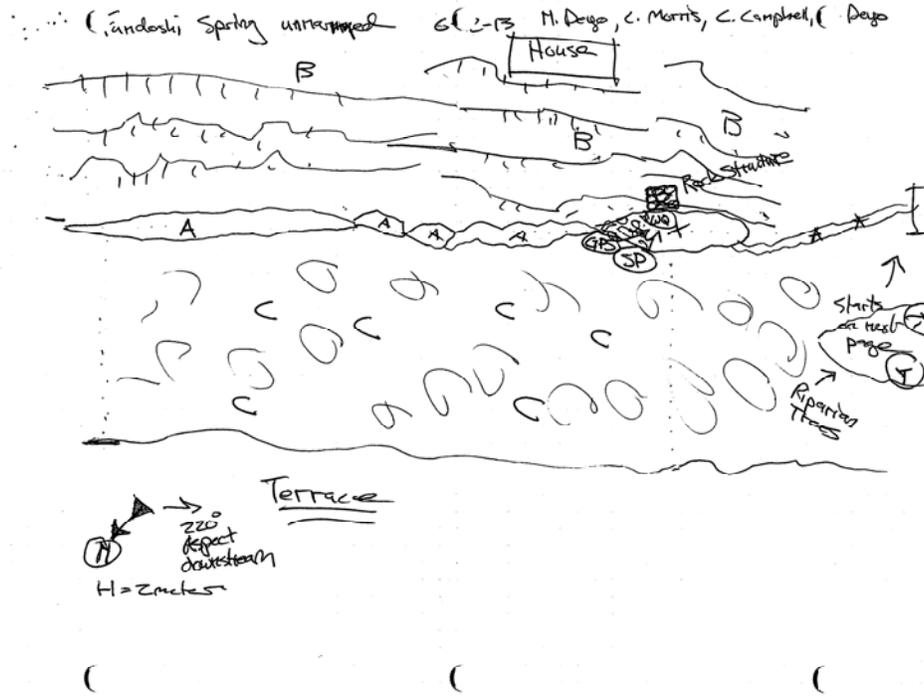


Fig 2 Rancho Fundoshi Spring Sketchmap: Page 1. See "Additional Images" for Page 2.

Felishi Springs unincorporated C-2. H. Devo, C. Morris, C. Campbell, & Morris

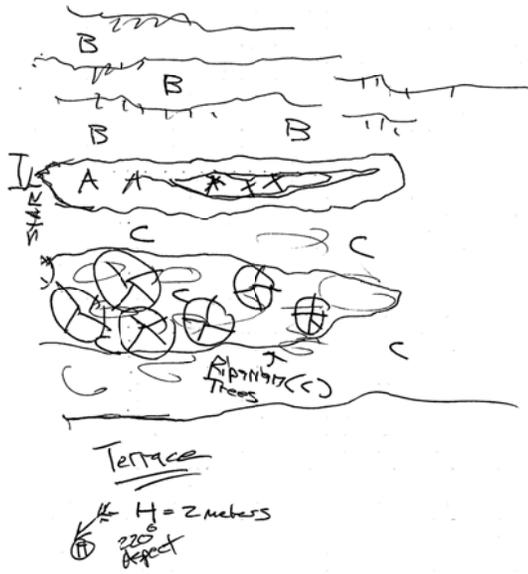


Fig 3 Rancho Fundoshi Spring: Page 2 of Sketch Map.

Ranger Station unnamed Survey Summary Report, Site ID 16964

Location: The Ranger Station unnamed ecosystem is located in Pima County in the Rillito Arizona 15050302 HUC, managed by the US Forest Service. The spring is located in the Santa Catalina RD, Coronado NF at 32.40610, -110.71504 in the Mount Bigelow USGS Quad, measured using a GPS (NAD83, estimated position error 5 meters). The elevation is approximately 2389 meters. Sami Hammer, Glenn Furnier, Emily Patterson, Aida Castillo-Flores, Sierrane Gatela, Katy Brown, Kristi Argenbright surveyed the site on 6/14/15 for 01:00 hours, beginning at 11:30, and collected data in 7 of 12 categories.

Physical Description: Ranger Station unnamed is a hillslope spring. A high-elevation developed spring near a scout camp and sewage ponds with a nice spring run and multiple boxes. The spring originates in a small box, flows through a pipe for 12m, and then empties into a channel that flows farther downslope. Most of the spring's flow is probably now piped to a large tank. The microhabitats associated with the spring cover 270.25 sqm. The site has 3 microhabitats, including A -- a 0 sqm pool, B -- a 250 sqm wet hillslope, C -- a 20 sqm channel. The geomorphic diversity is 0.12, based on the Shannon-Weiner diversity index.

Ranger Station unnamed emerges as a seepage or filtration spring from a igneous rock layer in an unknown unit. The emergence environment is subaerial, with a gravity flow force mechanism. The distance to the nearest spring is 644 meters.

Survey Notes: The spring appears to be in good condition, but quite altered by humans. It is probably piped to the large green tank below, which may be the water source for the adjacent boy scout camp. The springbox clinging to the hillside is empty with wet soil. There are lots of alders! Most of the flow at the flow measurement point was captured, but it is possible that most of the flow is actually piped to the tank via other unseen pipes, which would indicate the reported flow rate only represents a small proportion of the spring's total output.

Table 1 Ranger Station unnamed Water Quality with multiple readings averaged.

Characteristic Measured	Average Value
pH (field)	6.4
Specific conductance (field) (uS/cm)	70
Temperature, air C	17.8
Temperature, water C	11.9

Flora: Plant list is for the site as a whole. Surveyors identified 11 plant species at the site, with 0.0407 species/sqm. These included 6 native and 3 nonnative species; the native status of 2 species remains unknown.

Table 2 Ranger Station unnamed Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	6	0
Shrub	2	0
Mid-canopy	1	1
Tall canopy	2	0
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 3 Ranger Station unnamed Vegetation.

Species	Cover Code	Native Status	Wetland Status
Alnus oblongifolia	MC	N	R
Galium	GC	I	F
Geranium	GC	N	F
Juncus	GC		
Pinus ponderosa	TC	N	F
Pinus strobiformis	TC	N	
Poaceae fam	GC		
Pteridium	GC		U
Quercus hypoleucoides	SC	N	
Symphoricarpos	SC	N	U
Verbascum	GC	I	F

Fauna: Surveyors collected or observed 1 terrestrial invertebrates and 5 vertebrate specimens.

Table 4 Ranger Station unnamed Invertebrates.

Species	Lifestage	Habitat	Method
Coleoptera Erotylidae Megalodacne heros	Ad	T	Spot

Table 5 Ranger Station unnamed Vertebrates.

Species Common Name	Count	Detection
house wren	2	obs
deer	1	sign
lizard	1	obs
American robin	2	obs
rodent	1	sign

Assessment: Assessment scores were compiled in 5 categories and 29 subcategories, with 13 null condition scores, and 13 null risk scores. Aquifer functionality and water quality are moderate with some restoration potential and there is low risk. Geomorphology condition is moderate with some restoration potential and there is low risk. Habitat condition is moderate with some restoration potential and there is low risk. Biotic integrity is moderate with some restoration potential and there is moderate risk. Human influence of site is good with significant restoration potential and there is low risk. Administrative context status is

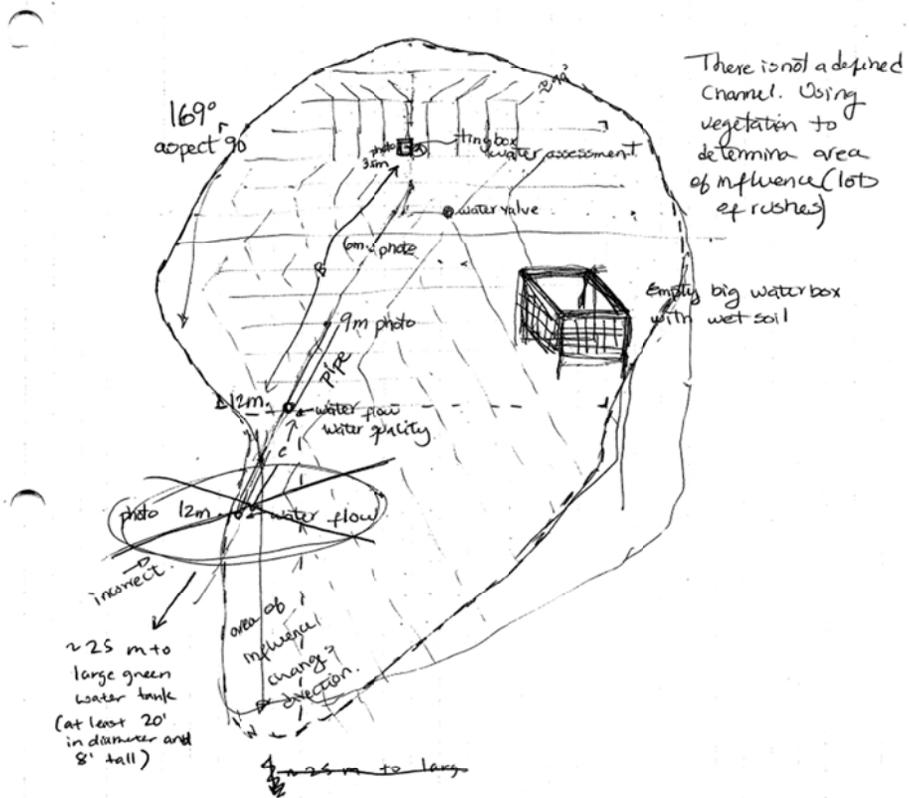
undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is moderate with some restoration potential and there is low risk.

Table 6 Ranger Station unnamed Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.8	2.4
Geomorphology	3.6	2.8
Habitat	3.5	2.5
Biota	3.8	3
Human Influence	4	2.6
Administrative Context	0	0
Overall Ecological Score	3.8	2.7

Management Recommendations: There is a sewage pond relatively close to the site, but it is across the drainage, so probably does not influence the spring.

June 14, 2015 Ranger Station un-named
Sta. Catalina Mountains



- 3.5m 1090115
- 6m 1090116
- 9m 1090117
- 12m 1090118
- 12m 1090119
- 14m 1090120
- 12m 1090121 slope picture

Fig 1 Ranger Station unnamed Sketchmap.

Red Spring Survey Summary Report, Site ID 12958

Location: The Red Spring ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 15050301 HUC, managed by the US Forest Service. The spring is located in the Nogales RD, Coronado NF at 31.63604, -111.13647 in the Saucito Mountain USGS Quad, measured using a GPS (WGS84, estimated position error 1.5 meters). The elevation is approximately 1215 meters. Sami Hammer, Bryon Lichtenhan, Emily Patterson surveyed the site on 7/31/15 for 01:00 hours, beginning at 10:15, and collected data in 7 of 12 categories.



Fig 1 Red Spring.

Physical Description: Red Spring is a rheocrene spring. At this location there is a rocky stretch of wash with standing water; water marks on the rock suggest that water is persistent at the site. It is possible the water in the stream is not from a spring, but monsoon precipitation (though some plants indicate it may be spring-fed); there is an unusually dense patch of trees that is prominent on satellite imagery at the original imported coordinates between the road and the drainage. We did not find an obvious spring there, but perhaps the search was not intensive enough, or the spring is a hypocrene type (see images on 7/31/15 survey). The site has 4 microhabitats, including A -- a 8 sqm pool, B -- a 0 sqm channel, C -- a 27 sqm sloping bedrock.

Red Spring emerges as a seepage or filtration spring from a igneous, granite rock layer in an unknown unit. The emergence environment is subaerial, with a gravity flow force mechanism. The distance to the nearest spring is 1596 meters.

Survey Notes: There were some migrant trash and clothes nearby. The spring was not flowing, but there were several pools along the drainage. Since there was no flow, and the survey was conducted during monsoon season, it is possible this is not the actual spring location, but we could not find anything else in the vicinity. The spring is not developed. There is an old pad from an exploration well (1996) across the drainage and 200-300m downstream.

Table 1 Red Spring Water Quality with multiple readings averaged.

Characteristic Measured	Average Value
pH (field)	8.6
Specific conductance (field) (uS/cm)	122
Temperature, air C	27.8
Temperature, water C	27.9

Flora: Plant list is for the site as a whole. Surveyors identified 18 plant species at the site, with 0.0679 species/sqm. These included 10 native and 8 nonnative species.

Table 2 Red Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	2	0
Shrub	3	1
Mid-canopy	1	0
Tall canopy	0	0
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 3 Red Spring Vegetation.

Species	Cover Code	Native Status	Wetland Status
Anisacanthus			
Baccharis sarothroides	SC	N	R
Bidens	GC		F
Brickellia			F
Celtis reticulata	MC	N	
Cnidoscolus angustidens		N	
Dasyllirion			
Ericameria laricifolia	SC	N	U
Erythrina flabelliformis		N	
Gossypium thurberi		N	
Ipomoea			
Mimosa biuncifera			
Mirabilis			
Muhlenbergia rigens	GC	N	U
Prosopis velutina	SC	N	F
Quercus oblongifolia		N	
Senna hirsuta		N	
Verbena			F

Fauna: Surveyors collected or observed 2 aquatic and 18 terrestrial invertebrates and 14 vertebrate specimens.

Table 4 Red Spring Invertebrates.

Species	Lifestage	Habitat	Method	Count	Species detail
Coleoptera	Ad	T	Spot	1	long-legged beetle
Coleoptera Gyrinidae	Ad	A	Spot	1	
Hemiptera Corixidae	Ad	A	Spot	1	
Hymenoptera Apidae Apis mellifera	Ad	T	Spot	1	
Hymenoptera Vespidae	Ad	T	Spot	1	
Lepidoptera HesperIIDae	Ad	T	Spot	1	dark spp
Lepidoptera HesperIIDae Piruna aea	Ad	T	Spot	1	
Lepidoptera HesperIIDae Pyrgus		T		1	male checkered
Lepidoptera Lycaenidae Celastrina ladon	Ad	T	Spot	50	
Lepidoptera Lycaenidae Hemiargus isola	Ad	T	Spot	1	
Lepidoptera Lycaenidae Leptotes marina	Ad	T	Spot	1	
Lepidoptera Nymphalidae Asterocampa leilia	Ad	T	Spot	1	
Lepidoptera Nymphalidae Vanessa virginiensis	Ad	T	Spot	1	
Lepidoptera Pieridae Colias cesonia	Ad	T	Spot	1	
Lepidoptera Pieridae Eurema nicippe	Ad	T	Spot	1	
Lepidoptera Pieridae Nathalis iole	Ad	T	Spot	1	
Lepidoptera Pieridae Phoebis sennae	Ad	T	Spot	1	
Lepidoptera Sphingidae	Ad	T	Spot	1	
Odonata Lestidae Archilestes grandis	Ad	T	Spot	1	
Odonata Libellulidae Tramea onusta	Ad	T	Spot	1	

Table 1.5 Red Spring Vertebrates.

Species Common Name	Count	Detection
rufous-crowned sparrow	1	obs
white-winged dove	1	obs
canyon wren	1	call
cactus wren	1	obs
Gambel's quail	1	obs
black-tailed gnatcatcher	1	obs
verdin	1	obs
house finch	1	obs
pyrrhuloxia	1	obs
black-throated sparrow	1	obs
ladder-backed woodpecker	1	obs
loggerhead shrike	1	obs
tadpole	1	obs
white-tailed Deer	1	sign

Assessment: Assessment scores were compiled in 5 categories and 29 subcategories, with 13 null condition scores, and 12 null risk scores. Aquifer functionality and water quality are moderate with some restoration potential and there is low risk. Geomorphology condition is good with significant restoration potential and there is low risk. Habitat condition is good with significant restoration potential and there is low risk. Biotic integrity is very good with excellent restoration potential and there is low risk. Human influence of site is good with significant restoration potential and there is low risk. Administrative context status is

undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is good with significant restoration potential and there is low risk.

Table 6 Red Spring Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.8	2
Geomorphology	4.8	2
Habitat	4.4	2.2
Biota	5	2
Human Influence	4.8	1.9
Administrative Context	0	0
Overall Ecological Score	4.6	2



Fig 2 Red Spring Sketchmap.



Fig 3 Red Spring: The spring may actually be at these original coordinates and hypocrene?

Rock Spring Survey Summary Report, Site ID 17013

Location: The Rock Spring ecosystem is located in Pima County in the Rillito Arizona 15050302 HUC, managed by the National Park Service. The spring is located in the Saguaro NP at 32.21691, -110.67572 in the Tanque Verde Peak USGS Quad, measured using a GPS (NAD83, estimated position error 7 meters). The elevation is approximately 1060 meters. Louise Misztal, Carianne Campbell, Dana Backer, Don Swann, Kristen Cull, Dan surveyed the site on 12/12/14 for 02:00 hours, beginning at 10:30, and collected data in 8 of 12 categories.

Physical Description: Rock Spring is a rheocrene spring. This rheocrene spring flowing towards steel tank is run-off dominated. The spring is hyperic above the orifice (water is traveling through alluvial material). The spring is surrounded by gradual sloping bedrock and boulders. The channel flows to a few small pools as it travels downstream. There is a manmade cement trough and dams present with a small dam interfering with flow. The stream is intermittent. Steel Tank is on the National Register of Historic Places. The grazing lease for this area was retired in 1976. The site has 5 microhabitats, including A -- a 0 sqm channel, B - - a 0 sqm sloping bedrock, C -- a 0 sqm sloping bedrock, D -- a 16 sqm pool, E -- a 0 sqm adjacent uplands.

Rock Spring emerges as a fracture spring from a combination rock layer in an unknown unit. The emergence environment is subaerial, with a gravity flow force mechanism. The distance to the nearest spring is 3972 meters.

Survey Notes: The site is being passively restored after removal of the piping from the spring to Steel Tank.

Table 1 Rock Spring Water Quality with multiple readings averaged.

Characteristic Measured	Average Value
pH (field)	6.87
Specific conductance (field) (uS/cm)	410
Temperature, water C	16

Flora: This plant list is for the entire site. Surveyors identified 31 plant species at the site, with 1.9745 species/sqm. These included 21 native and 4 nonnative species; the native status of 6 species remains unknown.

Table 2 Rock Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	12	3
Shrub	5	1
Mid-canopy	0	0
Tall canopy	0	0
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 3 Rock Spring Vegetation.

Species	Cover Code	Native Status	Wetland Status
<i>Abrutylon incanum</i>		N	
<i>Acacia greggii</i>	SC	N	F
<i>Agave schottii</i>	GC	N	
<i>Aristida</i>	GC		U
<i>Baccharis sarothroides</i>	SC	N	R
<i>Bothriochloa barbinodis</i>	GC	N	F
<i>Bouteloua aristidoides</i>		N	
<i>Bouteloua curtipendula</i>	GC	N	U
<i>Bouteloua repens</i>		N	
<i>Brickellia</i>			F
<i>Carnegia gigantea</i>			
<i>Cynodon dactylon</i>	GC	I	WR
<i>Eragrostis echinochloidea</i>		I	
<i>Eragrostis lehmanniana</i>	GC	I	U
<i>Ericameria laricifolia</i>	SC	N	U
<i>Fouquieria splendens</i>		N	
<i>Gossypium thurberi</i>		N	
<i>Heteropogon contortus</i>		N	
<i>Ipomoea</i>			
<i>Leptochloa dubia</i>	GC	N	
<i>Leptochloa filiformis</i>			
<i>Melinis repens</i>		I	
<i>Mimulus guttatus</i>	GC	N	W
<i>Muhlenbergia rigens</i>	GC	N	U
<i>Opuntia engelmannii</i>	SC	N	U
<i>Pennisetum setaceum</i>		N	
<i>Prosopis velutina</i>	SC	N	F
<i>Sonchus</i>	GC		F
<i>Sphaeralcea laxa</i>		N	
<i>Sporobolus contractus</i>	GC	N	F
<i>Xanthium strumarium</i>	GC	N	W

Fauna: Surveyors collected or observed 3 terrestrial invertebrates and 2 vertebrate specimens.

Table 4 Rock Spring Invertebrates.

Species	Lifestage	Habitat	Method
Lepidoptera Danaidae Danaus gilippus	Ad	T	Spot
Lepidoptera Papilionidae Papilio polyxenes	Ad	T	Spot
Lepidoptera Pieridae	Ad	T	Spot

Table 5 Rock Spring Vertebrates.

Species Common Name	Count	Detection
Sonoran whipsnake	1	obs
cactus wren	1	call

Assessment: Assessment scores were compiled in 5 categories and 27 subcategories, with 15 null condition scores, and 12 null risk scores. Aquifer functionality and water quality are very good with excellent restoration potential and there is negligible risk. Geomorphology condition is good with significant restoration potential and there is negligible risk. Habitat condition is good with significant restoration potential and there is negligible risk. Biotic integrity is good with significant restoration potential and there is negligible risk. Human influence of site is very good with excellent restoration potential and there is negligible risk. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is very good with excellent restoration potential and there is negligible risk.

Table 6 Rock Spring Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	5.5	1.4
Geomorphology	4.4	1.2
Habitat	4.5	1.5
Biota	4.7	1.3
Human Influence	5	1.7
Administrative Context	0	0
Overall Ecological Score	4.9	1.4

Management Recommendations: Set up an Adopt-A-Spring monitoring program here, laying out a transect starting 10m above the spring, using benchmarks for wet/dry mapping to monitor percent of length wetted. At certain points, measure depth.

Rock Water Spring Survey Summary Report, Site ID 11942

Location: The Rock Water Spring ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 15050301 HUC, managed by the US Forest Service. The spring is located in the Sierra Vista RD, Coronado NF at 31.40668, -111.09263 in the Pena Blanca Lake USGS Quad. The elevation is approximately 1205 meters. Christopher Morris, Cory Jones, Gus Glaser, Judy Atwell, and Lorrie and Rick Firth surveyed the site on 10/04/14 for 00:50 hours, beginning at 12:14, and collected data in 7 of 12 categories.



Fig 1 Rock Water Spring: Origin is where people are to the left. Piping runs to site below.

Physical Description: Rock Water Spring is a hillslope spring. The site consists of an almost dry seep within a narrow and deeply downcut channel below an access road surrounded by slopes carpeted in deergrass and mesquite. There is non-functioning cattle watering infrastructure below the seep and just above the confluence of a more prominent drainage. The site has 1 microhabitat, X -- a 782 sqm wet hillslope.

Rock Water Spring emerges from a sedimentary rock layer in an unknown unit. The emergence environment is subaerial, with a gravity flow force mechanism. The distance to the nearest spring is 1154 meters.

Survey Notes: The site believed to be the spring source is within an incised channel. Evidence of water at the site consists of nothing more than about one square foot of moist sand. There's an old rectangular cement trough below and broken piping running between.

Table 1 Rock Water Spring Water Quality with multiple readings averaged.

Characteristic Measured	Average Value
pH (field)	7.7
Specific conductance (field) (uS/cm)	945
Temperature, water C	25.6

Flora: Surveyors identified 14 plant species at the site. These included 9 native and 0 nonnative species; the native status of 5 species remains unknown.

Table 2 Rock Water Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	3	0
Shrub	6	2
Mid-canopy	1	0
Tall canopy	0	0
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 3 Rock Water Spring Vegetation.

Species	Cover Code	Native Status	Wetland Status
Acacia greggii	SC	N	F
Baccharis sarothroides	SC	N	R
Bothriochloa barbinodis	GC	N	F
Bouteloua curtipendula	GC	N	U
Dasyilirion			
Ipomoea			
Juniperus deppeana	MC	N	U
Muhlenbergia rigens	GC	N	U
Nolina microcarpa	SC	N	U
Prosopis			
Quercus	SC		U
Rhus trilobata	SC	N	F
Vitis arizonica	SC	N	R
Yucca			

Fauna: Surveyors collected or observed 3 vertebrate specimens.

Table 4 Rock Water Spring Vertebrates.

Species Common Name	Count	Detection
turkey vulture	1	obs
lesser earless lizard		obs
javelina	1	sign

Assessment: Assessment scores were compiled in 5 categories and 32 subcategories, with 10 null condition scores, and 10 null risk scores. Aquifer functionality and water quality are

moderate with some restoration potential and there is low risk. Geomorphology condition is moderate with some restoration potential and there is low risk. Habitat condition is moderate with some restoration potential and there is low risk. Biotic integrity is very good with excellent restoration potential and there is low risk. Human influence of site is moderate with some restoration potential and there is low risk. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is moderate with some restoration potential and there is low risk.

Table 5 Rock Water Spring Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	3	2.7
Geomorphology	3	2.4
Habitat	3.8	2.2
Biota	4.9	2
Human Influence	3.8	2.4
Administrative Context	0	0
Overall Ecological Score	3.8	2.3

Management Recommendations: The access road above the site has led to significant downcutting in the channel where the spring seep originates. Closure of the access road and erosion mitigation work would positively affect site conditions.

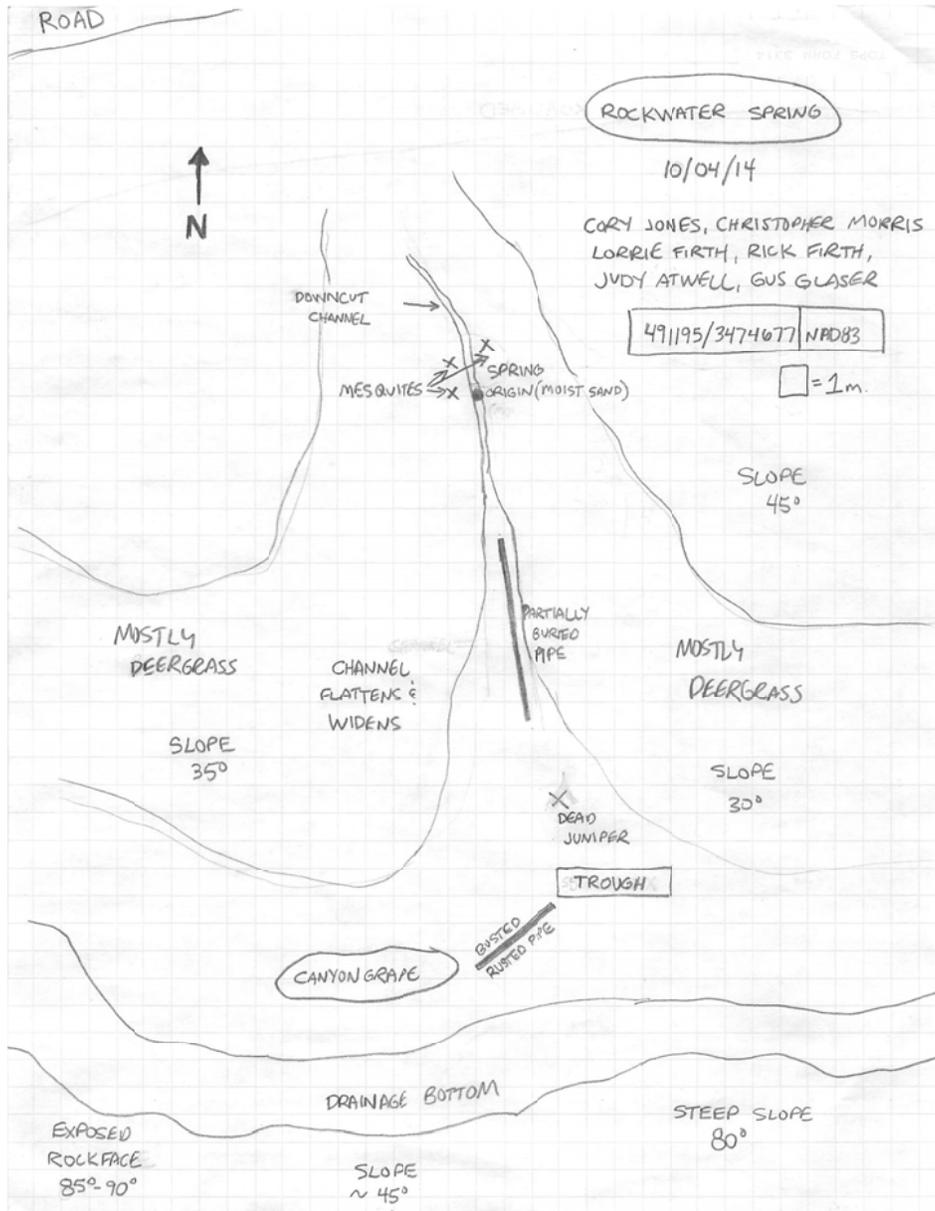


Fig 2 Rock Water Spring Sketchmap.

Ruelas Spring Survey Summary Report, Site ID 17058

Location: The Ruelas Spring ecosystem is located in Pima County in the Upper Santa Cruz Arizona 15050301 HUC, managed by the US Forest Service. The spring is located in the Nogales RD, Coronado NF at 31.82708, -110.78635 in the Helvetia USGS Quad, measured using a GPS (WGS84). The elevation is approximately 1523 meters. Louise Misztal, Randy Seraglio surveyed the site on 2/07/14 for 00:30 hours, beginning at 14:00, and collected data in 7 of 12 categories.

Physical Description: Ruelas Spring is a rheocrene spring. At the site is a stretch of stream with water in the lower elevations of the Santa Ritas with little human influence. The site has 1 microhabitat, A -- a 100 sqm channel.

Ruelas Spring emerges as a seepage or filtration spring from a igneous, granite rock layer in an unknown unit. The emergence environment is subaerial, with a gravity flow force mechanism. The distance to the nearest spring is 1959 meters.

Survey Notes: It seems like the vegetation is trampled, either from or . There is a cairn marking the location, but no development of the spring. Farther downstream (>200m), there is the beginning of a mine adit in the channel, with some water in it.

Table 1 Ruelas Spring Water Quality with multiple readings averaged.

Characteristic Measured	Average Value
pH (field)	8.25
Specific conductance (field) (uS/cm)	840
Temperature, air C	23.9
Temperature, water C	19

Flora: Surveyors identified 3 plant species at the site, with 0.03 species/sqm. These included 1 native and 2 nonnative species.

Table 2 Ruelas Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	1	0
Shrub	0	0
Mid-canopy	0	0
Tall canopy	0	0
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 3 Ruelas Spring Vegetation.

Species	Cover Code	Native Status	Wetland Status
Fraxinus			R
Muhlenbergia rigens	GC	N	U
Nolina			F

Fauna: Surveyors collected or observed 1 aquatic invertebrates and 4 vertebrate specimens.

Table 4 Ruelas Spring Invertebrates.

Species	Lifestage	Habitat	Method
Coleoptera Dytiscidae	Ad	A	Spot

Table 5 Ruelas Spring Vertebrates.

Species Common Name	Count	Detection
bridled titmouse	1	obs
javelina	1	sign
coyote	1	sign
deer	1	sign

Assessment: Assessment scores were compiled in 4 categories and 20 subcategories, with 22 null condition scores, and 22 null risk scores. Aquifer functionality and water quality are moderate with some restoration potential and there is low risk. Geomorphology condition is very good with excellent restoration potential and there is negligible risk. Habitat condition is moderate with some restoration potential and there is negligible risk. Biotic integrity is undetermined due to null scores and there is undetermined risk due to null scores. Human influence of site is very good with excellent restoration potential and there is negligible risk. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is very good with excellent restoration potential and there is negligible risk.

Table 6 Ruelas Spring Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.8	2.8
Geomorphology	5.3	1.8
Habitat	3.5	1.5
Biota	0	0
Human Influence	5.7	0.9
Administrative Context	0	0
Overall Ecological Score	4.9	1.6

Management Recommendations: This spring is potentially at risk from the proposed Rosemont Mine. Site is in the known range of a Jaguar and free from signs of human use/disturbance. It is fairly remote to access. Good site to keep protected, potential reference site, although difficult to access.

Sabino Greens Unnamed Survey Summary Report, Site ID 179835

Location: The Sabino Greens Unnamed ecosystem is located in Pima County in the Rillito Arizona 15050302 HUC, managed by the private US owner. The spring is located at 32.30544, -110.78541 in the Sabino Canyon USGS Quad, measured using a GPS (WGS84, estimated position error 2 meters). The elevation is approximately 849 meters. Samantha Hammer, Mirna Manteca surveyed the site on 9/11/15 for 01:45 hours, beginning at 10:15, and collected data in 8 of 12 categories.

Physical Description: Sabino Greens Unnamed is a rheocrene spring. A rheocrene spring emerging from at least two spots in a sandy drainage amid houses and a golf course at the base of the Catalina mountains. There is evidence the spring has been in existence for quite some time - there is a small waterfall in the channel about 1.5 m tall that seems to have/have been formed by travertine-like water deposits. The microhabitats associated with the spring cover 1500 sqm. The site has 6 microhabitats, including A -- a 0 sqm pool, B -- a 0 sqm channel, C -- a 0 sqm terrace, D -- a 0 sqm other, E -- a 2 sqm other. The geomorphic diversity is 0.00, based on the Shannon-Weiner diversity index.

Sabino Greens Unnamed emerges as a seepage or filtration spring from a sedimentary, unconsolidated rock layer in an unknown unit. The emergence environment is subaerial.

Survey Notes: The site is in decent condition with some very large willow trees and other riparian/wetland plants. A golf path runs along one side of the drainage, and there is a house very close to the spring above the drainage, but there is little evidence that humans visit it much. There is old barbed wire fencing on the west side of the drainage - it is unclear whether there may have once been an enclosure. The water from the spring eventually runs across the golf path and into the golf course, so no spring/riparian habitat exists past the water crossing.

Table 1 Sabino Greens Unnamed Water Quality with multiple readings averaged.

Characteristic Measured	Average Value
pH (field)	6.8
Temperature, water C	24.85

Flora: The plant list is a generic one for the whole site - plants are not just in polygon A. Surveyors identified 13 plant species at the site, with 0.0087 species/sqm. These included 7 native and 1 nonnative species; the native status of 5 species remains unknown.

Table 2 Sabino Greens Unnamed Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	4	2
Shrub	6	3
Mid-canopy	1	1
Tall canopy	0	0
Basal	0	0
Aquatic	1	1
Non-vascular	0	0

Table 3 Sabino Greens Unnamed Vegetation.

Species	Cover Code	Native Status	Wetland Status
algae	AQ	N	A
Arecaceae	SC		
Atriplex canescens	SC	N	R
Baccharis salicifolia	SC	N	R
Carex	GC		WR
Carnegiea gigantea		N	
Celtis pallida	SC	N	
Poaceae	GC		
Prosopis velutina	SC	N	F
Salix	MC	N	WR
Tamarix	SC	I	WR
Typha	GC		A
Xanthium	GC		WR

Fauna: Conditions for observing animals were poor - the survey was conducted around noon on a day that was in the 80s. Surveyors collected or observed 1 aquatic and 13 terrestrial invertebrates and 6 vertebrate specimens.

Table 4 Sabino Greens Unnamed Invertebrates.

Species	Lifestage	Habitat	Method
Diptera Culicidae	L	A	Spot
Hymenoptera Apidae	Ad	T	Spot
Isopoda	Ad	T	Spot
Lepidoptera Hesperidae Erynnis	Ad	T	Spot
Lepidoptera Lycaenidae Leptotes marina	Ad	T	Spot
Lepidoptera Nymphalidae Asterocampa celtis	Ad	T	Spot
Lepidoptera Nymphalidae Danaus gilippus	Ad	T	Spot
Lepidoptera Nymphalidae Libytheana carinenta	Ad	T	Spot
Lepidoptera Papilionidae Papilio cressphontes	Ad	T	Spot
Lepidoptera Pieridae Eurema nicippe	Ad	T	Spot
Lepidoptera Pieridae Phoebis sennae		T	Spot
Lepidoptera Pieridae Zerene cesonia	Ad	T	Spot
Odonata Libellulidae Libellula croceipennis	Ad	T	Spot
Odonata Zygoptera	Ad	T	Spot

Table 5 Sabino Greens Unnamed Vertebrates.

Species Common Name	Detection
hummingbirds	obs
javelina	sign
cottontail rabbit	sign
mourning dove	
Gambel's quail	obs
Aspidoscelis whiptail lizard	obs

Assessment: Assessment scores were compiled in 5 categories and 29 subcategories, with 13 null condition scores, and 13 null risk scores. Aquifer functionality and water quality are moderate with some restoration potential and there is moderate risk. Geomorphology condition is good with significant restoration potential and there is moderate risk. Habitat condition is good with significant restoration potential and there is high risk. Biotic integrity is moderate with some restoration potential and there is high risk. Human influence of site is good with significant restoration potential and there is moderate risk. Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores. Overall, the site condition is good with significant restoration potential and there is moderate risk.

Table 6 Sabino Greens Unnamed Assessment Scores.

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.8	3.6
Geomorphology	4.4	3.2
Habitat	4	4
Biota	3.8	4.7
Human Influence	4	3.7
Administrative Context	0	0
Overall Ecological Score	4	3.8

Shannon Spring Survey Summary Report, Site ID 16523

Location: The Shannon Spring ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 15050301 HUC, managed by the US Forest Service. The spring is located in the Sierra Vista RD, Coronado NF at 31.38843, -110.76198 in the Cumero Canyon USGS Quad (NAD 83). The elevation is approximately 1350 meters. Louise Misztal, Randy Seraglio, Nick Pacini, Karen Lowry surveyed the site on 4/20/14 for 00:45 hours, beginning at 12:30, and collected data in 1 of 12 categories.



Fig 1 Shannon Spring: dry channel at spring coordinates

Physical Description:

The distance to the nearest spring is 1563 meters.

Survey Notes: Spring not found. A mine shaft was found in the vicinity of the spring coordinates. No vegetation indicative of a spring was found.

Sally Spring Survey Summary Report, Site ID 19869

Location: The Sally Spring ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 15050301 HUC, managed by the US Forest Service. The spring is located in the Nogales RD, Coronado NF at 31.66959, -110.89681 in the Mount Hopkins USGS Quad, measured using a GPS (NAD83, estimated position error 6 meters). The elevation is approximately 1742 meters. Christopher Morris, Ryan Gillespie, Sara Murphy, John Murphy, Karen Lowery, Bill Knight, and Melis Arik surveyed the site on 2/07/15 for 01:45 hours, beginning at 11:15, and collected data in 8 of 12 categories.



Fig 1 Sally Spring.