Grand Canyon National Park and Grand Canyon National Park Foundation

May 2005 Monitoring Report
(Revised on August 20, 2005)
Management & Control of Tamarisk and Other Invasive Vegetation
at Backcountry Seeps, Springs and Tributaries
in Grand Canyon National Park
(First Year of Phase II of Comprehensive Project)

Arizona Water Protection Fund Contract Number 05-131WPF

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I. Abstract

Grand Canyon's backcountry seeps, spring and tributaries of the Colorado River are among the most pristine watersheds and riparian habitat remaining in the coterminous United States. These riparian systems deserve a high level of protection from invasive exotic plants. Grand Canyon National Park Foundation received a grant from the Arizona Water Protection Fund (AWPF) to control non-native plants at backcountry seeps, springs and tributaries within Grand Canyon National Park (GRCA), allowing native plant communities to recover and persist. The grant funds a project to be completed in partnership with the National Park Service (NPS) by December 31, 2006, with work occurring in 35 areas within the park. This report contains the details from the first monitoring river trip, which occurred in May 2005. The AWPF Commission has funded all or a portion of this report.

II. Introduction

a. Trip Objectives

The first of four river trips was conducted in May 2005. The purpose of the trip was to conduct pre-project inventories, complete habitat assessment for Southwestern willow flycatchers (SWIFL) and install monitoring transects and photopoints as described in the Monitoring Plan submitted as a deliverable for Task #2. This work is listed under Task #3 (Invasive Vegetation Management, Control Activities, Monitoring and Progress Reports) of the project contract.

b. Trip Logistics

The project coordinator submitted an application for a river trip to park management in November 2004. The trip was approved in January 2005 and the project coordinator initiated the logistical preparation for the trip. The crew leaders and boatmen were contacted regarding availability and the trip participants were invited. Three of the boatmen has been involved with the previous tamarisk control and monitoring work and were able to not only row boats, but also assist with the transects and tamarisk mapping. The 4 crew leaders returned full of energy, dedication and willingness to work extremely long days. We had the great fortune to have Wendy Hodgson from the Desert Botanical Garden agree to participate again as a volunteer botanist. In addition to assisting with the vegetation transects, Wendy completed vegetation inventories in the monitoring areas. We located and monitored rare plant species and discovered new plant species for the park due to her involvement with the project, and we also have a more complete pre-control floral inventory for the project areas. Lisa Hahn, Tina Ayers, Amy Prince and Frank Hays provided invaluable assistance. Both Amy and Frank had assisted with the vegetation monitoring for the previous grant, and their knowledge of the canyon and the transect process was also extremely helpful. Chris Murphy from the Idaho Heritage Program served as the trip hydrologist and did an excellent job completing the water sampling portion of the project. R.V. Ward, GRCA's Wildlife Biologist, not only rowed a boat on the upper half, but he completed the SWIFL habitat assessments and trained Carmen Sipe and Jason Lovelady, GRCA wildlife technicians. The following table displays the trip participants:

Table 1. Trip Participants, May 2005

Role	Upper Half	Lower Half
Trip Coordinator / Project Leader	Lori Makarick	Lori Makarick
Head Boatman / Trip Leader	Dan Hall	Dan Hall
Boatman	Dave Edwards	Dave Edwards
Boatman	Nicole Corbo	Nicole Corbo
Boatman	R.V. Ward	Tyler Williams
Crew Leader #1	Kari Malen	Kate Watters
Crew Leader #2	Maggie Drechsler	Maggie Drechsler
Crew Leader #3	Steve Till	Steve Till
Volunteer Botanist	Wendy Hodgson	Wendy Hodgson
Volunteer Botanist	Amy Prince	Amy Prince
Volunteer Botanist	Lisa Hahn	Lisa Hahn
Wildlife Technician	Carmen Sipe	Jason Lovelady
Volunteer Botanist	Frank Hays	Tina Ayers
Volunteer Hydrologist	Chris Murphy	Chris Murphy

Overall, the weather on the trip was perfect, with warm and sunny days. The one exception was the day at South Canyon, which was our first transect location. There was a tremendous downpour as one group began transect installation and a second group went to the top of the canyon to begin the mapping and habitat assessments. Through radio communication, group leaders discussed the possibility of flash flooding and developed a contingency plan. However, the storm finally let up and we felt safe continuing the work in the drainage. Due to the distance covered and weather, the transect group did not return to camp until 8 p.m., which ended up becoming rather standard practice. Thanks to the dedication of all trip participants, even after very long days, camp was a place of good meals and a great sense of community. All volunteers received an "Over the Edge Veg" t-shirt, purchased from the volunteer supply portion of this project for all upcoming project volunteers, as a token gift of appreciation. We have seen three of the volunteers proudly displaying their t-shirts around town, which also provides publicity for the work.

The initial itinerary for the trip was extremely full, and the actual itinerary became even more challenging as the project and trip leaders had to add additional sites and make changes on a daily basis. The lower half was particularly difficult because of the addition of several sites. Table 2 shows the initial itinerary for the trip and Table 3 displays the final itinerary for the trip.

Table 2. Initial Trip Itinerary, May 2005

Date	Day	Work Location	River Mile	Work Project(s) (Methods)	Camp (mile)
5/1 – Buying food (a few people) 5/2 – Packing Boats / Food (all boatmen) 5/3– Rigging at Lees Ferry					
5/4	1	Badger Canyon	8 R	Invasive plant management, vegetation inventory and survey, photodocumentation and transects	Badger Canyon, RM 8 R
5/5	2	Transit		Invasive plant management, inventories	South Canyon, 31.6 R
5/6	3	South Canyon	31.6 R	Invasive plant management, vegetation inventory and survey, photodocumentation and transects	Tatahatso, 37.7 L
		36.5 Mile Wash	36.5 R	"	
5/7	4	Saddle Canyon	47.2 R	Invasive plant management, vegetation inventory and survey, photodocumentation and transects	Saddle Area (upper), 47 R
5/8	5	Little Nankoweap Canyon	52 R	Invasive plant management, vegetation inventory and survey, photodocumentation and transects	Kwagunt Creek 56.2 R
		Kwagunt Creek - upper	56.2 R	"	
5/9	6	60 Mile Creek	59.8 R	Invasive plant management, vegetation inventory and survey, photodocumentation and transects	Carbon, RM 64.7 R
		Carbon Creek	64.7 R	"	
5/10	7	Cardenas Creek	71.2 L	Invasive plant management, vegetation inventory and survey, photodocumentation and transects	Cremation, RM 87.2 L
		Unkar Creek – upper	72.3 R	"	
		Papago Creek	76 L	"	
Crews will access Red Canyon, Hance, Cottonwood, Grapevine and Boulder Creeks by backpacking – but depending on time, we might stop.					
5/11	8	Exchange – Transit			New Shady Grove, RM 102.8 R
5/12	9	104 Mile Wash	104 R	Invasive plant management, vegetation inventory and survey, photodocumentation and transects	Garnet Area, RM 114.3 R
		Copper Canyon	110 L	"	
		112 Mile Wash	112 L	"	
5/13	10	127 Mile Creek	127 R	Invasive plant management, vegetation inventory and survey, photodocumentation and transects	Galloway, RM 131.8 R
		130 Mile Creek	130 R	"	
5/14	11	Transit – various		Invasive plant management, inventories	Below Upset, RM 150 area
5/15	12	Transit - various		Invasive plant management, inventories	Below Lava, RM 185 area
5/16	13	Parashant Canyon	198 R	Invasive plant management, vegetation inventory and survey, photodocumentation and transects	Parashant 198.5 R
5/17	14	Trail Canyon	219 R	Invasive plant management, vegetation inventory and survey,	220 Mile, RM 220 R

Date	Day	Work Location	River Mile	Work Project(s) (Methods)	Camp (mile)
				photodocumentation and transects	
5/18	15	220 Mile Canyon	220 R		220 Mile, RM 220 R
5/19	16	TAKE OUT!!!!!!!!! EVERYONE plan on a full day for cleanup at the boatshop.			

Table 3. Final Trip Itinerary, May 2005

Date	Day	Work Location	River Mile	Work Project(s) (Methods)	Camp (mile)
4/30 and 5/1 – Buying food (a few people) 5/2 – Packing Boats / Food (all boatmen) 5/3– Rigging at Lees Ferry					
5/4	1	Badger Canyon	8 R	Invasive plant management, vegetation inventory and survey, photodocumentation and transects	Badger Canyon, RM 8 R
5/5	2	Transit		Invasive plant management, inventories	South Canyon, 31.6 R
5/6	3	South Canyon	31.6 R	Invasive plant management, vegetation inventory and survey, photodocumentation and transects	South Canyon, 31.6 R
		36.5 Mile Wash	36.5 R	"	
5/7	4	Saddle Canyon	47.2 R	Invasive plant management, vegetation inventory and survey, photodocumentation and transects	Upper Saddle, 47 R
5/8	5	Little Nankoweap Canyon	52 R	Invasive plant management, vegetation inventory and survey, photodocumentation and transects	Carbon, RM 64.7 R
		60 Mile Creek	56.2 R	"	
5/9	6		59.8 R	Invasive plant management, vegetation inventory and survey, photodocumentation and transects	Carbon, RM 64.7 R
		Carbon Creek	64.7 R	"	
5/10	7	Cardenas Creek and nearby springs	71.2 L	Invasive plant management, vegetation inventory and survey, photodocumentation and transects	Cardenas Creek, RM 71 L
5/11	8	Transit		Invasive plant management, inventories	Cremation, RM 87.2 L
5/12	9	Exchange – Transit, work at Crystal Creek		Invasive plant management, vegetation inventory and survey, photodocumentation and transects	Crystal Creek, RM 98 R
5/13	10	Crystal Creek	98 R	Invasive plant management, vegetation inventory and survey, photodocumentation and transects	Ross Wheeler, RM 107.8L
				"	
5/14	11	Copper Canyon	110 L	Invasive plant management, vegetation inventory and survey, photodocumentation	Below Bedrock, RM 131.1R
		112 Mile		"	
		130 Mile Creek	130 R	"	
5/15	12	Transit		Invasive plant management, inventories	Tuckup, RM 164.5R
5/16	13	Transit	198 R	Invasive plant management, inventories	Upper Fat City, RM 191R
5/17	14	Trail Canyon	219 R	Invasive plant management, vegetation inventory and survey, photodocumentation and transects	Trail Canyon, RM 219.4R
5/18	15	Trail Canyon	219 R	Invasive plant management, vegetation inventory and survey, photodocumentation and transects	Trail Canyon, RM 219.4R
5/19	16	225.5 Mile Canyon	225.5 R	Invasive plant management, vegetation inventory and survey, photodocumentation and transects	225.5 Mile, RM 225.5R
5/20	17	TAKE OUT and de-rig! The day began with coffee at 4:30 am and lasted until nighttime. 4 people also assisted with additional trip cleanup on Saturday, May 21 as requested by the NPS boatshop.			

After reviewing the initial itinerary with the trip leader, the project coordinator added one day to the trip length in order to ensure that all the project work could be completed. Even with this addition, crews were unable to visit a few project areas. Crews were able to visit all of the monitoring sites, which were the priority for the trip, but had to miss the following sites:

- Upper Kwagunt – Crews completed work in the portion of this canyon during the previous phase of the project; by looking at previous site photographs, we determined that this area does not contain potential SWIFL habitat.
- Unkar Creek - Crews installed vegetation transects in this area during October 2004 and can complete the habitat assessment for this area based on that site visit with a determination that this area does not contain potential SWIFL habitat. We were unable to get hydrology and soil data for this area.
- Papago – Volunteers mapped the lower portion of this canyon during April 2005 and found no tamarisk. Crews will need to complete the tamarisk mapping and habitat assessment for the upper portion of the canyon in September 2005 because it is not accessible from the river.
- 127 Mile Canyon – Crews missed the pull in for this canyon. We will need to complete the tamarisk mapping and habitat assessments prior to work and will keep this site on the project list.

During the project area visits, crews found that the following areas wither had no tamarisk or safety concerns:

- Little Nankoweap – Crews visited this canyon during this trip and found no tamarisk; however we would like to keep this canyon on the project list and continue to remove other invasive species such as sowthistles (*Sonchus spp.*).
- Awatubi – Crews visited this canyon and found no tamarisk. Due to the dry nature of the canyon, we would like to remove this canyon from the project list.
- Sixtymile Canyon - Crews visited this canyon during this trip and found no tamarisk and also a very steep dryfall that is not safe to climb around. Due to the dry nature of the canyon and the additional safety concern, we would like to remove this canyon from the project list.
- Cardenas Canyon - Crews visited this canyon during this trip and found no tamarisk. Due to the dry nature of the canyon, we would like to remove this canyon from the project list.
- 104 Mile Wash – Crews visited this canyon to do a tamarisk survey in March 2005 and determined that access beyond 200m is unsafe. We will need to remove this canyon from the project list.
- Copper Canyon – Crews visited the lower portion of this canyon during this trip and removed hundreds of sowthistles (*Sonchus* spp.) We will keep this canyon on the project list, return to pull additional sowthistles and also evaluate upper portion from the Tonto Trail.
- Parashant Canyon - Crews visited this canyon in March 2005 and found no tamarisk. Due to the dry nature of the canyon, we would like to remove this canyon from the project list.
- 220 Mile Canyon – Crews visited this canyon during this trip and found no tamarisk. Due to the dry nature of the canyon, we would like to remove this canyon from the project list.

The following list includes the canyons we will include as a replacement project areas:

Canyon to Remove	Replacement Canyon
Awatubi	Transept Canyon
Sixtymile Canyon	70.2 Mile Cardenas Hillside Spring
Cardenas Creek	70.8 Mile Drainage
104 Mile Wash	Upper Pipe Creek
Parashant Canyon	Upper Boucher Creek
220 Mile Canyon	225.5 Mile Canyon

Please also refer to Section Va, Table 6. Revised Phase II Project Work Area List, which includes these changes.

III. Methods

a. Vegetation Transects

The primary monitoring objective is to determine the change in vegetation at the sites. Specifically, we want to be able to look at the change in the native plant species' composition in each area and we predict an increase in native plant species' cover as they are released from competition with tamarisk for the available resources. The following subset of project areas were randomly selected for transect installation in the Project Monitoring Plan:

South Canyon – Upper
Nankoweap Creek – Lower
Nankoweap Creek – Middle
Sixty mile Canyon
Cardenas Creek
Unkar Creek – Lower
Bright Angel Creek and Phantom Creek
Trail Canyon
220 Mile Canyon
Hance Creek (backup)
Carbon Creek (backup)

The two backup areas were listed in case any of the primary selections did not have sufficient tamarisk to warrant transect installation or there are logistical difficulties with the transect installation. We found no tamarisk at Sixty Mile Canyon, Cardenas Creek and 220 Mile Canyon, so we did have to use the backup selections. We did install transects in Carbon Creek (a backup site); however, Hance Creek also had insufficient tamarisk to warrant transect installation, so we selected Crystal Canyon to replace that site. When we realized that there were no tamarisk in 220 Mile Canyon, we selected 225.5 Mile Canyon as a new site for transect installation. However, there was a small waterfall that crews could not safely get around, so the project coordinator decided to drop 1 transect location. With these revisions, the final list of transect locations is as follows:

South Canyon – Upper
Nankoweap Creek – Lower
Nankoweap Creek – Middle
Carbon Creek
Unkar Creek – Lower
Bright Angel Creek and Phantom Creek
Crystal Creek
Trail Canyon

We used 50m line transects to measure vegetation cover, with one transect placed approximately in the middle of a treatment area and one in a nearby area with similar substrate and aspect in which little or no tamarisk occurs. Both transect lines run parallel to the drainage channel. The goal was to have 1-3 transect pairs per selected project area. Crews recorded point intercept, cover within 3m- radius circles, and total vegetation volume measurements.

The point intercept method characterizes substrates and documents the major plant species present along the transect lines. Crews used a 0.75cm diameter, 2m tall point and took a reading every 0.5m along the 50m transect, providing 100 points per transect. They noted the species identity of all live plants in contact with the pole and also characterize ground cover substrate in one of nine categories (Table 4).

Table 4. Ground cover substrate classes used along transects.

Category	**Description**
Bare soil	<0.1 mm (smaller than sand)
Sand	0.1 - 2mm
Gravel	2 mm – 6.4 cm
Cobble	6.4 cm – 19 cm
Stone	19 - 61 cm
Boulder	> 61cm
Bedrock	Solid rock surface, non-boulder
Litter (duff)	Dead plant material < 3cm diameter
Coarse woody debris	Dead wood 3-10 cm diameter

Woody debris structure	Woody material > 10 cm in depth and width

In future data analyses, we will sum the number of points recorded for each category (vegetation, substrate and debris) across all points and divide by 100 to calculate a percentage value for each type. The number of points covered by each species present will be converted to a percentage vegetative cover for all species present on the transect. This will allow us to determine overall ground cover including vegetation. Each transect is considered a sampling unit, and will be compared to themselves as well as the untreated pair to detect change in vegetation cover.

In order to further describe the composition of plant species present along the transects, crews collected ground cover and vegetation cover data on all plant species present in a 3m- radius circle at five points along the transect (5m, 15m, 25m, 35m, and 45 m). We recorded vegetative cover for all species present in a cylinder from the ground surface to the sky. We also included the categories of moss, lichen, and microbiotic soil crust. To minimize observer biases and increase the speed of the surveys, crews recorded cover in seven broad cover classes (Table 5). Because points on the transect are not independent of each other, cover scale values will be converted to the mid-point of the class ranges and averaged before being analyzed so that there is only a single value for each species recorded on the transect.

Table 5. Cover classes used in vegetative cover and ground cover surveys along transects.

Class	Cover Range
0	0%
1	<1%
2	1-5%
3	5-10%
4	10-25%
5	25% - 50%
6	50% - 75%
7	> 75%

In order to understand how the vegetation recorded in the cover data is distributed vertically at each point; crews recorded the three-dimensional structure, measured as total vegetation volume. At the center of each circle, a survey rod was held vertically and the number of 10cm segments in each meter above the ground with contacts with live vegetation was recorded. If there are more than one species present in a given tenth-meter increment, we will only count it once. The TVV measure for a particular point is the count of all tenth-meter increments occupied over that point. The TVV measures at each point will be summed to generate a transect measure, since individual points on the same transect cannot be considered independent for statistical purposes.

b. Hydrology Sampling

For hydrology, we measured discharge, pH, salinity, air and water temperature, and alkalinity (when applicable) at or near transect locations. We planned to take a GPS reading the beginning and end of surface water flow in the project areas.

c. Soil Sampling

We recorded soil salinity measurements at five points along the vegetation transects (5m, 15m, 25m, 35m, 45m). We used a standard soil probe, took three readings at each point, and also recorded the depth of the probe.

d. Photopoint Installation

In order to save time during the upcoming tamarisk management river trips, crews installed photopoints in project areas as part of the tamarisk mapping and transect installation. These photographs also depict the habitat assessments for the project areas. Since project areas were typically divided into 300-500 meter sections during

tamarisk mapping, some photopoints were installed in areas with no tamarisk, which is still valuable for long-term monitoring. Prior to the initiation of invasive plant management activities, crews will ensure that photopoints are installed in each project area. Crew leaders will subjectively select the additional photopoint locations so that they typify the vegetation characteristics of the area. At each location, the crew leaders record a UTM reading, compass bearing, camera height, and site description. They will then take photographs prior to tamarisk control, immediately following tamarisk removal, and then again during final project monitoring. Crews follow these standard operating procedures for photopoint installation:

- Write down the location and date on a sheet of paper and then take a photograph of the sheet. This will help with labeling and organizing the photographs following the trip.
- Make sure that the compass is declinated to 13 east.
- Make sure the GPS unit is set to NAD 83 (CONUS) and metric.
- Fill in the on the photo-log as you take the photographs. Write very neatly since someone else will be entering the data into the database.
- The photopoint name should be the name of the side canyon, followed by a number. If there are already photopoints installed in the area, use the next consecutive number. Transect photopoint names should include the transect number and type in the name.
- Keep in mind that there will usually be more than one view (i.e. different bearings) from the same photopoint – those views would be labeled 1, 2, etc. in the view # column.
- Take a photograph of a person at the photopoint to help relocate it (there is typically one associated with each of the photopoints) – this is the reference photo, denoted by an "a" in the view column (**Hance 2 view a** would be a photo of a person standing at Hance 2 photopoint).
- Please be as detailed as possible in the photopoint description, keeping in mind to include key site characteristics that are of a permanent nature (e.g. rocks, large trees)
- For the view from photopoint – please also be detailed about what you are looking at and describe what you are seeing (e.g. river in lower left corner, trail obliteration doing up sand dune).
- Keep in mind that this work will become part of the Park's files and archives – your work will be used by future Park managers and resource specialists.

e. Tamarisk Mapping

Prior to this trip, crews had already initiated qualitative monitoring in the majority of the 35 seeps, springs and tributaries. The initial assessment included approximate numbers of seedlings, saplings and mature tamarisk trees. A goal for this trip was to visit most of the remaining project area and complete tamarisk mapping forms. This was primarily done in order to estimate the number of people and time necessary for the tamarisk control work; however, this information also provides good baseline data for this project. In order to determine whether the treatment is effective, crews will count exact tamarisk numbers as control occurs. Future site visits for follow-up maintenance will help to judge the effectiveness of the treatment.

f. Southwestern Willow Flycatcher Habitat Assessments and Wildlife Monitoring

For wildlife, the initial plan called for recording observational data in the project areas and conducting pellet counts along the vegetation transects. The wildlife biologist planned on establishing 1/100-acre permanent circular plots at the beginning and end of each vegetation transect line, with comparison plots in nearby areas with similar physiographic and vegetative features. The wildlife biologist also hoped to conduct avifauna point counts in treated and untreated areas. However, the priority for this trip was to make certain that we met the U.S. Fish and Wildlife Service's requirements from the consultation, which necessitated the completion of habitat assessments in order to ensure that the project areas do not include potentially suitable habitat for the Southwestern willow flycatcher.

IV. Results

a. Vegetation Transects

Vegetation crews installed 28 transects in 8 project areas, which represents just under 25% of the total number 35 project areas. With the additional vegetation cover and structure data, plus the ancillary data and soil sampling,

each transect took 3-4 hours to read and record, which was much longer than anticipated. It was truly amazing that crews were able to accomplish what they did during this trip.

The data were entered into the project database and are included as Appendix B. Mike Kearsely, a biology professor at Northern Arizona University, has the data and will be performing preliminary statistical analyses that will be included in the final report for this project, along with the final analyses.

In addition to the vegetation cover and structure data, botanists compiled complete species lists for each of the transect areas. Wendy Hodgson, botanist with the Desert Botanical Garden, is in the process of annotating all of the specimens collected during the surveys. Once annotated, the data will be entered into the project database and detailed plant species lists for the various project areas will be produced. These surveys have already revealed 4 additions to the flora of the Park, and 2 species that were previously only known from one collection site. In addition, botanists documented new populations of some of the Park's more rare plant species (*Camissonia specuicola* ssp. *hesperia*, *Encelia resinifera* var. *tenuifolia*, *Anulocaulis leisolenus* var. *leisonlenus*, *Euphorbia aaron-rossii*, and likely a few others following annotation). Those data will be entered into the Park's database and crews will continue to monitor the populations in the future.

b. Hydrology Sampling

The trip hydrologist was able to gather water quality and flow data at 14 total sites within the following project areas: South Canyon, Carbon Canyon, Cardenas Hillside Seep, Crystal Creek, 112 Mile Canyon, Trail Creek and 225.5 Mile Canyon. Those data have been entered into the project database. The hydrology portion of the database is still under construction; therefore, those data will be submitted in the final project report. To the extent possible, crews will collect additional water quality data as time allows during upcoming river and backpacking trips. The data will also be provided to the Park's hydrologist as a contribution to long-term water sampling and monitoring. For some project areas, the Park's hydrologist has baseline information that can be used as additional pre-invasive plant removal data and compared to future data collection. As stated in the project Monitoring Plan, we planned to take a GPS reading the beginning and end of surface water flow in the project areas. However, there was insufficient time to do this during the May 2005 trip. This task will be completed as crews visit the project areas to conduct invasive plant removal.

c. Soil Sampling

The results of the soil sampling are included in Appendix B - Transect Monitoring Data. The soil probe used was very temperamental and did also provide accurate readings. In areas with very dry soil, we could often not get a good reading. We added distilled water to some of the reading locations, which helped to get a reading; however, we recommend the purchase of a better probe for subsequent trips.

d. Photopoint Installation

During this river trip and 2 backpacking trips, and an additional river trip and 2 backpacking trips (funded by the NPS), crews installed 216 photopoints in project areas. More than one photograph was taken from each photopoint, providing over 350 separate views of project areas. These photographs have all been given a file name depicting their photopoint name and are filed in folders for each separate project area. The photopoint portion of the project database is still under construction, so the data for each photopoint must still be entered electronically following completion of the database. The database will also allow the project coordinator to effortlessly print photographs in a format that is field ready (i.e. the layout the previous funded project final report Appendix B is in) so that crews can easily retake the photographs. During the upcoming control / management river trips (October 2005 and March 2006) and backpacking trips, crews will install additional photopoints in areas that we have yet to visit. These photographs provide an invaluable qualitative examination of project success.

e. Tamarisk Mapping

Crews completed 99 tamarisk mapping forms in the project areas. These have all been entered into the project database and are included as Appendix C – Tamarisk Mapping Data. Tamarisk mapping forms will be completed in September 2005 for the Clear Creek area, which needs to be accessed via backpacking. The Clear Creek project area is a 2 day hike from the South Rim so it is likely the survey and mapping will take 7 days; however, prior to

sending work crews such a long distance, it will be beneficial to send a 2 person mapping / assessment crew as soon as the weather cools down. The boatmen missed the pull in for 127 Mile Canyon, so crews will map that area as the work occurs over the winter. Crews did not complete tamarisk mapping in the remaining project areas that were far away from the river and for which we already have sufficient data (i.e. Nankoweap Creek, Lava Canyon, Unkar Creek, and Bright Angel Creek). We will merely initiate control work in these project areas in the fall with no additional mapping. Crews did map the lower portion of Papago Canyon and will not map the upper portion, but will complete the control work during the fall / winter season as part of a larger backpacking trip.

f. Southwestern Willow Flycatcher Habitat Assessments

Crews completed 62 Southwestern willow flycatcher habitat assessment forms in the project areas. These have all been entered into the project database and are included as Appendix D – Habitat Assessment Data. Habitat assessment forms will be completed for Clear Creek, Papago Creek and 127 Mile Canyon prior to the initiation of tamarisk control. The remaining assessments were completed based on current knowledge of the vegetation and water resources in the project areas (i.e. Nankoweap Creek, Unkar Creek, Kwagunt Creek). The park's Wildlife Biologist has recorded the remaining areas as "Not Southwestern Willow Flycatcher Habitat" based on his knowledge of the areas. These data still need to be entered into the database.

During the first visit to a transect area (South Canyon), the wildlife biologist determined that due to the dense nature of the vegetation along the transects, pellet counts would not provide good data. At the first transect location, no pellets were found, likely because of the closeness to the drainage that had recently flooded. Upon discussion with the project coordinator, a decision was made to remove this component from the project monitoring. Due to time constraints and our being in areas during the middle of the day, we also made the decision to not complete point counts for birds.

V. Discussion and Conclusions

a. Trip Summary

Overall, the crew did an amazing job installing the monitoring portion of this project and was able to gather excellent baseline data. In retrospect, the monitoring plan contained far too many components for the number of people and days that were allotted for this trip. It was literally impossible to get everything done, which was a valuable lesson to learn. After many discussions regarding the trip schedule, the project coordinator decided to focus on the most important components of the plan (i.e. vegetation transects, hydrology, photopoint installation and habitat assessments). After that decision was made, we were able to focus more intently on those components, and got a tremendous amount of work done. We recommend that for future monitoring project, we either extend the trip length and number of participants (and thereby cost) or permanently remove some of the components. The addition of components to the vegetation transect portion of the plan was valuable and should be retained. The ancillary data will be very useful and the two additional transect methods will provide a much more detailed picture of vegetation change than just one method alone. We also recommend including funding for statistical analysis in future monitoring plans since GRCA staff do not have the statistical software or expertise necessary to complete the detailed analyses that should be done.

b. Budget Expenditures

The initial budget for this river trip, not including food and supplies, was $35,720. These funds were transferred to a GRCA account for payroll and equipment rental. Some of the expenses still have not been debited from the account (boat rental, satellite phone fees, bunkhouse rental, and some payroll). At this date, $29,165.19 has been expended from the account. After the other expenditures hit the account, the remaining funds will be used to fund the remaining surveys and assessments (detailed in this report) that need to be completed as part of the project monitoring, prior to the initial of the control portion of this project.

c. Database

With NPS funding in 2004, GRCA staff contracted out the development of a complete, integrated database for this project. Portions of the database are still under construction, but it will be a valuable contribution to this project. Once completed, a complete copy of the database with all of the project data will be provided to GCNPF and AWPF.

d. Project Area Revisions

As stated earlier, when visiting a few of the project areas, crews did not find tamarisk, so those areas need to be removed from the initial project area list. The project coordinator has selected additional canyons to substitute for the ones that were removed. A revised project area map will be submitted as part of the final report. The following table includes the revised list of project areas:

Table 6. Revised Phase II Project Work Area List

River Mile	River Side	Canyon Name	Seedling	Sapling	Mature	SW IFL Habitat Assessment Complete	Archaeological Resources Within 300m
8	R	Badger Canyon	5	28	51	X	
31.6	R	South Canyon - Lower	Combined w/ Upper	Combined w/ Upper	Combined w/ Upper	X	X
31.6	R	South Canyon - Upper	4	123	156	X	X
36.5	R	36.5 Mile wash *	65	50	30	X	
47.2	R	Saddle Canyon *	0	1	2	X	
51.8	R	Little Nankoweap Creek	0	0	0	X	
52	R	Nankoweap Creek – Lower *	372	609	486	X	X
52	R	Nankoweap Creek - Middle	100+	100+	100+	X	X
52	R	Nankoweap Creek - Upper	100+	100+	100+	X	X
56.2	R	Kwagunt Creek - Upper	100+	100+	100+	X	X
~~58.3~~	~~R~~	~~Awatubi Canyon~~ Remove from list	~~0~~	~~0~~	~~0~~	~~X~~	
~~59.8~~	~~R~~	~~Sixtymile Creek~~ Remove from list	~~0~~	~~0~~	~~0~~	~~X~~	~~X~~
64.7	R	Carbon Creek – Upper	90	39	220	X	
65.5	R	Lava Canyon – Upper	100+	100+	100+	X	
70.2	L	70.2 Mile Cardenas Hillside Spring *Added	0	0	9	X	
70.8	L	70.8 Mile Drainage + Added	5	20	13	X	
~~71.2~~	~~L~~	~~Cardenas Creek~~ Remove from list	~~0~~	~~0~~	~~0~~	~~X~~	
72.3	R	Unkar Creek – Lower *	641	262	270	X	
72.3	R	Unkar Creek – Upper	100+	100+	100+	X	
76	L	Papago Creek	0	1	0	O	
76.6	L	Red Canyon	12	57	63	X	X
78.6	L	Hance Creek	85	238	109	X	
80.5	L	Cottonwood Creek	0	24	6	X	
81.5	L	Grapevine Creek	90	188	211	X	
82.8	L	Boulder Creek	50	106	124	X	
84	R	Clear Creek – Upper	Unknown	Unknown	Unknown	O	
88	R	Bright Angel Creek and Phantom Creek	100+	100+	100+	X	
88	R	Transept Canyon + Added	Unknown	Unknown	Unknown	X	
89	L	Pipe Creek *	1	173	244	X	
89	L	Pipe Creek – Upper + Added	12	57	63	X	
89	L	Garden Creek *	4	0	1	X	
97	L	Boucher Creek – Upper	Many	Many	Many	X	X
98	R	Crystal Creek	3643	2294	1041	~~X~~	
~~104~~	~~R~~	~~104 Mile Wash~~ Remove from list	~~0~~	~~0~~	~~0~~	~~X~~	
110	L	Copper Canyon	19	5	10	X	
112	L	112 Mile Wash	0	1	1	X	
127	R	127 Mile Creek	Unknown	Unknown	Unknown	X	
130	R	130 Mile Creek	0	8	15	X	
~~198.5~~	~~R~~	~~Parashant Wash~~ Remove from List	~~0~~	~~0~~	~~0~~	~~X~~	~~X~~
219	R	Trail Canyon	216	885	241	X	
~~220~~	~~R~~	~~220 Mile Canyon~~ Remove from List	~~1~~	~~1~~	~~0~~	~~X~~	~~X~~
225.5	R	225.5 Mile Canyon + Added	604	435	54	X	

X Surveys completed and areas cleared for project initiation.
O Tamarisk and southwest willow flycatcher habitat surveys will be completed before tamarisk control work begins.
+ Canyon added to list following May 2005 Monitoring Trip
* Work initiated

VI. Appendices

a. Appendix A - Representative Project Photographs – May 2005 Monitoring Trip Report

Appendix Heading – See attached appendix.

b. Appendix B - Monitoring Transect Data

Appendix Heading – See attached appendix.

c. Appendix C - Tamarisk Mapping Data

Appendix Heading – See attached appendix.

d. Appendix D – Habitat Assessment Data

Appendix Heading – See attached appendix.

e. Appendix E – Project Data Forms

Appendix Heading – See attached appendix.

APPENDIX A

Representative Project Photographs – May 2005 Monitoring Trip Report

Management & Control of Tamarisk and Other Invasive Vegetation at Backcountry Seeps, Springs and Tributaries in Grand Canyon National Park

Picture 1. The hard working crew

Picture 2. Transportation to work sites

Picture 3. Hydrology team at work

Picture 4. Documenting plants close up

Picture 5. Crystal Transect 1A start view 2, showing dense tamarisk near creek.

Picture 6. Bright Angel Creek Transect 1A start, view 2, showing tamarisk and native plants.

APPENDIX A

Representative Project Photographs – May 2005 Monitoring Trip Report

Management & Control of Tamarisk and Other Invasive Vegetation at Backcountry Seeps, Springs and Tributaries in Grand Canyon National Park

Picture 7. Transect through native vegetation.

Picture 8. Botanists collecting plant specimens, Crystal Creek transect area.

Picture 9. Collecting point intercept data, Upper Carbon transect.

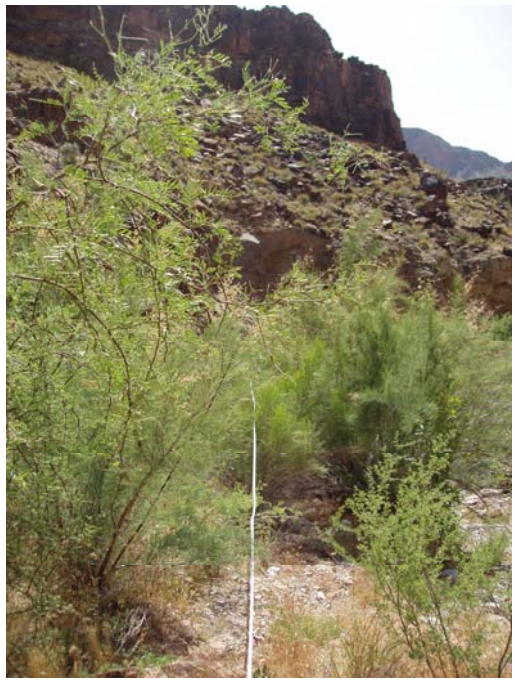
Picture 10. *Sonchus oleraceus* bouquet at 36.5 Mile project area.

APPENDIX A

Representative Project Photographs – May 2005 Monitoring Trip Report

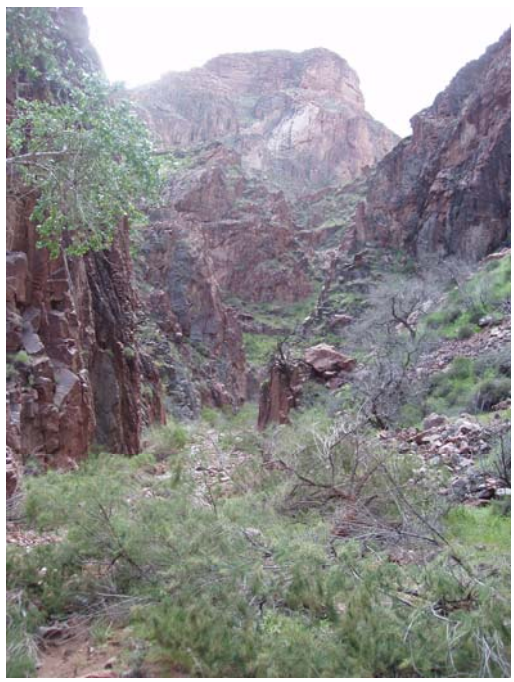
Management & Control of Tamarisk and Other Invasive Vegetation at Backcountry Seeps, Springs and Tributaries in Grand Canyon National Park

Picture 11. Trail Canyon hydrology 1 location.



Picture 12. Trail Canyon Transect 1A start, view 1, dense tamarisk.

Picture 13. Pipe Creek 6, view 1, pre-removal



Picture 14. Pipe Creek 6, view 1, post-removal

Appendix B - Monitoring Transect Data

Canyon/Park	**Bright Angel Creek**	River mile:	88 R
Transect Name:	Bright Angel Creek Transect 1	Type:	Tamarisk area
Date:	6/7/2005	Weather:	Clear, sunny, breezy
Start point:		End point:	
Easting	403720	Easting	403709
Northing	3999437	Northing	3999427
GPS accuracy (m)	11.7	GPS accuracy (m)	16.3
Bearing:	196	Elevation (m):	967
Aspect (0-360):	230	Slope (degrees):	2

Transect description: Transect is located 12km (7.5 miles) from Phantom Ranch heading north on N. Kaibab trail.

Geological layer: Vishnu schist metomorphic complex. Note also limestone in surface rock category.

Habitat type: Riparian

Dominant species: Salix exigua Nutt., Isocoma acradenia (Greene) Greene, Tamarix ramosissima Ledeb.

Associated species: Datura wrightii Regel, Bromus tectorum L., Gnaphalium chilense, Stephanomeria pauciflora (Torr.) A. Nels., Silene antirrhina L., Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm., Poa bigelovii Vasey & Scribn., Erigeron lobatus A. Nels., Aristida purpurea Nutt., Artemisia ludoviciana Nutt., Sonchus asper (L.) Hill, Bernardia incana Morton, Brickellia longifolia S. Wats., Cryptantha spp., Bromus rubens L., Bromus diandrus Roth, Acacia greggii Gray, Vulpia microstachys, Bebbia juncea (Benth.) Greene var. aspera Greene, Sporobolus cryptandrus (Torr.) Gray, Porophyllum gracile Benth., Cynodon dactylon (L.) Pers., Ephedra fasciculata A. Nels., Baccharis salicifolia (Ruiz & Pavón) Pers.

Surface water within 25 m? Surface water type: stream Surface rocks: cobbles sandstone

Landform: Drainage channel Light exposure: open partial-shade

Soil type: sand Soil moisture: dry

Point Intercept Transect (50m)	% Cover
Bare Soil	10
Boulder	3
Coarse woody debris	26
Cobble	10
Gravel	16
Litter (duff)	75
Stone	3
Woody debris structure	4
Aristida purpurea Nutt.	2
Baccharis salicifolia (Ruiz & Pavón) Pers.	3
Brickellia longifolia S. Wats.	4
Bromus rubens L.	58
Bromus tectorum L.	9
Cynodon dactylon (L.) Pers.	7
Isocoma acradenia (Greene) Greene	5
Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm.	2
Porophyllum gracile Benth.	3
Salix exigua Nutt.	5
Sporobolus cryptandrus (Torr.) Gray	1
Stephanomeria pauciflora (Torr.) A. Nels.	1
Tamarix ramosissima Ledeb.	32
Vulpia octoflora	5

Daubenmire Scale Cover Data from 50m Transect

Ground Cover Category	Meters	Cover Scale
Bare Soil	15	1 <1%
Bare Soil	25	1 <1%
Bare Soil	35	1 <1%
Bare Soil	45	1 <1%
Coarse woody debris	5	2 1-5%
Coarse woody debris	15	3 5-10%
Coarse woody debris	25	5 25-50%

Coarse woody debris	35	2 1-5%
Coarse woody debris	45	3 5-10%
Cobble	5	1 <1%
Cobble	15	2 1-5%
Cobble	25	4 10-25%
Cobble	35	4 10-25%
Cobble	45	3 5-10%
Gravel	5	1 <1%
Gravel	15	2 1-5%
Gravel	25	3 5-10%
Gravel	35	3 5-10%
Gravel	45	2 1-5%
Litter (duff)	5	7 75-100%
Litter (duff)	15	7 75-100%
Litter (duff)	25	6 50-75%
Litter (duff)	35	5 25-50%
Litter (duff)	45	6 50-75%
Sand	5	3 5-10%
Sand	15	2 1-5%
Sand	25	3 5-10%
Sand	35	3 5-10%
Sand	45	1 <1%
Stone	5	2 1-5%
Stone	15	3 5-10%
Stone	25	4 10-25%
Stone	35	4 10-25%
Stone	45	3 5-10%
Woody debris structure	35	1 <1%
Woody debris structure	45	2 1-5%

Species Name	Meters	Tree Age	Cover Scale
Acacia greggii Gray	5	M Mature	1 <1%
Aristida purpurea Nutt.	45		1 <1%
Artemisia ludoviciana Nutt.	45		2 1-5%
Baccharis salicifolia (Ruiz & Pavón) Pers.	5		2 1-5%
Baccharis salicifolia (Ruiz & Pavón) Pers.	15		2 1-5%
Baccharis salicifolia (Ruiz & Pavón) Pers.	25		3 5-10%
Bebbia juncea (Benth.) Greene var. aspera Greene	25		2 1-5%
Bebbia juncea (Benth.) Greene var. aspera Greene	45		2 1-5%
Bernardia incana Morton	15		2 1-5%
Bernardia incana Morton	35		2 1-5%
Bernardia incana Morton	45		2 1-5%
Brickellia longifolia S. Wats.	5		4 10-25%
Brickellia longifolia S. Wats.	15		4 10-25%
Brickellia longifolia S. Wats.	35		2 1-5%
Brickellia longifolia S. Wats.	45		3 5-10%
Bromus diandrus Roth	5		5 25-50%
Bromus diandrus Roth	25		1 <1%
Bromus rubens L.	5		5 25-50%
Bromus rubens L.	15		6 50-75%
Bromus rubens L.	25		4 10-25%
Bromus rubens L.	35		3 5-10%

Bromus rubens L.	45		5 25-50%
Bromus tectorum L.	5		2 1-5%
Bromus tectorum L.	15		1 <1%
Bromus tectorum L.	45		1 <1%
Cryptantha spp.	5		1 <1%
Cryptantha spp.	35		1 <1%
Cryptobiotic soil	5		3 5-10%
Cryptobiotic soil	15		1 <1%
Cryptobiotic soil	25		2 1-5%
Cryptobiotic soil	35		3 5-10%
Cryptobiotic soil	45		2 1-5%
Cynodon dactylon (L.) Pers.	15		2 1-5%
Cynodon dactylon (L.) Pers.	25		3 5-10%
Cynodon dactylon (L.) Pers.	45		3 5-10%
Datura wrightii Regel	25		2 1-5%
Datura wrightii Regel	35		1 <1%
Datura wrightii Regel	45		1 <1%
Erigeron lobatus A. Nels.	45		1 <1%
Gnaphalium chilense	25		1 <1%
Isocoma acradenia (Greene) Greene	15		1 <1%
Isocoma acradenia (Greene) Greene	45		3 5-10%
Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm.	35		3 5-10%
Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm.	45		1 <1%
Poa bigelovii Vasey & Scribn.	35		1 <1%
Porophyllum gracile Benth.	15		1 <1%
Porophyllum gracile Benth.	25		2 1-5%
Porophyllum gracile Benth.	35		2 1-5%
Porophyllum gracile Benth.	45		1 <1%
Salix exigua Nutt.	15		5 25-50%
Salix exigua Nutt.	25		5 25-50%
Salix exigua Nutt.	35		4 10-25%
Salix exigua Nutt.	45		3 5-10%
Silene antirrhina L.	35		1 <1%
Sonchus asper (L.) Hill	45		1 <1%
Sporobolus cryptandrus (Torr.) Gray	5		2 1-5%
Stephanomeria pauciflora (Torr.) A. Nels.	25		1 <1%
Stephanomeria pauciflora (Torr.) A. Nels.	35		2 1-5%
Stephanomeria pauciflora (Torr.) A. Nels.	45		2 1-5%
Tamarix ramosissima Ledeb.	5		5 25-50%
Tamarix ramosissima Ledeb.	15		6 50-75%
Tamarix ramosissima Ledeb.	25		4 10-25%
Tamarix ramosissima Ledeb.	45		4 10-25%
Vulpia microstachys	5		1 <1%

Vegetation Structure Data

Species Name	Meters	# of Hits	Height
Sporobolus cryptandrus (Torr.) Gray	5	7	0-1.0
Tamarix ramosissima Ledeb.	5	2	0-1.0
Tamarix ramosissima Ledeb.	5	10	1-2
Bromus rubens L.	15	9	0-1.0
Tamarix ramosissima Ledeb.	15	3	1-2
Tamarix ramosissima Ledeb.	15	15	2-3
Salix exigua Nutt.	25	2	0-1.0
Bromus rubens L.	45	3	0-1.0
Isocoma acradenia (Greene) Greene	45	3	0-1.0
Tamarix ramosissima Ledeb.	45	1	1-2
Tamarix ramosissima Ledeb.	45	18	0-1.0

Soil Data

Meters	Probe depth (cm)	Reading 1	Reading 2	Reading 3	Average Reading
5	9	0	0	0	0.00
15	4	0	0	0.03	0.01
25	3	0.03	0	0	0.01
35	4	0	0	0	0.00
45	4	0.01	0	0.01	0.01

Canyon/Park	**Bright Angel Creek**	River mile:	88 R
Transect Name:	Bright Angel Creek Transect 2	Type:	Tamarisk area
Date:	6/7/2005	Weather:	Sunny, no clouds, VERY hot!
Start point:		End point:	
Easting	404343	Easting	404302
Northing	4000313	Northing	4000280
GPS accuracy (m)	6.2	GPS accuracy (m)	7.7
Bearing:	230	Elevation (m):	1025
Aspect (0-360):	210	Slope (degrees):	4

Transect description: In a side drainage on creek left of Bright Angel Creek, near the trail, 6.5km (~4miles) up from Phantom Ranch. About 2.5km (~1.5 miles) downcreek from Ribbon Falls. Further up canyon on creek left is small, shallow canyon coming in.

Geological layer: Granite and schist

Habitat type: Riparian Great Basin desert scrub

Dominant species: Bromus rubens L., Tamarix ramosissima Ledeb., Artemisia dracunculus L., Acacia greggii Gray, Fallugia paradoxa (D. Don) Endl. ex Torr., Isocoma acradenia (Greene) Greene

Associated species: Brickellia longifolia S. Wats., Bromus tectorum L., Cryptobiotic soil, Erodium cicutarium (L.) L'Hér. ex Ait., Bothriochloa barbinodis (Lag.) Herter, Aristida adscensionis L., Vitis arizonica Engelm., Tridens muticus (Torr.) Nash, Argemone spp., Rhus trilobata Nutt. var. simplicifolia (Greene) Barkl., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Achnatherum speciosum (Trin. & Rupr.) Barkworth, Aristida purpurea Nutt., Stephanomeria pauciflora (Torr.) A. Nels., Opuntia phaeacantha Engelm., Cynodon dactylon (L.) Pers., Datura wrightii Regel, Vulpia microstachys, Bromus diandrus Roth, Poa bigelovii Vasey & Scribn., Plantago patagonica Jacq., Astragalus nuttallianus DC., Poa fendleriana (Steud.) Vasey, Salix exigua Nutt., Sporobolus contractus A.S. Hitchc., Sporobolus cryptandrus (Torr.) Gray, Muhlenbergia porteri Scribn. ex Beal, Opuntia basilaris Engelm. & Bigelow, Mirabilis bigelovii Gray, Lepidium lasiocarpum Nutt. var. lasiocarpum, Yucca baccata Torr.

Surface water within 25 m? Surface water type: stream Surface rocks: sandstone limestone

Landform: Drainage channel Light exposure: open

Soil type: sand Soil moisture: dry

Point Intercept Transect (50m)	% Cover
Bare Soil	18
Coarse woody debris	36
Gravel	3
Litter (duff)	73
Stone	4
Woody debris structure	7
Acacia greggii Gray	1
Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth	1
Achnatherum speciosum (Trin. & Rupr.) Barkworth	1
Artemisia dracunculus L.	21
Brickellia longifolia S. Wats.	11
Bromus diandrus Roth	5
Bromus rubens L.	51
Cryptantha spp.	1
Erodium cicutarium (L.) L'Hér. ex Ait.	1
Fallugia paradoxa (D. Don) Endl. ex Torr.	11
Isocoma acradenia (Greene) Greene	1
Salix exigua Nutt.	3
Tamarix ramosissima Ledeb.	27
Vulpia microstachys	9

Daubenmire Scale Cover Data from 50m Transect

Ground Cover Category	Meters	Cover Scale
Bare Soil	5	1 <1%
Bare Soil	15	1 <1%
Bare Soil	25	1 <1%
Boulder	25	1 <1%
Boulder	35	2 1-5%
Boulder	45	2 1-5%
Coarse woody debris	15	2 1-5%

Coarse woody debris	25	2 1-5%
Coarse woody debris	35	2 1-5%
Cobble	5	1 <1%
Cobble	15	3 5-10%
Cobble	25	2 1-5%
Cobble	35	2 1-5%
Cobble	45	1 <1%
Gravel	15	2 1-5%
Gravel	25	2 1-5%
Gravel	35	1 <1%
Litter (duff)	5	6 50-75%
Litter (duff)	15	5 25-50%
Litter (duff)	25	5 25-50%
Litter (duff)	35	7 75-100%
Litter (duff)	45	7 75-100%
Sand	5	1 <1%
Sand	15	2 1-5%
Sand	25	2 1-5%
Sand	35	2 1-5%
Sand	45	1 <1%
Stone	15	2 1-5%
Stone	25	3 5-10%
Stone	35	2 1-5%
Stone	45	1 <1%
Woody debris structure	15	1 <1%
Woody debris structure	45	2 1-5%

Species Name	Meters	Tree Age	Cover Scale
Acacia greggii Gray	15		2 1-5%
Acacia greggii Gray	25		1 <1%
Achnatherum speciosum (Trin. & Rupr.) Barkworth	15		1 <1%
Aristida adscensionis L.	15		1 <1%
Aristida purpurea Nutt.	15		2 1-5%
Aristida purpurea Nutt.	25		1 <1%
Aristida purpurea Nutt.	35		1 <1%
Artemisia dracunculus L.	5		3 5-10%
Artemisia dracunculus L.	15		2 1-5%
Artemisia dracunculus L.	25		2 1-5%
Artemisia dracunculus L.	35		2 1-5%
Artemisia ludoviciana Nutt.	15		2 1-5%
Astragalus nuttallianus DC.	15		1 <1%
Astragalus nuttallianus DC.	25		1 <1%
Bothriochloa barbinodis (Lag.) Herter	15		1 <1%
Brickellia longifolia S. Wats.	5		1 <1%
Brickellia longifolia S. Wats.	15		4 10-25%
Brickellia longifolia S. Wats.	25		4 10-25%
Brickellia longifolia S. Wats.	35		4 10-25%
Brickellia longifolia S. Wats.	45		5 25-50%
Bromus diandrus Roth	25		1 <1%
Bromus diandrus Roth	35		3 5-10%
Bromus diandrus Roth	45		3 5-10%

Bromus rubens L.	5		3 5-10%
Bromus rubens L.	15		3 5-10%
Bromus rubens L.	25		3 5-10%
Bromus rubens L.	35		5 25-50%
Bromus rubens L.	45		5 25-50%
Bromus tectorum L.	15		1 <1%
Bromus tectorum L.	25		1 <1%
Bromus tectorum L.	35		3 5-10%
Cryptantha spp.	35		1 <1%
Cryptobiotic soil	15		6 50-75%
Cryptobiotic soil	25		6 50-75%
Cryptobiotic soil	35		3 5-10%
Cynodon dactylon (L.) Pers.	15		2 1-5%
Cynodon dactylon (L.) Pers.	25		3 5-10%
Erodium cicutarium (L.) L'Hér. ex Ait.	15		2 1-5%
Fallugia paradoxa (D. Don) Endl. ex Torr.	5		6 50-75%
Fallugia paradoxa (D. Don) Endl. ex Torr.	25		1 <1%
Fallugia paradoxa (D. Don) Endl. ex Torr.	35		3 5-10%
Fallugia paradoxa (D. Don) Endl. ex Torr.	45		3 5-10%
Gutierrezia sarothrae (Pursh) Britt. & Rusby	15		1 <1%
Isocoma acradenia (Greene) Greene	5		2 1-5%
Isocoma acradenia (Greene) Greene	15		1 <1%
Isocoma acradenia (Greene) Greene	25		2 1-5%
Isocoma acradenia (Greene) Greene	35		1 <1%
Isocoma acradenia (Greene) Greene	45		2 1-5%
Lepidium lasiocarpum Nutt. var. lasiocarpum	25		1 <1%
Lepidium lasiocarpum Nutt. var. lasiocarpum	35		1 <1%
Mirabilis bigelovii Gray	15		2 1-5%
Mirabilis bigelovii Gray	25		1 <1%
Muhlenbergia porteri Scribn. ex Beal	5		1 <1%
Muhlenbergia porteri Scribn. ex Beal	35		1 <1%
Opuntia basilaris Engelm. & Bigelow	15		1 <1%
Opuntia phaeacantha Engelm.	15		2 1-5%
Plantago patagonica Jacq.	5		1 <1%
Plantago patagonica Jacq.	15		1 <1%
Plantago patagonica Jacq.	25		2 1-5%
Plantago patagonica Jacq.	35		1 <1%
Poa bigelovii Vasey & Scribn.	5		1 <1%
Poa fendleriana (Steud.) Vasey	15		1 <1%
Salix exigua Nutt.	45		4 10-25%
Sporobolus contractus A.S. Hitchc.	45		1 <1%
Sporobolus cryptandrus (Torr.) Gray	5		1 <1%
Sporobolus cryptandrus (Torr.) Gray	15		2 1-5%
Sporobolus cryptandrus (Torr.) Gray	25		2 1-5%
Sporobolus cryptandrus (Torr.) Gray	35		1 <1%
Stephanomeria pauciflora (Torr.) A. Nels.	15		2 1-5%
Stephanomeria pauciflora (Torr.) A. Nels.	25		2 1-5%
Stephanomeria pauciflora (Torr.) A. Nels.	35		1 <1%
Tamarix ramosissima Ledeb.	5		4 10-25%
Tamarix ramosissima Ledeb.	35		4 10-25%
Tamarix ramosissima Ledeb.	45		6 50-75%
Tridens muticus (Torr.) Nash	15		1 <1%
Tridens muticus (Torr.) Nash	25		1 <1%
Vitis arizonica Engelm.	25		1 <1%
Vulpia microstachys	5		2 1-5%
Vulpia microstachys	15		2 1-5%
Vulpia microstachys	25		1 <1%

Vulpia microstachys	35		2 1-5%

Vegetation Structure Data

Species Name	Meters	# of Hits	Height
Artemisia dracunculus L.	5	3	0-1.0
Bromus rubens L.	5	2	0-1.0
Artemisia dracunculus L.	15	4	0-1.0
Bromus rubens L.	15	4	0-1.0
Bromus rubens L.	25	2	0-1.0
Artemisia dracunculus L.	35	5	1-2
Artemisia dracunculus L.	35	9	0-1.0
Bromus rubens L.	45	5	0-1.0
Tamarix ramosissima Ledeb.	45	3	1-2
Tamarix ramosissima Ledeb.	45	5	2-3
Tamarix ramosissima Ledeb.	45	5	0-1.0

Soil Data

Meters	Probe depth (cm)	Reading 1	Reading 2	Reading 3	Average Reading
5	8	0	0	0	0.00
15	4	0.01	0	0	0.00
25	8	0	0	0	0.00
35	8	0	0	0	0.00
45	4	0.07	0.03	0.04	0.05

Canyon/Park	**Bright Angel Creek**	River mile:	88 R
Transect Name:	Bright Angel Creek Transect 2	Type:	Reference
Date:	6/7/2005	Weather:	Hot, sunny, breezy
Start point:		End point:	
Easting	404413	Easting	404369
Northing	4000348	Northing	4000328
GPS accuracy (m)	5	GPS accuracy (m)	5.3
Bearing:	220	Elevation (m):	1033
Aspect (0-360):	210	Slope (degrees):	5

Transect description: Transect start is 7.25km (4.5 miles and 2.5 hours of steady hiking) from Phantom Ranch, where canyon opens up and you start going up hills almost to Ribbon Falls.

Geological layer: Vishnu schist

Habitat type: Riparian Great Basin desert scrub

Dominant species: Isocoma acradenia (Greene) Greene, Bromus rubens L., Acacia greggii Gray

Associated species: Quercus turbinella Greene, Phlox longifolia Nutt., Ephedra fasciculata A. Nels., Encelia farinosa Gray ex Torr., Bebbia juncea (Benth.) Greene var. aspera Greene, Mirabilis bigelovii Gray, Aristida purpurea Nutt., Porophyllum gracile Benth., Erodium cicutarium (L.) L'Hér. ex Ait., Pleuraphis jamesii Torr., Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb., Vulpia microstachys, Sporobolus contractus A.S. Hitchc., Brickellia longifolia S. Wats., Astragalus nuttallianus DC., Sporobolus cryptandrus (Torr.) Gray, Poa bigelovii Vasey & Scribn., Plantago patagonica Jacq., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Yucca baccata Torr., Opuntia phaeacantha Engelm., Echinocereus engelmannii (Parry ex Engelm.) Lem., Fallugia paradoxa (D. Don) Endl. ex Torr., Argemone munita Dur. & Hilg., Agave utahensis Engelm., Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth, Elymus elymoides (Raf.) Swezey, Artemisia ludoviciana Nutt., Opuntia basilaris Engelm. & Bigelow, Heterotheca villosa (Pursh) Shinners, Stephanomeria pauciflora (Torr.) A. Nels., Bouteloua eriopoda (Torr.) Torr., Thymophylla pentachaeta (DC.) Small, Bothriochloa barbinodis (Lag.) Herter, Descurainia pinnata (Walt.) Britt., Cryptobiotic soil, Achnatherum speciosum (Trin. & Rupr.) Barkworth, Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird, Lepidium lasiocarpum Nutt. var. lasiocarpum

Surface water within 25 m? Surface water type: stream Surface rocks: schist granite

Landform: Drainage channel Light exposure: open

Soil type: sand Soil moisture: dry

Point Intercept Transect (50m)	% Cover
Bare Soil	34
Boulder	15
Coarse woody debris	18
Cobble	15
Gravel	12
Litter (duff)	26
Stone	6
Woody debris structure	4
Acacia greggii Gray	7
Achnatherum speciosum (Trin. & Rupr.) Barkworth	3
Agave utahensis Engelm.	1
Bromus rubens L.	18
Fallugia paradoxa (D. Don) Endl. ex Torr.	3
Gutierrezia sarothrae (Pursh) Britt. & Rusby	1
Heterotheca villosa (Pursh) Shinners	2
Isocoma acradenia (Greene) Greene	19
Salix exigua Nutt.	1
Sporobolus cryptandrus (Torr.) Gray	2
Vulpia microstachys	5

Daubenmire Scale Cover Data from 50m Transect

Ground Cover Category	Meters	Cover Scale
Bare Soil	5	1 <1%
Bare Soil	15	1 <1%
Bare Soil	35	1 <1%
Bare Soil	45	1 <1%
Bedrock	5	3 5-10%
Bedrock	15	1 <1%
Boulder	5	3 5-10%

Boulder	15	3 5-10%
Boulder	25	4 10-25%
Boulder	35	3 5-10%
Boulder	45	4 10-25%
Coarse woody debris	5	1 <1%
Coarse woody debris	15	2 1-5%
Coarse woody debris	25	2 1-5%
Coarse woody debris	35	1 <1%
Coarse woody debris	45	2 1-5%
Cobble	5	4 10-25%
Cobble	15	2 1-5%
Cobble	25	2 1-5%
Cobble	35	2 1-5%
Cobble	45	2 1-5%
Gravel	5	5 25-50%
Gravel	15	4 10-25%
Gravel	25	2 1-5%
Gravel	35	3 5-10%
Gravel	45	2 1-5%
Litter (duff)	5	2 1-5%
Litter (duff)	15	4 10-25%
Litter (duff)	25	3 5-10%
Litter (duff)	35	3 5-10%
Litter (duff)	45	3 5-10%
Sand	5	1 <1%
Sand	15	2 1-5%
Sand	25	1 <1%
Sand	35	1 <1%
Sand	45	2 1-5%
Stone	5	4 10-25%
Stone	15	3 5-10%
Stone	25	4 10-25%
Stone	35	4 10-25%
Stone	45	2 1-5%
Woody debris structure	5	1 <1%
Woody debris structure	15	2 1-5%

Species Name	Meters	Tree Age	Cover Scale
Acacia greggii Gray	5		3 5-10%
Acacia greggii Gray	25		2 1-5%
Acacia greggii Gray	35		3 5-10%
Acacia greggii Gray	45		3 5-10%
Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth	45		1 <1%
Achnatherum speciosum (Trin. & Rupr.) Barkworth	5		2 1-5%
Achnatherum speciosum (Trin. & Rupr.) Barkworth	25		1 <1%
Achnatherum speciosum (Trin. & Rupr.) Barkworth	35		1 <1%
Achnatherum speciosum (Trin. & Rupr.) Barkworth	45		2 1-5%
Agave utahensis Engelm.	35		1 <1%
Agave utahensis Engelm.	45		2 1-5%
Aristida purpurea Nutt.	5		2 1-5%
Aristida purpurea Nutt.	15		2 1-5%

Aristida purpurea Nutt.	25		2 1-5%
Aristida purpurea Nutt.	35		1 <1%
Artemisia ludoviciana Nutt.	35		1 <1%
Astragalus nuttallianus DC.	5		1 <1%
Astragalus nuttallianus DC.	15		1 <1%
Astragalus nuttallianus DC.	25		1 <1%
Astragalus nuttallianus DC.	35		1 <1%
Astragalus nuttallianus DC.	45		1 <1%
Bebbia juncea (Benth.) Greene var. aspera Greene	25		1 <1%
Bothriochloa barbinodis (Lag.) Herter	5		2 1-5%
Bothriochloa barbinodis (Lag.) Herter	15		2 1-5%
Bothriochloa barbinodis (Lag.) Herter	35		1 <1%
Bouteloua eriopoda (Torr.) Torr.	25		1 <1%
Brickellia longifolia S. Wats.	35		1 <1%
Bromus rubens L.	5		2 1-5%
Bromus rubens L.	15		1 <1%
Bromus rubens L.	25		2 1-5%
Bromus rubens L.	35		2 1-5%
Bromus rubens L.	45		4 10-25%
Cryptantha spp.	15		1 <1%
Cryptantha spp.	25		1 <1%
Cryptantha spp.	45		1 <1%
Cryptobiotic soil	5		1 <1%
Cryptobiotic soil	15		1 <1%
Cryptobiotic soil	25		5 25-50%
Cryptobiotic soil	35		4 10-25%
Cryptobiotic soil	45		5 25-50%
Descurainia pinnata (Walt.) Britt.	5		1 <1%
Descurainia pinnata (Walt.) Britt.	45		1 <1%
Echinocereus engelmannii (Parry ex Engelm.) Lem.	45		1 <1%
Elymus elymoides (Raf.) Swezey	45		1 <1%
Encelia farinosa Gray ex Torr.	15		2 1-5%
Ephedra fasciculata A. Nels.	45		1 <1%
Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird	5		2 1-5%
Erodium cicutarium (L.) L'Hér. ex Ait.	45		1 <1%
Fallugia paradoxa (D. Don) Endl. ex Torr.	25		3 5-10%
Fallugia paradoxa (D. Don) Endl. ex Torr.	35		3 5-10%
Gutierrezia sarothrae (Pursh) Britt. & Rusby	25		2 1-5%
Heterotheca villosa (Pursh) Shinners	15		3 5-10%
Heterotheca villosa (Pursh) Shinners	25		2 1-5%
Heterotheca villosa (Pursh) Shinners	35		2 1-5%
Isocoma acradenia (Greene) Greene	5		4 10-25%
Isocoma acradenia (Greene) Greene	15		4 10-25%
Isocoma acradenia (Greene) Greene	25		4 10-25%
Isocoma acradenia (Greene) Greene	35		4 10-25%
Isocoma acradenia (Greene) Greene	45		5 25-50%
Lepidium lasiocarpum Nutt. var. lasiocarpum	5		1 <1%
Lepidium lasiocarpum Nutt. var. lasiocarpum	15		1 <1%
Lepidium lasiocarpum Nutt. var. lasiocarpum	25		1 <1%
Lepidium lasiocarpum Nutt. var. lasiocarpum	45		1 <1%
Mirabilis bigelovii Gray	5		1 <1%
Mirabilis bigelovii Gray	45		1 <1%
Opuntia basilaris Engelm. & Bigelow	5		1 <1%
Opuntia basilaris Engelm. & Bigelow	35		1 <1%
Opuntia basilaris Engelm. & Bigelow	45		1 <1%
Opuntia phaeacantha Engelm.	25		1 <1%
Phlox longifolia Nutt.	25		1 <1%

Plantago patagonica Jacq.	25		1 <1%
Plantago patagonica Jacq.	35		1 <1%
Pleuraphis jamesii Torr.	35		1 <1%
Poa bigelovii Vasey & Scribn.	5		1 <1%
Poa bigelovii Vasey & Scribn.	35		1 <1%
Poa bigelovii Vasey & Scribn.	45		1 <1%
Porophyllum gracile Benth.	5		1 <1%
Porophyllum gracile Benth.	35		1 <1%
Quercus turbinella Greene	15		3 5-10%
Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.	45		2 1-5%
Sporobolus cryptandrus (Torr.) Gray	5		1 <1%
Sporobolus cryptandrus (Torr.) Gray	15		1 <1%
Sporobolus cryptandrus (Torr.) Gray	25		1 <1%
Sporobolus cryptandrus (Torr.) Gray	35		1 <1%
Sporobolus cryptandrus (Torr.) Gray	45		1 <1%
Stephanomeria pauciflora (Torr.) A. Nels.	5		1 <1%
Stephanomeria pauciflora (Torr.) A. Nels.	25		1 <1%
Stephanomeria pauciflora (Torr.) A. Nels.	35		1 <1%
Stephanomeria pauciflora (Torr.) A. Nels.	45		1 <1%
Thymophylla pentachaeta (DC.) Small	35		1 <1%
Vulpia microstachys	5		1 <1%
Vulpia microstachys	15		1 <1%
Vulpia microstachys	25		2 1-5%
Vulpia microstachys	35		2 1-5%
Vulpia microstachys	45		2 1-5%
Yucca baccata Torr.	15		2 1-5%

Vegetation Structure Data

Species Name	Meters	# of Hits	Height
Vulpia microstachys	25	1	0-1.0
Fallugia paradoxa (D. Don) Endl. ex Torr.	35	9	0-1.0

Soil Data

Meters	Probe depth (cm)	Reading 1	Reading 2	Reading 3	Average Reading
5	6	0.01	0	0	0.00
15	7	0	0	0	0.00
25	5	0	0	0	0.00
35	3	0	0	0	0.00
45	5	0	0	0	0.00

Canyon/Park	**Carbon Canyon**	River mile:	64.7 R
Transect Name:	Carbon Canyon Transect 4	Type:	Tamarisk area
Date:	5/8/2005	Weather:	Blue skies, sunny upper 70-80F
Start point:		End point:	
Easting	424733	Easting	424704
Northing	4001731	Northing	4001692
GPS accuracy (m)	5	GPS accuracy (m)	8
Bearing:	208	Elevation (m):	988
Aspect (0-360):	130	Slope (degrees):	6

Transect description: Transect is on creek right, starting at reddish sandstone boulder. Remaining along creek right, ending near where creek bends ~110degrees. Down creek from forked zone in Carbon drainage.

Geological layer: Supergroup

Habitat type: Riparian Great Basin desert scrub

Dominant species: Bromus rubens L., Tamarix ramosissima Ledeb., Prosopis glandulosa Torr.

Associated species: Stanleya pinnata (Pursh) Britt., Calycoseris parryi Gray, Plantago patagonica Jacq., Descurainia pinnata (Walt.) Britt., Gilia scopulorum M.E. Jones, Acacia greggii Gray, Erodium cicutarium (L.) L'Hér. ex Ait., Lepidium spp., Isocoma acradenia (Greene) Greene, Artemisia ludoviciana Nutt., Cirsium neomexicanum Gray, Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb., Psorothamnus fremontii (Torr. ex Gray) Barneby var. fremontii, Atriplex canescens (Pursh) Nutt., Aster species, Phacelia crenulata Torr. ex S. Wats., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Mirabilis bigelovii Gray, Chaenactis stevioides Hook. & Arn., Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake, Layia glandulosa (Hook.) Hook. & Arn., Sphaeralcea spp.

Surface water within 25 m? Surface water type: stream Surface rocks: sandstone shale

Landform: Side slope Lower slope Light exposure: open

Soil type: sandy loam Soil moisture: moist

Point Intercept Transect (50m)	% Cover
Boulder	2
Cobble	5
Gravel	8
Litter (duff)	71
Sand	55
Stone	3
Acacia greggii Gray	5
Artemisia ludoviciana Nutt.	1
Astragalus spp.	1
Bromus rubens L.	24
Descurainia pinnata (Walt.) Britt.	8
Erodium cicutarium (L.) L'Hér. ex Ait.	23
Prosopis glandulosa Torr.	14
Stanleya pinnata (Pursh) Britt.	1
Tamarix ramosissima Ledeb.	37

Daubenmire Scale Cover Data from 50m Transect

Ground Cover Category	Meters	Cover Scale
Boulder	5	1 <1%
Boulder	15	2 1-5%
Coarse woody debris	5	1 <1%
Coarse woody debris	15	3 5-10%
Coarse woody debris	25	3 5-10%
Coarse woody debris	35	3 5-10%
Cobble	5	3 5-10%
Cobble	45	2 1-5%
Litter (duff)	5	3 5-10%
Litter (duff)	15	3 5-10%
Litter (duff)	35	6 50-75%
Sand	5	7 75-100%
Sand	15	6 50-75%

Sand	25	6 50-75%
Sand	35	4 10-25%
Sand	45	6 50-75%
Stone	15	3 5-10%
Stone	25	1 <1%
Stone	45	1 <1%

Species Name	Meters	Tree Age	Cover Scale
Acacia greggii Gray	25		3 5-10%
Acacia greggii Gray	35		1 <1%
Acacia greggii Gray	45		2 1-5%
Artemisia ludoviciana Nutt.	35		1 <1%
Astragalus spp.	45		1 <1%
Atriplex canescens (Pursh) Nutt.	35		3 5-10%
Atriplex canescens (Pursh) Nutt.	45		3 5-10%
Brickellia microphylla (Nutt.) Gray var. scabra Gray	45		1 <1%
Bromus rubens L.	5		4 10-25%
Bromus rubens L.	15		5 25-50%
Bromus rubens L.	25		4 10-25%
Bromus rubens L.	35		4 10-25%
Bromus rubens L.	45		2 1-5%
Calibrachoa parviflora (Juss.) D'Arcy	25		1 <1%
Calibrachoa parviflora (Juss.) D'Arcy	35		1 <1%
Calibrachoa parviflora (Juss.) D'Arcy	45		1 <1%
Chaenactis stevioides Hook. & Arn.	45		1 <1%
Cirsium neomexicanum Gray	45		1 <1%
Descurainia pinnata (Walt.) Britt.	5		1 <1%
Descurainia pinnata (Walt.) Britt.	15		1 <1%
Descurainia pinnata (Walt.) Britt.	25		2 1-5%
Descurainia pinnata (Walt.) Britt.	35		2 1-5%
Descurainia pinnata (Walt.) Britt.	45		2 1-5%
Encelia spp.	45		1 <1%
Erodium cicutarium (L.) L'Hér. ex Ait.	5		3 5-10%
Erodium cicutarium (L.) L'Hér. ex Ait.	15		1 <1%
Erodium cicutarium (L.) L'Hér. ex Ait.	25		2 1-5%
Erodium cicutarium (L.) L'Hér. ex Ait.	35		1 <1%
Erodium cicutarium (L.) L'Hér. ex Ait.	45		2 1-5%
Gilia scopulorum M.E. Jones	45		1 <1%
Gutierrezia sarothrae (Pursh) Britt. & Rusby	25		1 <1%
Gutierrezia sarothrae (Pursh) Britt. & Rusby	45		1 <1%
Isocoma acradenia (Greene) Greene	25		1 <1%
Layia glandulosa (Hook.) Hook. & Arn.	25		1 <1%
Mirabilis bigelovii Gray	15		1 <1%
Phacelia crenulata Torr. ex S. Wats.	45		1 <1%
Plantago patagonica Jacq.	45		1 <1%
Prosopis glandulosa Torr.	5		5 25-50%
Prosopis glandulosa Torr.	15		4 10-25%
Psorothamnus fremontii (Torr. ex Gray) Barneby var. fremontii	45		1 <1%
Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.	5		1 <1%
Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.	15		1 <1%
Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.	25		1 <1%
Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.	45		2 1-5%
Stanleya pinnata (Pursh) Britt.	45		1 <1%
Tamarix ramosissima Ledeb.	15		6 50-75%
Tamarix ramosissima Ledeb.	35		6 50-75%

Vegetation Structure Data

Species Name	Meters	# of Hits	Height
Bromus rubens L.	5	8	0-1.0
Erodium cicutarium (L.) L'Hér. ex Ait.	5	4	0-1.0
Tamarix ramosissima Ledeb.	15	2	2-3
Tamarix ramosissima Ledeb.	15	4	1-2
Descurainia pinnata (Walt.) Britt.	25	3	0-1.0
Bromus rubens L.	35	3	0-1.0
Tamarix ramosissima Ledeb.	35	2	3-4
Tamarix ramosissima Ledeb.	35	7	2-3
Tamarix ramosissima Ledeb.	35	13	1-2
Tamarix ramosissima Ledeb.	35	13	0-1.0
Bromus rubens L.	45	6	0-1.0

Soil Data

Meters	Probe depth (cm)	Reading 1	Reading 2	Reading 3	Average Reading
5	7.6	0.09	0.09	0.14	0.11
15	3.8	0.2	0.19	0.22	0.20
25	15.2	0.39	0.39	0.39	0.39
35	5.1	5	0.04	0.06	1.70
45	15.2	0.2	0.18	0.17	0.18

Canyon/Park	**Carbon Canyon**	River mile:	64.7 R
Transect Name:	Carbon Canyon Transect 4	Type:	Reference
Date:	5/8/2005	Weather:	Blue sky, breezy
Start point:		End point:	
Easting	424724	Easting	424731
Northing	4001642	Northing	4001596
GPS accuracy (m)	2	GPS accuracy (m)	4
Bearing:	169	Elevation (m):	898
Aspect (0-360):	83	Slope (degrees):	19

Transect description: About 1km above where trail forks to Lava Chuar. Also down canyon from where three forks converge. Transect is on creek right 50m downcanyon from T4A.

Geological layer: Supergroup

Habitat type: Riparian Great Basin desert scrub

Dominant species: Atriplex canescens (Pursh) Nutt., Prosopis glandulosa Torr., Bromus rubens L.

Associated species: Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb., Artemisia ludoviciana Nutt., Stanleya pinnata (Pursh) Britt., Phacelia crenulata Torr. ex S. Wats., Descurainia pinnata (Walt.) Britt., Lycium spp., Schismus spp., Erodium cicutarium (L.) L'Hér. ex Ait., Chaenactis stevioides Hook. & Arn., Psorothamnus fremontii (Torr. ex Gray) Barneby var. attenuatus Barneby, Isocoma acradenia (Greene) Greene, Acacia greggii Gray, Gutierrezia sarothrae (Pursh) Britt. & Rusby, Pleuraphis jamesii Torr., Gilia stellata Heller

Surface water within 25 m? Surface water type: stream Surface rocks: sandstone shale

Landform: Lower slope Light exposure: partial-shade

Soil type: sandy loam Soil moisture: dry

Point Intercept Transect (50m)	% Cover
Coarse woody debris	2
Litter (duff)	85
Sand	33
Acacia greggii Gray	10
Atriplex canescens (Pursh) Nutt.	15
Brickellia spp.	2
Bromus rubens L.	34
Descurainia pinnata (Walt.) Britt.	42
Erodium cicutarium (L.) L'Hér. ex Ait.	6
Gutierrezia sarothrae (Pursh) Britt. & Rusby	2
Lepidium perfoliatum L.	1
Lycium spp.	4
Prosopis glandulosa Torr.	32
Psorothamnus fremontii (Torr. ex Gray) Barneby var. attenuatus Barneby	1
Schismus spp.	9
Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.	3
Stanleya pinnata (Pursh) Britt.	4

Daubenmire Scale Cover Data from 50m Transect

Ground Cover Category	Meters	Cover Scale
Cobble	5	1 <1%
Cobble	15	1 <1%
Gravel	5	1 <1%
Gravel	15	2 1-5%
Litter (duff)	5	5 25-50%
Litter (duff)	15	5 25-50%
Sand	5	5 25-50%
Sand	15	5 25-50%
Woody debris structure	5	1 <1%
Woody debris structure	15	1 <1%

Species Name	Meters	Tree Age	Cover Scale
Acacia greggii Gray	15		3 5-10%
Acacia greggii Gray	45		1 <1%

Artemisia ludoviciana Nutt.	5		1 <1%
Atriplex canescens (Pursh) Nutt.	5		3 5-10%
Atriplex canescens (Pursh) Nutt.	15		3 5-10%
Atriplex canescens (Pursh) Nutt.	25		2 1-5%
Atriplex canescens (Pursh) Nutt.	35		2 1-5%
Atriplex canescens (Pursh) Nutt.	45		3 5-10%
Bromus rubens L.	5		4 10-25%
Bromus rubens L.	15		4 10-25%
Bromus rubens L.	25		5 25-50%
Bromus rubens L.	35		4 10-25%
Bromus rubens L.	45		4 10-25%
Chaenactis stevioides Hook. & Arn.	15		1 <1%
Chaenactis stevioides Hook. & Arn.	45		1 <1%
Descurainia pinnata (Walt.) Britt.	5		1 <1%
Descurainia pinnata (Walt.) Britt.	15		2 1-5%
Descurainia pinnata (Walt.) Britt.	25		3 5-10%
Descurainia pinnata (Walt.) Britt.	35		2 1-5%
Descurainia pinnata (Walt.) Britt.	45		2 1-5%
Erodium cicutarium (L.) L'Hér. ex Ait.	35		1 <1%
Erodium cicutarium (L.) L'Hér. ex Ait.	45		1 <1%
Gilia stellata Heller	45		1 <1%
Gutierrezia sarothrae (Pursh) Britt. & Rusby	25		1 <1%
Isocoma acradenia (Greene) Greene	15		1 <1%
Lepidium spp.	5		1 <1%
Lepidium spp.	15		1 <1%
Lepidium spp.	25		1 <1%
Lepidium spp.	35		1 <1%
Lepidium spp.	45		1 <1%
Lycium spp.	35		1 <1%
Phacelia crenulata Torr. ex S. Wats.	15		1 <1%
Phacelia crenulata Torr. ex S. Wats.	25		1 <1%
Phacelia crenulata Torr. ex S. Wats.	35		1 <1%
Pleuraphis jamesii Torr.	25		1 <1%
Prosopis glandulosa Torr.	25		7 75-100%
Prosopis glandulosa Torr.	35		4 10-25%
Prosopis glandulosa Torr.	45		5 25-50%
Psorothamnus fremontii (Torr. ex Gray) Barneby var. attenuatus Barneby	15		1 <1%
Psorothamnus fremontii (Torr. ex Gray) Barneby var. attenuatus Barneby	45		1 <1%
Schismus spp.	5		1 <1%
Schismus spp.	25		1 <1%
Schismus spp.	35		1 <1%
Schismus spp.	45		1 <1%
Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.	15		2 1-5%
Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.	35		2 1-5%
Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.	45		2 1-5%
Stanleya pinnata (Pursh) Britt.	5		1 <1%
Stanleya pinnata (Pursh) Britt.	25		1 <1%
Suaeda moquinii (Torr.) Greene	5		3 5-10%

Vegetation Structure Data

Species Name	Meters	# of Hits	Height
Atriplex canescens (Pursh) Nutt.	15	8	0-1.0
Descurainia pinnata (Walt.) Britt.	15	6	0-1.0
Gutierrezia spp.	25	7	0-1.0
Prosopis glandulosa Torr.	25	3	0-1.0
Prosopis glandulosa Torr.	25	5	3-4
Prosopis glandulosa Torr.	25	7	2-3
Prosopis glandulosa Torr.	25	9	1-2
Prosopis glandulosa Torr.	25	12	4-5
Bromus rubens L.	35	2	0-1.0
Descurainia pinnata (Walt.) Britt.	35	6	0-1.0
Prosopis glandulosa Torr.	35	3	2-3
Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.	35	1	0-1.0
Bromus rubens L.	45	1	0-1.0
Descurainia pinnata (Walt.) Britt.	45	5	0-1.0
Prosopis glandulosa Torr.	45	9	1-2
Prosopis glandulosa Torr.	45	15	0-1.0

Soil Data

Meters	Probe depth (cm)	Reading 1	Reading 2	Reading 3	Average Reading
5	15	0.13	0.19	0.21	0.18
15	15	0.07	0.02	0.08	0.06
25	10	0.24	0.22	0.2	0.22
35	11	0.16	0.09	0.16	0.14
45	11	0.08	0.1	0.09	0.09

Canyon/Park	**Carbon Canyon**	River mile:	64.7 R
Transect Name:	Carbon Canyon Transect 5	Type:	Tamarisk area
Date:	5/9/2005	Weather:	Sunny, partly cloudy, breezy, hot
Start point:		End point:	
Easting	424783	Easting	424792
Northing	4002075	Northing	4002036
GPS accuracy (m)	6	GPS accuracy (m)	6
Bearing:	170	Elevation (m):	1026
Aspect (0-360):	235	Slope (degrees):	6

Transect description: Near the confluence of east and west branches of carbon, about 100 meters up east branch.

Geological layer: Supergroup

Habitat type: Riparian Great Basin desert scrub

Dominant species: Prosopis glandulosa Torr., Tamarix ramosissima Ledeb., Bromus rubens L.

Associated species: Erodium cicutarium (L.) L'Hér. ex Ait., Descurainia pinnata (Walt.) Britt., Dasyochloa pulchella (Kunth) Willd. ex Rydb., Acacia greggii Gray, Cryptantha maritima (Greene) Greene, Artemisia ludoviciana Nutt., Stanleya pinnata (Pursh) Britt., Camissonia walkeri (A. Nels.) Raven, Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb., Bromus tectorum L., Plantago patagonica Jacq., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Isocoma acradenia (Greene) Greene, Sporobolus cryptandrus (Torr.) Gray, Draba cuneifolia Nutt. ex Torr. & Gray, Linanthus bigelovii (Gray) Greene, Thymophylla pentachaeta (DC.) Small, Lepidium spp., Stephanomeria pauciflora (Torr.) A. Nels., Gilia stellata Heller, Vulpia octoflora, Phacelia crenulata Torr. ex S. Wats., Atriplex canescens (Pursh) Nutt., Silene antirrhina L., Tiquilia latior (I.M. Johnston) A. Richards., Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake

Surface water within 25 m? Surface water type: stream Surface rocks: sandstone shale

Landform: Lower slope Light exposure: open

Soil type: sandy loam Soil moisture: moist

Point Intercept Transect (50m)	% Cover
Bare Soil	37
Boulder	4
Cobble	2
Gravel	16
Litter (duff)	52
Sand	18
Stone	13
Artemisia ludoviciana Nutt.	1
Bromus rubens L.	7
Isocoma acradenia (Greene) Greene	2
Lepidium spp.	1
Plantago patagonica Jacq.	1
Prosopis glandulosa Torr.	7
Stanleya pinnata (Pursh) Britt.	2
Tamarix ramosissima Ledeb.	58

Daubenmire Scale Cover Data from 50m Transect

Ground Cover Category	Meters	Cover Scale
Bare Soil	15	1 <1%
Bare Soil	25	1 <1%
Bare Soil	35	1 <1%
Boulder	5	3 5-10%
Boulder	15	3 5-10%
Cobble	5	3 5-10%
Cobble	15	2 1-5%
Cobble	25	3 5-10%
Cobble	35	1 <1%
Gravel	5	5 25-50%
Gravel	15	3 5-10%
Gravel	25	6 50-75%
Gravel	35	1 <1%

Litter (duff)	5	2 1-5%
Litter (duff)	15	2 1-5%
Litter (duff)	25	4 10-25%
Litter (duff)	35	4 10-25%
Sand	5	5 25-50%
Sand	15	5 25-50%
Sand	25	4 10-25%
Sand	35	2 1-5%
Stone	5	3 5-10%
Stone	15	3 5-10%
Stone	25	4 10-25%
Stone	35	1 <1%
Woody debris structure	5	2 1-5%
Woody debris structure	15	2 1-5%
Woody debris structure	25	2 1-5%
Woody debris structure	35	2 1-5%

Species Name	Meters	Tree Age	Cover Scale
Acacia greggii Gray	45		1 <1%
Artemisia ludoviciana Nutt.	5		1 <1%
Atriplex canescens (Pursh) Nutt.	45		1 <1%
Bromus rubens L.	5		1 <1%
Bromus rubens L.	15		2 1-5%
Bromus rubens L.	25		3 5-10%
Bromus rubens L.	35		2 1-5%
Bromus rubens L.	45		3 5-10%
Bromus tectorum L.	25		1 <1%
Camissonia walkeri (A. Nels.) Raven	45		1 <1%
Cryptantha maritima (Greene) Greene	15		1 <1%
Cryptantha maritima (Greene) Greene	35		1 <1%
Cryptantha maritima (Greene) Greene	45		1 <1%
Dasyochloa pulchella (Kunth) Willd. ex Rydb.	5		1 <1%
Descurainia pinnata (Walt.) Britt.	15		1 <1%
Descurainia pinnata (Walt.) Britt.	25		1 <1%
Descurainia pinnata (Walt.) Britt.	35		1 <1%
Descurainia pinnata (Walt.) Britt.	45		1 <1%
Draba cuneifolia Nutt. ex Torr. & Gray	15		1 <1%
Draba cuneifolia Nutt. ex Torr. & Gray	45		1 <1%
Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake	5		1 <1%
Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake	15		1 <1%
Encelia spp.	5		1 <1%
Encelia spp.	15		1 <1%
Erodium cicutarium (L.) L'Hér. ex Ait.	15		1 <1%
Gutierrezia sarothrae (Pursh) Britt. & Rusby	15		1 <1%
Isocoma acradenia (Greene) Greene	5		2 1-5%
Isocoma acradenia (Greene) Greene	15		3 5-10%
Lepidium spp.	15		1 <1%
Lepidium spp.	25		1 <1%
Lepidium spp.	35		1 <1%
Lepidium spp.	45		1 <1%
Linanthus bigelovii (Gray) Greene	15		1 <1%
Phacelia crenulata Torr. ex S. Wats.	45		1 <1%
Plantago patagonica Jacq.	5		1 <1%
Plantago patagonica Jacq.	15		1 <1%

Plantago patagonica Jacq.	25		1 <1%
Plantago patagonica Jacq.	35		1 <1%
Plantago patagonica Jacq.	45		1 <1%
Prosopis glandulosa Torr.	15		5 25-50%
Prosopis glandulosa Torr.	25		4 10-25%
Silene antirrhina L.	45		1 <1%
Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.	5		1 <1%
Sporobolus cryptandrus (Torr.) Gray	15		1 <1%
Stanleya pinnata (Pursh) Britt.	15		2 1-5%
Stanleya pinnata (Pursh) Britt.	25		1 <1%
Stanleya pinnata (Pursh) Britt.	35		1 <1%
Stanleya pinnata (Pursh) Britt.	45		2 1-5%
Stephanomeria pauciflora (Torr.) A. Nels.	25		1 <1%
Tamarix ramosissima Ledeb.	5		4 10-25%
Tamarix ramosissima Ledeb.	25		6 50-75%
Tamarix ramosissima Ledeb.	35		6 50-75%
Tamarix ramosissima Ledeb.	45		5 25-50%
Thymophylla pentachaeta (DC.) Small	5		1 <1%
Tiquilia latior (I.M. Johnston) A. Richards.	5		1 <1%

Vegetation Structure Data

Species Name	Meters	# of Hits	Height
Prosopis glandulosa Torr.	15	2	1-2
Prosopis glandulosa Torr.	15	5	0-1.0
Tamarix ramosissima Ledeb.	25	6	2-3
Tamarix ramosissima Ledeb.	35	4	3-4
Tamarix ramosissima Ledeb.	35	6	0-1.0
Tamarix ramosissima Ledeb.	35	7	1-2
Tamarix ramosissima Ledeb.	35	15	2-3
Tamarix ramosissima Ledeb.	45	2	3-4
Tamarix ramosissima Ledeb.	45	7	1-2
Tamarix ramosissima Ledeb.	45	7	2-3
Tamarix ramosissima Ledeb.	45	7	0-1.0

Soil Data

Meters	Probe depth (cm)	Reading 1	Reading 2	Reading 3	Average Reading
5	8	0.22	0.26	0.22	0.23
15	15	0.59	0.64	0.65	0.63
25	15	0.78	0.82	0.8	0.80
35	15	0.13	0.15	0.15	0.14
45	15	0.41	0.62	0.53	0.52

Canyon/Park	**Carbon Canyon**	River mile:	64.7 R
Transect Name:	Carbon Canyon Transect 5	Type:	Reference
Date:	5/9/2005	Weather:	Windy, sunny/partly cloudy, hot
Start point:		End point:	
Easting	424809	Easting	0
Northing	4002120	Northing	0
GPS accuracy (m)		GPS accuracy (m)	
Bearing:	205	Elevation (m):	1030
Aspect (0-360):	280	Slope (degrees):	4

Transect description: Start point is about 50m up canyon from start point of 5A. ~0.5m from base of ACAGRE on a pile of three huge boulders. Start is on the 5x4m boulder just across creek from 2 stromatalites. On creek left ~4m from center of channel. End of 5B just farther stream left (5m) than start of 5A - they almost overlap.

Geological layer: Supergroup

Habitat type: Riparian Great Basin desert scrub

Dominant species: Prosopis glandulosa Torr., Atriplex canescens (Pursh) Nutt., Bromus rubens L.

Associated species: Stephanomeria exigua Nutt., Stanleya pinnata (Pursh) Britt., Camissonia walkeri (A. Nels.) Raven, Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb., Thymophylla pentachaeta (DC.) Small, Erodium cicutarium (L.) L'Hér. ex Ait., Sporobolus cryptandrus (Torr.) Gray, Descurainia pinnata (Walt.) Britt., Vulpia octoflora, Gutierrezia sarothrae (Pursh) Britt. & Rusby, Cirsium neomexicanum Gray, Erigeron spp., Draba cuneifolia Nutt. ex Torr. & Gray, Artemisia ludoviciana Nutt., Mammillaria spp., Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth, Moss spp., Dasyochloa pulchella (Kunth) Willd. ex Rydb., Silene antirrhina L., Hesperostipa spp., Lycium spp., Atriplex canescens (Pursh) Nutt., Lappula redowski, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Eucrypta micrantha (Torr.) Heller, Cryptantha pterocarya (Torr.) Greene, Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake, Cryptantha spp., Aristida spp., Camissonia spp., Linanthus bigelovii (Gray) Greene, Plantago patagonica Jacq., Lepidium spp., Acacia greggii Gray, Isocoma acradenia (Greene) Greene, Schismus spp., Encelia farinosa Gray ex Torr., Cryptantha barbigera (Gray) Greene

Surface water within 25 m? Surface water type: stream Surface rocks: sandstone other

Landform: Lower slope Light exposure: open

Soil type: sandy loam Soil moisture: dry

Point Intercept Transect (50m)	% Cover
Bare Soil	19
Boulder	8
Cobble	3
Gravel	14
Litter (duff)	53
Sand	19
Stone	12
Acacia greggii Gray	4
Atriplex canescens (Pursh) Nutt.	1
Bromus rubens L.	17
Cryptantha barbigera (Gray) Greene	1
Descurainia pinnata (Walt.) Britt.	5
Hesperostipa spp.	1
Isocoma acradenia (Greene) Greene	5
Lepidium spp.	1
Moss	1
Plantago patagonica Jacq.	1
Prosopis glandulosa Torr.	30
Schismus spp.	1
Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.	2
Stanleya pinnata (Pursh) Britt.	5

Daubenmire Scale Cover Data from 50m Transect

Ground Cover Category	Meters	Cover Scale
Boulder	5	2 1-5%
Boulder	15	3 5-10%
Boulder	25	2 1-5%
Boulder	35	2 1-5%
Boulder	45	3 5-10%
Coarse woody debris	5	2 1-5%
Coarse woody debris	15	2 1-5%

Coarse woody debris	25	1 <1%
Coarse woody debris	35	2 1-5%
Coarse woody debris	45	2 1-5%
Cobble	5	3 5-10%
Cobble	15	2 1-5%
Cobble	25	1 <1%
Cobble	35	2 1-5%
Cobble	45	4 10-25%
Gravel	5	4 10-25%
Gravel	15	4 10-25%
Gravel	25	4 10-25%
Gravel	35	3 5-10%
Gravel	45	5 25-50%
Litter (duff)	5	2 1-5%
Litter (duff)	15	4 10-25%
Litter (duff)	25	5 25-50%
Litter (duff)	35	5 25-50%
Litter (duff)	45	2 1-5%
Sand	5	5 25-50%
Sand	15	4 10-25%
Sand	25	4 10-25%
Sand	35	5 25-50%
Sand	45	3 5-10%
Stone	5	2 1-5%
Stone	15	3 5-10%
Stone	25	1 <1%
Stone	35	3 5-10%
Stone	45	4 10-25%

Species Name	Meters	Tree Age	Cover Scale
Acacia greggii Gray	5		3 5-10%
Acacia greggii Gray	45		2 1-5%
Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth	35		1 <1%
Aristida spp.	5		1 <1%
Aristida spp.	15		1 <1%
Aristida spp.	45		1 <1%
Artemisia ludoviciana Nutt.	5		1 <1%
Artemisia ludoviciana Nutt.	35		1 <1%
Astragalus spp.	5		1 <1%
Atriplex canescens (Pursh) Nutt.	5		1 <1%
Atriplex canescens (Pursh) Nutt.	15		2 1-5%
Atriplex canescens (Pursh) Nutt.	25		1 <1%
Atriplex canescens (Pursh) Nutt.	35		1 <1%
Atriplex canescens (Pursh) Nutt.	45		1 <1%
Bromus rubens L.	5		1 <1%
Bromus rubens L.	15		1 <1%
Bromus rubens L.	25		5 25-50%
Bromus rubens L.	35		5 25-50%
Bromus rubens L.	45		2 1-5%
Camissonia walkeri (A. Nels.) Raven	15		1 <1%
Cirsium neomexicanum Gray	15		1 <1%
Cryptantha barbigera (Gray) Greene	25		1 <1%

Cryptantha maritima (Greene) Greene	35		1 <1%
Cryptantha pterocarya (Torr.) Greene	15		1 <1%
Cryptantha spp.	5		1 <1%
Cryptantha spp.	25		1 <1%
Cryptantha spp.	45		1 <1%
Dasyochloa pulchella (Kunth) Willd. ex Rydb.	45		1 <1%
Descurainia pinnata (Walt.) Britt.	5		1 <1%
Descurainia pinnata (Walt.) Britt.	15		2 1-5%
Descurainia pinnata (Walt.) Britt.	25		3 5-10%
Descurainia pinnata (Walt.) Britt.	35		4 10-25%
Draba cuneifolia Nutt. ex Torr. & Gray	35		1 <1%
Encelia spp.	5		1 <1%
Encelia spp.	45		2 1-5%
Erigeron spp.	5		1 <1%
Erigeron spp.	15		1 <1%
Erodium cicutarium (L.) L'Hér. ex Ait.	5		1 <1%
Erodium cicutarium (L.) L'Hér. ex Ait.	15		1 <1%
Erodium cicutarium (L.) L'Hér. ex Ait.	25		1 <1%
Erodium cicutarium (L.) L'Hér. ex Ait.	45		1 <1%
Gutierrezia sarothrae (Pursh) Britt. & Rusby	5		1 <1%
Gutierrezia sarothrae (Pursh) Britt. & Rusby	15		1 <1%
Gutierrezia sarothrae (Pursh) Britt. & Rusby	35		1 <1%
Gutierrezia sarothrae (Pursh) Britt. & Rusby	45		2 1-5%
Hesperostipa spp.	5		1 <1%
Hesperostipa spp.	45		1 <1%
Isocoma acradenia (Greene) Greene	5		4 10-25%
Isocoma acradenia (Greene) Greene	15		1 <1%
Isocoma acradenia (Greene) Greene	25		1 <1%
Isocoma acradenia (Greene) Greene	35		1 <1%
Isocoma acradenia (Greene) Greene	45		3 5-10%
Lappula redowski	25		1 <1%
Lappula redowski	35		1 <1%
Lepidium spp.	5		1 <1%
Lepidium spp.	15		1 <1%
Lepidium spp.	25		1 <1%
Lepidium spp.	35		1 <1%
Lepidium spp.	45		1 <1%
Linanthus bigelovii (Gray) Greene	5		1 <1%
Linanthus bigelovii (Gray) Greene	15		1 <1%
Linanthus bigelovii (Gray) Greene	35		1 <1%
Lycium spp.	45		1 <1%
Mammillaria spp.	45		1 <1%
Mirabilis bigelovii Gray	45		1 <1%
Plantago patagonica Jacq.	5		1 <1%
Plantago patagonica Jacq.	15		1 <1%
Plantago patagonica Jacq.	35		1 <1%
Plantago patagonica Jacq.	45		2 1-5%
Prosopis glandulosa Torr.	15	M Mature	3 5-10%
Prosopis glandulosa Torr.	25	M Mature	5 25-50%
Prosopis glandulosa Torr.	35	M Mature	5 25-50%
Silene antirrhina L.	35		1 <1%
Silene antirrhina L.	45		1 <1%
Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.	5		1 <1%
Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.	45		2 1-5%
Sporobolus cryptandrus (Torr.) Gray	5		1 <1%
Stanleya pinnata (Pursh) Britt.	25		2 1-5%
Stanleya pinnata (Pursh) Britt.	35		1 <1%

Stephanomeria exigua Nutt.	15		1 <1%
Thymophylla pentachaeta (DC.) Small	45		1 <1%
Vulpia octoflora	5		1 <1%
Vulpia octoflora	15		1 <1%
Vulpia octoflora	25		1 <1%
Vulpia octoflora	35		1 <1%
Vulpia octoflora	45		1 <1%

Vegetation Structure Data

Species Name	Meters	# of Hits	Height
Acacia greggii Gray	5	2	0-1.0
Prosopis glandulosa Torr.	25	1	1-2
Prosopis glandulosa Torr.	25	2	0-1.0
Bromus rubens L.	35	5	0-1.0
Descurainia pinnata (Walt.) Britt.	35	1	0-1.0
Prosopis glandulosa Torr.	35	1	2-3
Prosopis glandulosa Torr.	35	2	0-1.0
Prosopis glandulosa Torr.	35	3	1-2
Bromus rubens L.	45	2	0-1.0
Isocoma acradenia (Greene) Greene	45	4	0-1.0
Vulpia octoflora	45	3	0-1.0

Soil Data

Meters	Probe depth (cm)	Reading 1	Reading 2	Reading 3	Average Reading
5	0.01	0	0	0	0.00
15	5	0.15	0.16	0.15	0.15
25	15	0.35	0.18	0.2	0.24
35	13	0.03	0.03	0.04	0.03
45	11	0.03	0.02	0.02	0.02

Canyon/Park	**Crystal Canyon**	River mile:	99 R
Transect Name:	Crystal Creek Transect 1	Type:	Tamarisk area
Date:	5/12/2005	Weather:	Warm, sunny 10% clouds
Start point:		End point:	
Easting	388641	Easting	388631
Northing	3999939	Northing	3999925
GPS accuracy (m)	10	GPS accuracy (m)	10
Bearing:	0	Elevation (m):	897
Aspect (0-360):	96	Slope (degrees):	3

Transect description: Up canyon ~200m from T1B at end of 125m stretch.

Geological layer: Schist

Habitat type: Riparian Mojave desert scrub

Dominant species: Isocoma acradenia (Greene) Greene, Tamarix ramosissima Ledeb.

Associated species: Encelia farinosa Gray ex Torr., Cryptantha barbigera (Gray) Greene, Bromus rubens L., Erodium cicutarium (L.) L'Hér. ex Ait., Plantago patagonica Jacq., Vulpia microstachys, Galium aparine L., Lepidium lasiocarpum Nutt. var. lasiocarpum, Pectocarya recurvata I.M. Johnston, Poa bigelovii Vasey & Scribn., Sporobolus cryptandrus (Torr.) Gray, Mirabilis bigelovii Gray, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Eragrostis cilianensis (All.) Vign. ex Janchen, Stylocline micropoides Gray, Pseudognaphalium chilense, Cryptantha maritima (Greene) Greene, Iva acerosa (Nutt.) R.C. Jackson, Cryptobiotic soil, Acacia greggii Gray, Typha latifolia L., Baccharis emoryi Gray, Mammillaria grahamii Engelm. var. grahamii

Surface water within 25 m? Surface water type: stream Surface rocks: other

Landform: Drainage channel Light exposure: open

Soil type: sand Soil moisture: moist

Point Intercept Transect (50m)	% Cover
Boulder	19
Cobble	5
Gravel	6
Litter (duff)	25
Sand	67
Stone	11
Isocoma acradenia (Greene) Greene	13
Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	2
Plantago patagonica Jacq.	1
Tamarix ramosissima Ledeb.	32

Daubenmire Scale Cover Data from 50m Transect

Ground Cover Category	Meters	Cover Scale
Bedrock	5	1 <1%
Bedrock	15	0 <0%
Bedrock	25	0 <0%
Bedrock	35	0 <0%
Bedrock	45	0 <0%
Boulder	5	2 1-5%
Boulder	15	2 1-5%
Boulder	25	3 5-10%
Boulder	35	3 5-10%
Boulder	45	3 5-10%
Coarse woody debris	15	3 5-10%
Coarse woody debris	25	1 <1%
Coarse woody debris	35	2 1-5%
Coarse woody debris	45	1 <1%
Cobble	5	2 1-5%
Cobble	15	2 1-5%
Cobble	25	2 1-5%
Cobble	35	2 1-5%

Cobble	45	3 5-10%
Gravel	5	2 1-5%
Gravel	15	2 1-5%
Gravel	25	3 5-10%
Gravel	35	4 10-25%
Gravel	45	3 5-10%
Litter (duff)	5	3 5-10%
Litter (duff)	15	3 5-10%
Litter (duff)	25	3 5-10%
Litter (duff)	35	4 10-25%
Litter (duff)	45	2 1-5%
Sand	5	5 25-50%
Sand	15	6 50-75%
Sand	25	5 25-50%
Sand	35	4 10-25%
Sand	45	4 10-25%
Stone	5	5 25-50%
Stone	15	3 5-10%
Stone	25	4 10-25%
Stone	35	4 10-25%
Stone	45	3 5-10%

Species Name	Meters	Tree Age	Cover Scale
Acacia greggii Gray	5	M Mature	2 1-5%
Baccharis emoryi Gray	45		3 5-10%
Bromus rubens L.	5		1 <1%
Bromus rubens L.	15		1 <1%
Bromus rubens L.	25		1 <1%
Bromus rubens L.	35		2 1-5%
Bromus rubens L.	45		1 <1%
Cryptantha barbigera (Gray) Greene	15		1 <1%
Cryptantha barbigera (Gray) Greene	35		1 <1%
Cryptantha barbigera (Gray) Greene	45		1 <1%
Cryptantha maritima (Greene) Greene	5		1 <1%
Cryptantha maritima (Greene) Greene	25		1 <1%
Cryptantha maritima (Greene) Greene	35		1 <1%
Cryptobiotic soil	15		1 <1%
Cryptobiotic soil	25		1 <1%
Cryptobiotic soil	35		1 <1%
Cryptobiotic soil	45		1 <1%
Encelia farinosa Gray ex Torr.	5		1 <1%
Encelia farinosa Gray ex Torr.	15		0 <0%
Encelia farinosa Gray ex Torr.	25		1 <1%
Encelia farinosa Gray ex Torr.	35		1 <1%
Encelia farinosa Gray ex Torr.	45		0 <0%
Eragrostis cilianensis (All.) Vign. ex Janchen	35		1 <1%
Eragrostis cilianensis (All.) Vign. ex Janchen	45		1 <1%
Erodium cicutarium (L.) L'Hér. ex Ait.	25		1 <1%
Isocoma acradenia (Greene) Greene	5		3 5-10%
Isocoma acradenia (Greene) Greene	15		4 10-25%
Isocoma acradenia (Greene) Greene	25		4 10-25%
Isocoma acradenia (Greene) Greene	35		5 25-50%
Isocoma acradenia (Greene) Greene	45		3 5-10%

Lepidium lasiocarpum Nutt. var. lasiocarpum	5		1 <1%
Lepidium lasiocarpum Nutt. var. lasiocarpum	15		1 <1%
Lepidium lasiocarpum Nutt. var. lasiocarpum	25		1 <1%
Lepidium lasiocarpum Nutt. var. lasiocarpum	35		1 <1%
Lepidium lasiocarpum Nutt. var. lasiocarpum	45		1 <1%
Mammillaria grahamii Engelm. var. grahamii	35		1 <1%
Mirabilis bigelovii Gray	35		1 <1%
Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	5		1 <1%
Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	15		1 <1%
Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	25		1 <1%
Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	35		2 1-5%
Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	45		3 5-10%
Pectocarya recurvata I.M. Johnston	25		1 <1%
Plantago patagonica Jacq.	5		1 <1%
Plantago patagonica Jacq.	15		1 <1%
Plantago patagonica Jacq.	25		1 <1%
Plantago patagonica Jacq.	35		1 <1%
Plantago patagonica Jacq.	45		1 <1%
Poa bigelovii Vasey & Scribn.	45		1 <1%
Pseudognaphalium chilense	5		1 <1%
Pseudognaphalium chilense	15		1 <1%
Pseudognaphalium chilense	25		1 <1%
Sporobolus cryptandrus (Torr.) Gray	35		1 <1%
Sporobolus cryptandrus (Torr.) Gray	45		1 <1%
Stylocline micropoides Gray	35		1 <1%
Stylocline micropoides Gray	45		1 <1%
Tamarix ramosissima Ledeb.	5	P Sapling	2 1-5%
Tamarix ramosissima Ledeb.	15	P Sapling	3 5-10%
Tamarix ramosissima Ledeb.	25	P Sapling	3 5-10%
Tamarix ramosissima Ledeb.	35	P Sapling	4 10-25%
Tamarix ramosissima Ledeb.	45	P Sapling	2 1-5%
Typha latifolia L.	15		1 <1%
Vulpia microstachys	5		1 <1%
Vulpia microstachys	15		1 <1%
Vulpia microstachys	25		1 <1%
Vulpia microstachys	35		1 <1%
Vulpia microstachys	45		1 <1%

Vegetation Structure Data

Species Name	Meters	# of Hits	Height
Tamarix ramosissima Ledeb.	35	2	0-1.0
Tamarix ramosissima Ledeb.	35	3	1-2

Soil Data

Meters	Probe depth (cm)	Reading 1	Reading 2	Reading 3	Average Reading
5	3	0.07	0.09	0.11	0.09
15	15	0	0	0	0.00
25	15	0	0.02	0.02	0.01
35	15	0	0	0	0.00
45	4	0.45	0.44	0.49	0.46

Canyon/Park	**Crystal Canyon**	River mile:	99 R
Transect Name:	Crystal Creek Transect 1	Type:	Reference
Date:	5/12/2005	Weather:	Clear sky, light wind, 83F
Start point:		End point:	
Easting	388641	Easting	388631
Northing	3999939	Northing	3999925
GPS accuracy (m)	10	GPS accuracy (m)	10
Bearing:	219	Elevation (m):	897
Aspect (0-360):	142	Slope (degrees):	6

Transect description: Transect is ~650m up canyon from river, just as canyon narrows and becomes less densely vegetated.

Geological layer:

Habitat type: Riparian Mojave desert scrub

Dominant species: Tamarix ramosissima Ledeb., Encelia farinosa Gray ex Torr., Pluchea sericea (Nutt.) Coville

Associated species: Thymophylla pentachaeta (DC.) Small, Cryptantha spp., Plantago patagonica Jacq., Vulpia microstachys, Bebbia juncea (Benth.) Greene var. aspera Greene, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Bromus rubens L., Poa bigelovii Vasey & Scribn., Typha latifolia L., Moss spp., Descurainia pinnata (Walt.) Britt., Stylocline micropoides Gray, Baccharis emoryi Gray, Porophyllum gracile Benth., Artemisia ludoviciana Nutt., Aristida purpurea Nutt., Ephedra fasciculata A. Nels., Ayenia filiformis, Dasyochloa pulchella (Kunth) Willd. ex Rydb., Eragrostis cilianensis (All.) Vign. ex Janchen, Opuntia basilaris Engelm. & Bigelow var. longiareolata (Clover & Jotter) L. Benson, Mammillaria grahamii Engelm. var. grahamii, Pseudognaphalium chilense, Salix exigua Nutt., Mirabilis bigelovii Gray, Eriogonum inflatum Torr. & Frém., Silene antirrhina L., Cryptantha barbigera (Gray) Greene

Surface water within 25 m? Surface water type: stream Surface rocks: schist

Landform: Drainage channel Side slope Light exposure: open

Soil type: sandy loam Soil moisture: dry

Point Intercept Transect (50m)	% Cover
Boulder	2
Cobble	21
Gravel	12
Litter (duff)	27
Sand	44
Stone	12
Bromus rubens L.	4
Cryptantha barbigera (Gray) Greene	2
Cryptobiotic soil	2
Encelia farinosa Gray ex Torr.	6
Ephedra fasciculata A. Nels.	3
Pluchea sericea (Nutt.) Coville	30
Tamarix ramosissima Ledeb.	11
Vulpia microstachys	4

Daubenmire Scale Cover Data from 50m Transect

Ground Cover Category	Meters	Cover Scale
Bare Soil	5	1 <1%
Bare Soil	15	2 1-5%
Bare Soil	25	1 <1%
Bare Soil	35	1 <1%
Bare Soil	45	1 <1%
Bedrock	5	3 5-10%
Bedrock	15	5 25-50%
Bedrock	25	3 5-10%
Bedrock	35	3 5-10%
Bedrock	45	4 10-25%
Boulder	5	3 5-10%
Boulder	15	1 <1%
Boulder	25	2 1-5%
Boulder	35	2 1-5%

Boulder	45	3 5-10%
Coarse woody debris	5	1 <1%
Coarse woody debris	15	1 <1%
Coarse woody debris	25	2 1-5%
Coarse woody debris	35	2 1-5%
Coarse woody debris	45	2 1-5%
Cobble	5	3 5-10%
Cobble	15	2 1-5%
Cobble	25	3 5-10%
Cobble	35	4 10-25%
Cobble	45	3 5-10%
Gravel	5	3 5-10%
Gravel	15	2 1-5%
Gravel	25	3 5-10%
Gravel	35	2 1-5%
Gravel	45	2 1-5%
Litter (duff)	5	3 5-10%
Litter (duff)	15	3 5-10%
Litter (duff)	25	4 10-25%
Litter (duff)	35	3 5-10%
Litter (duff)	45	4 10-25%
Sand	5	2 1-5%
Sand	15	3 5-10%
Sand	25	4 10-25%
Sand	35	4 10-25%
Sand	45	4 10-25%
Stone	5	3 5-10%
Stone	15	4 10-25%
Stone	25	2 1-5%
Stone	35	3 5-10%
Stone	45	4 10-25%
Woody debris structure	35	1 <1%
Woody debris structure	45	1 <1%

Species Name	Meters	Tree Age	Cover Scale
Aristida purpurea Nutt.	5		2 1-5%
Aristida purpurea Nutt.	15		2 1-5%
Artemisia ludoviciana Nutt.	15		5 25-50%
Ayenia filiformis Ayenia filiformis	5		1 <1%
Baccharis emoryi Gray	5	S Seedling	1 <1%
Baccharis emoryi Gray	15	S Seedling	1 <1%
Baccharis emoryi Gray	25	S Seedling	1 <1%
Bebbia juncea (Benth.) Greene var. aspera Greene	35		1 <1%
Bromus rubens L.	5		1 <1%
Bromus rubens L.	15		1 <1%
Bromus rubens L.	25		1 <1%
Cryptantha barbigera (Gray) Greene	5		1 <1%
Cryptobiotic soil	5		1 <1%
Cryptobiotic soil	15		2 1-5%
Dasyochloa pulchella (Kunth) Willd. ex Rydb.	5		1 <1%

Descurainia pinnata (Walt.) Britt.	5		1 <1%
Encelia farinosa Gray ex Torr.	5	S Seedling	4 10-25%
Encelia farinosa Gray ex Torr.	15	S Seedling	1 <1%
Encelia farinosa Gray ex Torr.	25	S Seedling	1 <1%
Ephedra fasciculata A. Nels.	5		2 1-5%
Eragrostis cilianensis (All.) Vign. ex Janchen	15		1 <1%
Eriogonum inflatum Torr. & Frém.	5		1 <1%
Mammillaria grahamii Engelm. var. grahamii	5		1 <1%
Mammillaria grahamii Engelm. var. grahamii	35		1 <1%
Mirabilis bigelovii Gray	5		1 <1%
Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	15		1 <1%
Opuntia basilaris Engelm. & Bigelow var. longiareolata (Clover & Jotter) L. Benson	5		1 <1%
Plantago patagonica Jacq.	5		1 <1%
Pluchea sericea (Nutt.) Coville	15	M Mature	5 25-50%
Pluchea sericea (Nutt.) Coville	25	M Mature	4 10-25%
Pluchea sericea (Nutt.) Coville	35	M Mature	4 10-25%
Pluchea sericea (Nutt.) Coville	45	M Mature	4 10-25%
Poa bigelovii Vasey & Scribn.	5		1 <1%
Porophyllum gracile Benth.	5		2 1-5%
Pseudognaphalium chilense	5		1 <1%
Pseudognaphalium chilense	25		1 <1%
Salix exigua Nutt.	45		1 <1%
Silene antirrhina L.	5		1 <1%
Stylocline micropoides Gray	5		1 <1%
Stylocline micropoides Gray	15		1 <1%
Tamarix ramosissima Ledeb.	5	P Sapling	2 1-5%
Tamarix ramosissima Ledeb.	15	P Sapling	3 5-10%
Tamarix ramosissima Ledeb.	25	P Sapling	4 10-25%
Tamarix ramosissima Ledeb.	35	P Sapling	4 10-25%
Tamarix ramosissima Ledeb.	45	S Seedling	4 10-25%
Thymophylla pentachaeta (DC.) Small	5		1 <1%
Thymophylla pentachaeta (DC.) Small	15		1 <1%
Typha latifolia L.	45		1 <1%
Vulpia microstachys	5		3 5-10%
Vulpia microstachys	15		2 1-5%
Vulpia microstachys	25		2 1-5%

Vegetation Structure Data

Species Name	Meters	# of Hits	Height
Encelia farinosa Gray ex Torr.	5	2	0-1.0
Vulpia microstachys	5	1	0-1.0
Tamarix ramosissima Ledeb.	25	2	0-1.0
Pluchea sericea (Nutt.) Coville	35	1	2-3
Pluchea sericea (Nutt.) Coville	35	2	1-2
Tamarix ramosissima Ledeb.	35	2	1-2
Tamarix ramosissima Ledeb.	35	5	0-1.0

Soil Data

Meters	Probe depth (cm)	Reading 1	Reading 2	Reading 3	Average Reading
5	11	0.04	0.03	0.08	0.05
15	7	0.16	0.19	0.22	0.19
25	4	0.06	0.08	0.08	0.07
35	13	0.6	0.59	0.63	0.61
45	6	0.67	0.08	0.1	0.28

Canyon/Park	**Crystal Canyon**	River mile:	99 R
Transect Name:	Crystal Creek Transect 2	Type:	Tamarisk area
Date:	5/13/2005	Weather:	<15% clouds, stable, low breeze
Start point:		End point:	
Easting	388463	Easting	388444
Northing	3999677	Northing	3999631
GPS accuracy (m)	5	GPS accuracy (m)	7
Bearing:	206	Elevation (m):	
Aspect (0-360):	280	Slope (degrees):	5

Transect description: Transect runs parallel to perennial creek and is perched on 2m high alluvial terrace about 2m from bankfull. About 200m upstream of where Crystal Creek leaves cliff-sloped gorge and forms alluvial fan; about 500+m upstream from mouth of crystal creek.

Geological layer: Canyon walls are vishnu schist with occasional granite outcrop.

Habitat type: Riparian

Dominant species: Tamarix ramosissima Ledeb., Bromus rubens L., Salix exigua Nutt., Baccharis emoryi Gray

Associated species: Cryptantha maritima (Greene) Greene, Machaeranthera pinnatifida (Hook.) Shinners, Baccharis salicifolia (Ruiz & Pavón) Pers., Eragrostis cilianensis (All.) Vign. ex Janchen, Camissonia chamaenerioides (Gray) Raven, Plantago patagonica Jacq., Parietaria hespera Hinton, Thymophylla pentachaeta (DC.) Small, Iva acerosa (Nutt.) R.C. Jackson, Sporobolus cryptandrus (Torr.) Gray, Cryptobiotic soil, Phragmites australis (Cav.) Trin. ex Steud., Trixis californica Kellogg, Encelia farinosa Gray ex Torr., Acacia greggii Gray, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Vulpia microstachys, Cryptantha spp., Isocoma acradenia (Greene) Greene, Aristida spp.

Surface water within 25 m? Surface water type: stream Surface rocks: sandstone schist

Landform: Terrace Light exposure: partial-shade

Soil type: sandy loam Soil moisture: dry

Point Intercept Transect (50m)	% Cover
Boulder	1
Cobble	4
Gravel	3
Litter (duff)	89
Sand	16
Stone	2
Baccharis salicifolia (Ruiz & Pavón) Pers.	63
Salix exigua Nutt.	17
Sporobolus cryptandrus (Torr.) Gray	1
Tamarix ramosissima Ledeb.	51

Daubenmire Scale Cover Data from 50m Transect

Ground Cover Category	Meters	Cover Scale
Boulder	5	3 5-10%
Boulder	15	2 1-5%
Boulder	25	1 <1%
Boulder	35	3 5-10%
Boulder	45	1 <1%
Coarse woody debris	5	1 <1%
Coarse woody debris	15	2 1-5%
Coarse woody debris	25	3 5-10%
Coarse woody debris	35	2 1-5%
Coarse woody debris	45	2 1-5%
Cobble	5	3 5-10%
Cobble	15	2 1-5%
Cobble	25	2 1-5%
Cobble	35	2 1-5%
Cobble	45	2 1-5%

Gravel	5	5 25-50%
Gravel	15	2 1-5%
Gravel	25	1 <1%
Gravel	35	1 <1%
Gravel	45	2 1-5%
Litter (duff)	5	3 5-10%
Litter (duff)	15	6 50-75%
Litter (duff)	25	7 75-100%
Litter (duff)	35	6 50-75%
Litter (duff)	45	6 50-75%
Sand	5	5 25-50%
Sand	15	1 <1%
Sand	25	2 1-5%
Sand	35	1 <1%
Sand	45	2 1-5%
Stone	5	3 5-10%
Stone	15	2 1-5%
Stone	25	2 1-5%
Stone	35	2 1-5%
Stone	45	2 1-5%
Woody debris structure	15	1 <1%
Woody debris structure	35	1 <1%

Species Name	Meters	Tree Age	Cover Scale
Baccharis salicifolia (Ruiz & Pavón) Pers.	5		4 10-25%
Baccharis salicifolia (Ruiz & Pavón) Pers.	15		5 25-50%
Baccharis salicifolia (Ruiz & Pavón) Pers.	25		4 10-25%
Baccharis salicifolia (Ruiz & Pavón) Pers.	35		1 <1%
Baccharis salicifolia (Ruiz & Pavón) Pers.	45		5 25-50%
Bromus rubens L.	5		1 <1%
Bromus rubens L.	15		2 1-5%
Bromus rubens L.	25		2 1-5%
Bromus rubens L.	35		1 <1%
Bromus rubens L.	45		2 1-5%
Cryptantha maritima (Greene) Greene	45		1 <1%
Cryptobiotic soil	5		3 5-10%
Cryptobiotic soil	15		1 <1%
Cryptobiotic soil	25		1 <1%
Encelia farinosa Gray ex Torr.	15	S Seedling	1 <1%
Eragrostis cilianensis (All.) Vign. ex Janchen	45		1 <1%
Machaeranthera pinnatifida (Hook.) Shinners	15		1 <1%
Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	5		2 1-5%
Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	25		1 <1%
Muhlenbergia spp.	45		1 <1%
Salix exigua Nutt.	5		2 1-5%
Salix exigua Nutt.	15		5 25-50%
Salix exigua Nutt.	25		4 10-25%
Salix exigua Nutt.	35		2 1-5%
Salix exigua Nutt.	45	S Seedling	1 <1%
Sporobolus cryptandrus (Torr.) Gray	5		1 <1%
Sporobolus cryptandrus (Torr.) Gray	15		1 <1%
Tamarix ramosissima Ledeb.	5	P Sapling	2 1-5%
Tamarix ramosissima Ledeb.	15	P Sapling	4 10-25%

Tamarix ramosissima Ledeb.	25	P Sapling	4 10-25%
Tamarix ramosissima Ledeb.	35	P Sapling	6 50-75%
Tamarix ramosissima Ledeb.	45	P Sapling	4 10-25%
Trixis californica Kellogg	15		6 50-75%
Trixis californica Kellogg	25		2 1-5%
Vulpia microstachys	15		1 <1%
Vulpia microstachys	45		1 <1%

Vegetation Structure Data

Species Name	Meters	# of Hits	Height
Baccharis salicifolia (Ruiz & Pavón) Pers.	5	1	0-1.0
Tamarix ramosissima Ledeb.	5	3	0-1.0
Salix exigua Nutt.	15	2	0-1.0
Salix exigua Nutt.	15	3	1-2
Tamarix ramosissima Ledeb.	15	1	0-1.0
Tamarix ramosissima Ledeb.	15	2	1-2
Salix exigua Nutt.	25	2	1-2
Salix exigua Nutt.	25	3	2-3
Tamarix ramosissima Ledeb.	25	3	0-1.0
Tamarix ramosissima Ledeb.	35	1	0-1.0
Tamarix ramosissima Ledeb.	35	10	1-2
Tamarix ramosissima Ledeb.	35	30	4-5
Tamarix ramosissima Ledeb.	35	37	2-3
Tamarix ramosissima Ledeb.	35	45	2-3
Baccharis salicifolia (Ruiz & Pavón) Pers.	45	5	0-1.0
Tamarix ramosissima Ledeb.	45	2	0-1.0
Tamarix ramosissima Ledeb.	45	8	2-3
Tamarix ramosissima Ledeb.	45	23	1-2

Soil Data

Probe depth (cm)	Reading 1	Reading 2	Reading 3	Average Reading
6	0	0	0	0.00
6	0.03	0.04	0.5	0.19
15	0.12	0.12	0.01	0.08
6	0.03	0.04	0.04	0.04
11	0.01	0.01	0.01	0.01

Canyon/Park	**Crystal Canyon**	River mile:	99 R
Transect Name:	Crystal Creek Transect 2	Type:	Reference
Date:	5/13/2005	Weather:	No clouds, clear sky, getting warmer, to 80F
Start point:		End point:	
Easting	388512	Easting	388486
Northing	3999751	Northing	3999714
GPS accuracy (m)	6	GPS accuracy (m)	6
Bearing:	206	Elevation (m):	
Aspect (0-360):	271	Slope (degrees):	5

Transect description: About 600m from mouth of creek & about 130m above where creek makes a sharp turn around a rocky delta.

Geological layer: Schist

Habitat type: Riparian

Dominant species: Baccharis emoryi Gray

Associated species: Vulpia microstachys, Bromus rubens L., Eucrypta micrantha (Torr.) Heller, Typha latifolia L., Linanthus bigelovii (Gray) Greene, Tamarix ramosissima Ledeb., Acacia greggii Gray, Chaenactis stevioides Hook. & Arn., Stylocline micropoides Gray, Draba cuneifolia Nutt. ex Torr. & Gray, Galium aparine L., Chamaesyce fendleri (Torr. & Gray) Small, Gilia spp., Cryptobiotic soil, Cryptantha spp., Mammillaria grahamii Engelm. var. grahamii, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Equisetum ×ferrissii Clute (pro sp.), Camissonia walkeri (A. Nels.) Raven, Astragalus spp., Lepidium lasiocarpum Nutt. var. lasiocarpum, Bebbia juncea (Benth.) Greene var. aspera Greene, Porophyllum gracile Benth., Encelia farinosa Gray ex Torr., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Aristida purpurea Nutt., Cryptantha barbigera (Gray) Greene, Cynodon dactylon (L.) Pers., Iva acerosa (Nutt.) R.C. Jackson, Isocoma acradenia (Greene) Greene, Rafinesquia neomexicana Gray, Chorizanthe spp., Pseudognaphalium chilense, Cryptantha pterocarya (Torr.) Greene, Salix exigua Nutt.

Surface water within 25 m? Surface water type: stream Surface rocks: cobbles

Landform: Drainage channel Light exposure: open

Soil type: sand Soil moisture: moist

Point Intercept Transect (50m)	% Cover
Bedrock	1
Boulder	3
Cobble	15
Gravel	16
Litter (duff)	74
Sand	53
Stone	14
Woody debris structure	10
Baccharis emoryi Gray	82
Cryptobiotic soil	4
Draba cuneifolia Nutt. ex Torr. & Gray	1
Isocoma acradenia (Greene) Greene	2
Plantago patagonica Jacq.	1
Salix exigua Nutt.	1
Tamarix ramosissima Ledeb.	15
Vulpia microstachys	1

Daubenmire Scale Cover Data from 50m Transect

Ground Cover Category	Meters	Cover Scale
Bedrock	5	2 1-5%
Boulder	5	2 1-5%
Boulder	15	2 1-5%
Boulder	25	3 5-10%
Boulder	35	3 5-10%
Boulder	45	3 5-10%
Cobble	5	3 5-10%
Cobble	15	4 10-25%
Cobble	25	4 10-25%
Cobble	35	4 10-25%
Cobble	45	4 10-25%
Gravel	5	5 25-50%

Gravel	15	2 1-5%
Gravel	25	2 1-5%
Gravel	35	3 5-10%
Gravel	45	4 10-25%
Litter (duff)	5	4 10-25%
Litter (duff)	15	5 25-50%
Litter (duff)	25	6 50-75%
Litter (duff)	35	5 25-50%
Litter (duff)	45	4 10-25%
Sand	5	5 25-50%
Sand	15	5 25-50%
Sand	25	4 10-25%
Sand	35	4 10-25%
Sand	45	3 5-10%
Stone	5	4 10-25%
Stone	15	3 5-10%
Stone	25	5 25-50%
Stone	35	4 10-25%
Stone	45	4 10-25%
Woody debris structure	5	2 1-5%
Woody debris structure	15	3 5-10%
Woody debris structure	25	3 5-10%
Woody debris structure	35	3 5-10%
Woody debris structure	45	3 5-10%

Species Name	Meters	Tree Age	Cover Scale
Acacia greggii Gray	5	M Mature	1 <1%
Acacia greggii Gray	35	M Mature	1 <1%
Aristida purpurea Nutt.	25		1 <1%
Aristida purpurea Nutt.	35		1 <1%
Aristida purpurea Nutt.	45		1 <1%
Astragalus spp.	35		5 25-50%
Baccharis emoryi Gray	5	M Mature	4 10-25%
Baccharis emoryi Gray	15	M Mature	5 25-50%
Baccharis emoryi Gray	25	M Mature	6 50-75%
Baccharis emoryi Gray	35	M Mature	6 50-75%
Baccharis emoryi Gray	45	M Mature	4 10-25%
Bromus rubens L.	5		1 <1%
Bromus rubens L.	15		1 <1%
Bromus rubens L.	35		1 <1%
Bromus rubens L.	45		1 <1%
Camissonia walkeri (A. Nels.) Raven	25		1 <1%
Chaenactis stevioides Hook. & Arn.	45		1 <1%
Chamaesyce fendleri (Torr. & Gray) Small	5		1 <1%
Chorizanthe spp.	45		1 <1%
Cryptantha barbigera (Gray) Greene	5		1 <1%
Cryptantha barbigera (Gray) Greene	15		2 1-5%
Cryptantha barbigera (Gray) Greene	45		1 <1%
Cryptantha maritima (Greene) Greene	5		1 <1%
Cryptantha maritima (Greene) Greene	15		1 <1%
Cryptantha pterocarya (Torr.) Greene	15		1 <1%
Cryptantha pterocarya (Torr.) Greene	35		1 <1%
Cryptantha spp.	5		1 <1%

Cryptantha spp.	15		1 <1%
Cryptantha spp.	25		1 <1%
Cryptantha spp.	35		1 <1%
Cryptantha spp.	45		1 <1%
Cryptobiotic soil	5		3 5-10%
Cryptobiotic soil	15		3 5-10%
Cryptobiotic soil	25		4 10-25%
Cryptobiotic soil	35		3 5-10%
Cryptobiotic soil	45		4 10-25%
Draba cuneifolia Nutt. ex Torr. & Gray	5		1 <1%
Encelia farinosa Gray ex Torr.	5		1 <1%
Encelia farinosa Gray ex Torr.	25		1 <1%
Equisetum ×ferrissii Clute (pro sp.)	25		1 <1%
Eucrypta micrantha (Torr.) Heller	5		1 <1%
Galium aparine L.	5		1 <1%
Galium aparine L.	15		1 <1%
Gilia spp.	5		1 <1%
Gilia spp.	15		1 <1%
Gutierrezia sarothrae (Pursh) Britt. & Rusby	35		1 <1%
Isocoma acradenia (Greene) Greene	5		5 25-50%
Isocoma acradenia (Greene) Greene	15		1 <1%
Isocoma acradenia (Greene) Greene	25		1 <1%
Isocoma acradenia (Greene) Greene	35		1 <1%
Isocoma acradenia (Greene) Greene	45		1 <1%
Iva acerosa (Nutt.) R.C. Jackson	15		2 1-5%
Iva acerosa (Nutt.) R.C. Jackson	25		1 <1%
Linanthus bigelovii (Gray) Greene	5		1 <1%
Mammillaria grahamii Engelm. var. grahamii	5		1 <1%
Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	15		3 5-10%
Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	25		3 5-10%
Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	35		2 1-5%
Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	45		1 <1%
Pluchea sericea (Nutt.) Coville	45		1 <1%
Salix exigua Nutt.	15		2 1-5%
Salix exigua Nutt.	25		2 1-5%
Salix exigua Nutt.	35		2 1-5%
Sporobolus cryptandrus (Torr.) Gray	35		1 <1%
Sporobolus cryptandrus (Torr.) Gray	45		1 <1%
Stylocline micropoides Gray	5		1 <1%
Stylocline micropoides Gray	15		1 <1%
Stylocline micropoides Gray	45		1 <1%
Tamarix ramosissima Ledeb.	5	M Mature	3 5-10%
Tamarix ramosissima Ledeb.	15	M Mature	4 10-25%
Tamarix ramosissima Ledeb.	25	M Mature	3 5-10%
Tamarix ramosissima Ledeb.	35	M Mature	2 1-5%
Tamarix ramosissima Ledeb.	45	M Mature	4 10-25%
Typha latifolia L.	15		1 <1%
Typha latifolia L.	25		1 <1%
Vulpia microstachys	5		2 1-5%
Vulpia microstachys	15		1 <1%
Vulpia microstachys	25		1 <1%
Vulpia microstachys	35		1 <1%

Vegetation Structure Data

Species Name	Meters	# of Hits	Height
Baccharis emoryi Gray	5	2	1-2
Baccharis emoryi Gray	5	8	0-1.0
Tamarix ramosissima Ledeb.	15	1	0-1.0
Baccharis emoryi Gray	25	3	0-1.0
Baccharis emoryi Gray	35	2	1-2
Baccharis emoryi Gray	35	5	0-1.0
Tamarix ramosissima Ledeb.	45	5	0-1.0

Soil Data

Crews did not collect soil data for this transect.

Canyon/Park	**Nankoweap Creek (lower)**	River mile:	52.1 R
Transect Name:	Nankoweap Creek Transect 1	Type:	Tamarisk area
Date:	10/1/2004	Weather:	Stormy weather, clouds and overcast
Start point:		End point:	
Easting	422461	Easting	422487
Northing	4017798	Northing	4017829
GPS accuracy (m)	6.4	GPS accuracy (m)	8
Bearing:	41	Elevation (m):	
Aspect (0-360):		Slope (degrees):	

Transect description: Transect top starts 704 m from where trail drops into drainage. Start point is upstream with end downstream. Start point is on red sandstone boulder almost flush with ground; also 15m upstream from the photopoint boulder. Put small white dot on start rock, covered with another sandstone boulder. End has no rock but is at the trunk of the cottonwood tree. Transect lines up with large round boulder on the near slope. Across the river there is a vertical cave or chimney in the wall toward the top of the Muav that is also in line. From 41m mark on transect toward start point, lines up with large black boulder 3/4 up.

Geological layer: Muav limestone

Habitat type: Riparian Great Basin desert scrub

Dominant species: Stephanomeria pauciflora (Torr.) A. Nels., Brickellia longifolia S. Wats., Tamarix ramosissima Ledeb.

Associated species: Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Bromus rubens L., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Populus fremontii S. Wats., Sphaeralcea ambigua Gray, Aristida purpurea Nutt., Baccharis emoryi Gray, Erodium cicutarium (L.) L'Hér. ex Ait., Ephedra spp., Sporobolus flexuosus (Thurb. ex Vasey) Rydb.

Surface water within 25 m? Surface water type: Surface rocks: cobbles

Landform: Drainage channel Interfluve Light exposure: open

Soil type: sand Soil moisture: dry

Point Intercept Transect (50m)	% Cover
Bare Soil	55
Cobble	19
Litter (duff)	25
Aristida purpurea Nutt.	2
Brickellia longifolia S. Wats.	13
Bromus rubens L.	2
Gutierrezia sarothrae (Pursh) Britt. & Rusby	4
Populus fremontii S. Wats.	5
Stephanomeria pauciflora (Torr.) A. Nels.	6
Tamarix ramosissima Ledeb.	19

Daubenmire Scale Cover Data from 50m Transect

Crews did not collect ground cover data for this transect.

Species Name	Meters	Tree Age	Cover Scale
Aristida purpurea Nutt.	5		1 <1%
Aristida purpurea Nutt.	15		1 <1%
Aristida purpurea Nutt.	25		2 1-5%
Aristida purpurea Nutt.	35		1 <1%
Baccharis emoryi Gray	5		2 1-5%
Baccharis emoryi Gray	35		2 1-5%
Brickellia longifolia S. Wats.	5		2 1-5%
Brickellia longifolia S. Wats.	15		2 1-5%
Brickellia longifolia S. Wats.	25		3 5-10%
Brickellia longifolia S. Wats.	35		3 5-10%
Brickellia longifolia S. Wats.	45		3 5-10%
Bromus rubens L.	5		3 5-10%
Bromus rubens L.	45		1 <1%
Ephedra spp.	25		2 1-5%
Erodium cicutarium (L.) L'Hér. ex Ait.	5		1 <1%
Erodium cicutarium (L.) L'Hér. ex Ait.	35		1 <1%
Gutierrezia sarothrae (Pursh) Britt. & Rusby	25		2 1-5%

Gutierrezia sarothrae (Pursh) Britt. & Rusby	35		2 1-5%
Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	25		2 1-5%
Populus fremontii S. Wats.	35		2 1-5%
Sphaeralcea ambigua Gray	5		1 <1%
Sporobolus flexuosus (Thurb. ex Vasey) Rydb.	25		1 <1%
Sporobolus flexuosus (Thurb. ex Vasey) Rydb.	35		1 <1%
Sporobolus flexuosus (Thurb. ex Vasey) Rydb.	45		2 1-5%
Stephanomeria pauciflora (Torr.) A. Nels.	5		4 10-25%
Stephanomeria pauciflora (Torr.) A. Nels.	15		2 1-5%
Stephanomeria pauciflora (Torr.) A. Nels.	25		2 1-5%
Stephanomeria pauciflora (Torr.) A. Nels.	35		2 1-5%
Tamarix ramosissima Ledeb.	5	M Mature	5 25-50%
Tamarix ramosissima Ledeb.	15	P Sapling	2 1-5%

Vegetation Structure Data

Species Name	Meters	# of Hits	Height
Tamarix ramosissima Ledeb.	5	1	1-2
Tamarix ramosissima Ledeb.	5	6	0-1.0
Aristida purpurea Nutt.	15	1	0-1.0
Stephanomeria pauciflora (Torr.) A. Nels.	15	3	0-1.0
Gutierrezia sarothrae (Pursh) Britt. & Rusby	25	1	0-1.0

Soil Data

Crews did not collect soil data for this transect.

Canyon/Park	**Nankoweap Creek (lower)**	River mile:	52.1 R
Transect Name:	Nankoweap Creek Transect 1	Type:	Reference
Date:	10/2/2004	Weather:	Stormy weather, clouds and overcast
Start point:		End point:	
Easting	422441	Easting	422481
Northing	4017839	Northing	4017869
GPS accuracy (m)	8	GPS accuracy (m)	8
Bearing:	50	Elevation (m):	
Aspect (0-360):		Slope (degrees):	

Transect description: Top and bottom are at driftwood logs. Transect 1B is located 25m left of and parallel to 1A at about the same level canyon slope. Top is on limestone boulder at a high point next to an ancient driftwood pile. A large ACENEG is located to the left of the transect at 15m mark. Start boulder has a dimple in the top (see photo). Bottom is a red sandstone boulder next to a log 30cm x 1.5m. Top and bottom are marked with red veg knob.

Geological layer: Muav limestone / Bright Angel Shale

Habitat type: Riparian Great Basin desert scrub

Dominant species: Thymophylla pentachaeta (DC.) Small, Gutierrezia sarothrae (Pursh) Britt. & Rusby, Encelia farinosa Gray ex Torr., Stephanomeria pauciflora (Torr.) A. Nels.

Associated species: Dasyochloa pulchella (Kunth) Willd. ex Rydb., Ephedra nevadensis S. Wats., Brickellia longifolia S. Wats., Tiquilia latior (I.M. Johnston) A. Richards., Muhlenbergia porteri Scribn. ex Beal, Acacia greggii Gray, Bouteloua eriopoda (Torr.) Torr., Erodium cicutarium (L.) L'Hér. ex Ait., Eriogonum inflatum Torr. & Frém., Bromus rubens L., Sporobolus flexuosus (Thurb. ex Vasey) Rydb., Sphaeralcea ambigua Gray, Aristida spp., Machaeranthera pinnatifida (Hook.) Shinners, Opuntia basilaris Engelm. & Bigelow, Opuntia erinacea Engelm. & Bigelow ex Engelm.

Surface water within 25 m? Surface water type: Surface rocks: sandstone limestone

Landform: Drainage channel Interfluve Light exposure: open

Soil type: sand Soil moisture: dry

Point Intercept Transect (50m)	% Cover
Bare Soil	24
Cobble	52
Litter (duff)	12
Woody debris structure	1
Acacia greggii Gray	2
Aristida purpurea Nutt.	1
Aristida spp.	2
Bouteloua eriopoda (Torr.) Torr.	5
Bromus rubens L.	8
Cryptobiotic soil	10
Encelia farinosa Gray ex Torr.	1
Gutierrezia sarothrae (Pursh) Britt. & Rusby	2
Stephanomeria pauciflora (Torr.) A. Nels.	4
Thymophylla pentachaeta (DC.) Small	2

Daubenmire Scale Cover Data from 50m Transect

Crews did not collect ground cover data for this transect.

Species Name	Meters	Tree Age	Cover Scale
Acacia greggii Gray	15	M Mature	3 5-10%
Acacia greggii Gray	25	P Sapling	1 <1%
Aristida spp.	5		2 1-5%
Aristida spp.	15		2 1-5%
Aristida spp.	35		1 <1%
Aristida spp.	45		2 1-5%
Bouteloua eriopoda (Torr.) Torr.	5		2 1-5%
Bouteloua eriopoda (Torr.) Torr.	15		1 <1%
Bouteloua eriopoda (Torr.) Torr.	25		2 1-5%
Bouteloua eriopoda (Torr.) Torr.	35		1 <1%
Brickellia longifolia S. Wats.	35		1 <1%
Bromus rubens L.	15		1 <1%
Bromus rubens L.	25		2 1-5%

Bromus rubens L.	35		2 1-5%
Bromus rubens L.	45		1 <1%
Encelia farinosa Gray ex Torr.	5		1 <1%
Encelia farinosa Gray ex Torr.	15		1 <1%
Encelia farinosa Gray ex Torr.	25		2 1-5%
Encelia farinosa Gray ex Torr.	35		1 <1%
Encelia farinosa Gray ex Torr.	45		2 1-5%
Ephedra nevadensis S. Wats.	25		2 1-5%
Eriogonum inflatum Torr. & Frém.	15		2 1-5%
Eriogonum inflatum Torr. & Frém.	45		1 <1%
Erioneuron pulchellum	25		1 <1%
Erioneuron pulchellum	45		1 <1%
Erodium cicutarium (L.) L'Hér. ex Ait.	25		1 <1%
Gutierrezia sarothrae (Pursh) Britt. & Rusby	5		2 1-5%
Gutierrezia sarothrae (Pursh) Britt. & Rusby	15		3 5-10%
Gutierrezia sarothrae (Pursh) Britt. & Rusby	25		2 1-5%
Gutierrezia sarothrae (Pursh) Britt. & Rusby	35		2 1-5%
Gutierrezia sarothrae (Pursh) Britt. & Rusby	45		1 <1%
Machaeranthera pinnatifida (Hook.) Shinners	25		2 1-5%
Muhlenbergia porteri Scribn. ex Beal	15		1 <1%
Opuntia basilaris Engelm. & Bigelow	25		1 <1%
Opuntia basilaris Engelm. & Bigelow	35		1 <1%
Opuntia basilaris Engelm. & Bigelow	45		1 <1%
Opuntia erinacea Engelm. & Bigelow ex Engelm.	25		2 1-5%
Opuntia erinacea Engelm. & Bigelow ex Engelm.	45		2 1-5%
Sphaeralcea ambigua Gray	25		1 <1%
Sphaeralcea ambigua Gray	45		1 <1%
Sporobolus flexuosus (Thurb. ex Vasey) Rydb.	5		1 <1%
Sporobolus flexuosus (Thurb. ex Vasey) Rydb.	15		1 <1%
Sporobolus flexuosus (Thurb. ex Vasey) Rydb.	25		1 <1%
Sporobolus flexuosus (Thurb. ex Vasey) Rydb.	35		2 1-5%
Sporobolus flexuosus (Thurb. ex Vasey) Rydb.	45		1 <1%
Stephanomeria pauciflora (Torr.) A. Nels.	5		2 1-5%
Stephanomeria pauciflora (Torr.) A. Nels.	15		2 1-5%
Stephanomeria pauciflora (Torr.) A. Nels.	25		3 5-10%
Stephanomeria pauciflora (Torr.) A. Nels.	35		3 5-10%
Stephanomeria pauciflora (Torr.) A. Nels.	45		2 1-5%
Thymophylla pentachaeta (DC.) Small	5		2 1-5%
Thymophylla pentachaeta (DC.) Small	15		2 1-5%
Thymophylla pentachaeta (DC.) Small	25		2 1-5%
Thymophylla pentachaeta (DC.) Small	35		2 1-5%
Thymophylla pentachaeta (DC.) Small	45		2 1-5%
Tiquilia latior (I.M. Johnston) A. Richards.	5		2 1-5%
Tiquilia latior (I.M. Johnston) A. Richards.	25		1 <1%
Tiquilia latior (I.M. Johnston) A. Richards.	35		3 5-10%
Tiquilia latior (I.M. Johnston) A. Richards.	45		2 1-5%

Vegetation Structure Data

Species Name	Meters	# of Hits	Height
Stephanomeria pauciflora (Torr.) A. Nels.	15	3	0-1.0
Bouteloua eriopoda (Torr.) Torr.	25	1	0-1.0
Bromus rubens L.	25	1	0-1.0

Soil Data

Crews did not collect soil data for this transect.

Canyon/Park	**Nankoweap Creek (lower)**	River mile:	52.1 R
Transect Name:	Nankoweap Creek Transect 2	Type:	Tamarisk area
Date:	10/2/2004	Weather:	Stormy weather, clouds and overcast
Start point:		End point:	
Easting	421235	Easting	421228
Northing	4016988	Northing	4017042
GPS accuracy (m)	15	GPS accuracy (m)	6
Bearing:	340	Elevation (m):	
Aspect (0-360):		Slope (degrees):	

Transect description: Runs down right side of wash along muav wall. Top of transect is at base of ACENEG in the Muav wall on a red sandstone boulder 50x50cm. Painted a red veg knob on boulder and covered it with a Muav slab 15x15cm. Transect runs close to edge of wall toward a big stripey boulder half way up the talus slope opposite. Transect ends in wash ~5m from Muav ledges/wall on right, and ~1.5m left of 5" dbh cottonwood.

Geological layer: Muav limestone

Habitat type: Riparian Great Basin desert scrub

Dominant species: Tamarix ramosissima Ledeb., Artemisia ludoviciana Nutt., Acacia greggii Gray

Associated species: Sporobolus flexuosus (Thurb. ex Vasey) Rydb., Echinocereus spp., Baccharis emoryi Gray, Erodium cicutarium (L.) L'Hér. ex Ait., Ephedra spp., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Ephedra nevadensis S. Wats., Bromus rubens L., Aristida purpurea Nutt., Baccharis sergiloides Gray, Encelia frutescens (Gray) Gray, Brickellia longifolia S. Wats.

Surface water within 25 m? Surface water type: stream Surface rocks: sandstone

Landform: Drainage channel Interfluve Light exposure: open

Soil type: sand Soil moisture: dry

Point Intercept Transect (50m)	% Cover
Bare Soil	36
Cobble	42
Litter (duff)	14
Woody debris structure	7
Acacia greggii Gray	4
Artemisia ludoviciana Nutt.	3
Baccharis emoryi Gray	6
Brickellia longifolia S. Wats.	1
Bromus rubens L.	11
Cryptobiotic soil	1
Erodium cicutarium (L.) L'Hér. ex Ait.	1
Tamarix ramosissima Ledeb.	16

Daubenmire Scale Cover Data from 50m Transect

Crews did not collect ground cover data for this transect.

Species Name	Meters	Tree Age	Cover Scale
Acacia greggii Gray	5	P Sapling	2 1-5%
Acacia greggii Gray	15	P Sapling	2 1-5%
Acacia greggii Gray	35	S Seedling	1 <1%
Aristida purpurea Nutt.	5		2 1-5%
Aristida purpurea Nutt.	35		1 <1%
Artemisia ludoviciana Nutt.	5		2 1-5%
Artemisia ludoviciana Nutt.	15		2 1-5%
Artemisia ludoviciana Nutt.	25		2 1-5%
Artemisia ludoviciana Nutt.	35		3 5-10%
Baccharis emoryi Gray	45		3 5-10%
Baccharis sergiloides Gray	45		2 1-5%
Brickellia longifolia S. Wats.	35		2 1-5%
Bromus rubens L.	5		3 5-10%
Bromus rubens L.	15		2 1-5%
Bromus rubens L.	25		2 1-5%
Bromus rubens L.	35		2 1-5%

Bromus rubens L.	45		2 1-5%
Echinocereus spp.	5		2 1-5%
Encelia frutescens (Gray) Gray	35		1 <1%
Ephedra nevadensis S. Wats.	5		2 1-5%
Ephedra spp.	25		2 1-5%
Ephedra spp.	35		2 1-5%
Erigeron speciosus (Lindl.) DC. var. macranthus (Nutt.) Cronq.	25		1 <1%
Erodium cicutarium (L.) L'Hér. ex Ait.	5		1 <1%
Erodium cicutarium (L.) L'Hér. ex Ait.	25		2 1-5%
Gutierrezia sarothrae (Pursh) Britt. & Rusby	5		2 1-5%
Gutierrezia sarothrae (Pursh) Britt. & Rusby	25		2 1-5%
Gutierrezia sarothrae (Pursh) Britt. & Rusby	35		3 5-10%
Sporobolus flexuosus (Thurb. ex Vasey) Rydb.	5		1 <1%
Sporobolus flexuosus (Thurb. ex Vasey) Rydb.	35		1 <1%
Tamarix ramosissima Ledeb.	5	M Mature	2 1-5%
Tamarix ramosissima Ledeb.	15	M Mature	5 25-50%
Tamarix ramosissima Ledeb.	25	P Sapling	2 1-5%
Tamarix ramosissima Ledeb.	35	M Mature	4 10-25%
Tamarix ramosissima Ledeb.	45	M Mature	4 10-25%

Vegetation Structure Data

Species Name	Meters	# of Hits	Height
Tamarix ramosissima Ledeb.	5	2	1-2
Tamarix ramosissima Ledeb.	5	4	0-1.0
Tamarix ramosissima Ledeb.	15	1	0-1.0
Tamarix ramosissima Ledeb.	15	3	1-2
Bromus rubens L.	35	1	0-1.0
Baccharis emoryi Gray	45	1	0-1.0
Baccharis emoryi Gray	45	2	1-2
Tamarix ramosissima Ledeb.	45	1	2-3

Soil Data

Crews did not collect soil data for this transect.

Canyon/Park	**Nankoweap Creek (lower)**	River mile:	52.1 R
Transect Name:	Nankoweap Creek Transect 2	Type:	Reference
Date:	10/2/2004	Weather:	Stormy weather, clouds and overcast
Start point:		End point:	
Easting	421237	Easting	421245
Northing	4017009	Northing	4016973
GPS accuracy (m)	7	GPS accuracy (m)	7
Bearing:	350	Elevation (m):	
Aspect (0-360):		Slope (degrees):	

Transect description: Transect ends at top of 2A, ~5m over toward wash. Transect top is a large cottonwood tree in the drainage, 350 degree bearing from tree to bottom, no mark at top. Transect bottom is at the same level as the top of 2A, but over ~5m in a brush pile. End point has a red veg knob on a smallish (10x20cm) limestone boulder almost flush with ground. Covered with larger 30x30cm boulder, right below downstream end of brush/debris pile.

Geological layer: Muav limestone

Habitat type: Riparian Great Basin desert scrub

Dominant species: Stephanomeria pauciflora (Torr.) A. Nels., Populus tremuloides Michx.

Associated species: Gutierrezia sarothrae (Pursh) Britt. & Rusby, Machaeranthera pinnatifida (Hook.) Shinners, Acacia greggii Gray, Stanleya pinnata (Pursh) Britt., Datura wrightii Regel, Eriogonum inflatum Torr. & Frém., Artemisia ludoviciana Nutt., Brickellia longifolia S. Wats., Mentzelia albicaulis (Dougl. ex Hook.) Dougl. ex Torr. & Gray, Sphaeralcea ambigua Gray, Opuntia erinacea Engelm. & Bigelow ex Engelm., Bromus rubens L., Encelia frutescens (Gray) Gray, Sporobolus flexuosus (Thurb. ex Vasey) Rydb., Tiquilia latior (I.M. Johnston) A. Richards., Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth, Erodium cicutarium (L.) L'Hér. ex Ait.

Surface water within 25 m? Surface water type: Surface rocks: limestone

Landform: Drainage channel Interfluve Light exposure: open

Soil type: sandy loam Soil moisture: dry

Point Intercept Transect (50m)	% Cover
Bare Soil	40
Cobble	48
Litter (duff)	4
Woody debris structure	9
Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth	2
Aristida purpurea Nutt.	1
Bromus rubens L.	2
Encelia frutescens (Gray) Gray	1
Erodium cicutarium (L.) L'Hér. ex Ait.	3
Gutierrezia sarothrae (Pursh) Britt. & Rusby	1
Populus tremuloides Michx.	7
Stanleya pinnata (Pursh) Britt.	1

Daubenmire Scale Cover Data from 50m Transect

Crews did not collect ground cover data for this transect.

Species Name	Meters	Tree Age	Cover Scale
Acacia greggii Gray	15	P Sapling	1 <1%
Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth	45		2 1-5%
Artemisia ludoviciana Nutt.	5		1 <1%
Artemisia ludoviciana Nutt.	45		2 1-5%
Brickellia longifolia S. Wats.	15		2 1-5%
Bromus rubens L.	5		1 <1%
Bromus rubens L.	25		2 1-5%
Bromus rubens L.	35		2 1-5%
Bromus rubens L.	45		2 1-5%
Datura wrightii Regel	25		1 <1%
Datura wrightii Regel	45		2 1-5%
Encelia frutescens (Gray) Gray	45		2 1-5%
Eriogonum inflatum Torr. & Frém.	35		2 1-5%
Erodium cicutarium (L.) L'Hér. ex Ait.	25		1 <1%

Erodium cicutarium (L.) L'Hér. ex Ait.	35		3 5-10%
Erodium cicutarium (L.) L'Hér. ex Ait.	45		1 <1%
Gutierrezia sarothrae (Pursh) Britt. & Rusby	25		2 1-5%
Machaeranthera pinnatifida (Hook.) Shinners	15		1 <1%
Mentzelia albicaulis (Dougl. ex Hook.) Dougl. ex Torr. & Gray	25		1 <1%
Mentzelia albicaulis (Dougl. ex Hook.) Dougl. ex Torr. & Gray	35		2 1-5%
Sphaeralcea ambigua Gray	35		1 <1%
Sporobolus flexuosus (Thurb. ex Vasey) Rydb.	45		1 <1%
Stephanomeria pauciflora (Torr.) A. Nels.	5		1 <1%
Stephanomeria pauciflora (Torr.) A. Nels.	15		2 1-5%
Stephanomeria pauciflora (Torr.) A. Nels.	25		2 1-5%
Stephanomeria pauciflora (Torr.) A. Nels.	45		1 <1%
Tiquilia latior (I.M. Johnston) A. Richards.	45		1 <1%

Vegetation Structure Data

No hits.

Soil Data

Crews did not collect soil data for this transect.

Canyon/Park	**Nankoweap Creek (middle)**	River mile:	52.1 R
Transect Name:	Nankoweap Creek Transect 3	Type:	Tamarisk area
Date:	10/3/2004	Weather:	Clear, warm
Start point:		End point:	
Easting	420988	Easting	420983
Northing	4016603	Northing	4016652
GPS accuracy (m)	20	GPS accuracy (m)	11
Bearing:	350	Elevation (m):	
Aspect (0-360):		Slope (degrees):	

Transect description: Runs along left edge of wash. Transect top is a large 1.5x1.5 m grey limestone boulder on the left edge of the wash. Ends right of a tan 2m x 2m boulder embedded in the wash. This is downstream from a large mesquite perched on the edge of the bank.

Geological layer: Muav limestone

Habitat type: Riparian Great Basin desert scrub

Dominant species: Artemisia ludoviciana Nutt., Tamarix ramosissima Ledeb., Brickellia longifolia S. Wats.

Associated species: Bromus rubens L., Stephanomeria pauciflora (Torr.) A. Nels., Aster species, Ephedra spp., Baccharis emoryi Gray, Purshia mexicana (D. Don) Henrickson, Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth, Aristida spp., Gnaphalium chilense, Cercis orbiculata Greene, Gutierrezia sarothrae (Pursh) Britt. & Rusby, Equisetum ×ferrissii Clute (pro sp.), Oenothera spp., Sporobolus flexuosus (Thurb. ex Vasey) Rydb., Machaeranthera spp., Populus fremontii S. Wats., Chrysothamnus spp., Opuntia erinacea Engelm. & Bigelow ex Engelm.

Surface water within 25 m? Surface water type: Surface rocks: limestone

Landform: Drainage channel Interfluve Light exposure: open partial-shade

Soil type: sand Soil moisture: dry

Point Intercept Transect (50m)	% Cover
	1
Bare Soil	66
Cobble	23
Litter (duff)	42
Artemisia ludoviciana Nutt.	2
Aster species	54
Baccharis emoryi Gray	1
Brickellia longifolia S. Wats.	7
Bromus rubens L.	1
Equisetum ×ferrissii Clute (pro sp.)	2
Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	1
Purshia spp.	2
Stephanomeria pauciflora (Torr.) A. Nels.	6
Tamarix ramosissima Ledeb.	15

Daubenmire Scale Cover Data from 50m Transect

Crews did not collect ground cover data for this transect.

Species Name	Meters	Tree Age	Cover Scale
Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth	5		1 <1%
Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth	35		2 1-5%
Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth	45		2 1-5%
Aristida spp.	5		1 <1%
Aristida spp.	15		2 1-5%
Aristida spp.	25		1 <1%
Artemisia ludoviciana Nutt.	5		2 1-5%
Artemisia ludoviciana Nutt.	15		2 1-5%
Artemisia ludoviciana Nutt.	25		2 1-5%
Artemisia ludoviciana Nutt.	35		3 5-10%
Aster species	5		4 10-25%
Aster species	15		2 1-5%
Aster species	25		3 5-10%
Aster species	25		4 10-25%
Aster species	35		2 1-5%

Aster species	45		3 5-10%
Aster species	45		4 10-25%
Baccharis emoryi Gray	5		3 5-10%
Baccharis emoryi Gray	15		3 5-10%
Brickellia longifolia S. Wats.	5		2 1-5%
Brickellia longifolia S. Wats.	15		3 5-10%
Brickellia longifolia S. Wats.	25		2 1-5%
Brickellia longifolia S. Wats.	35		3 5-10%
Brickellia longifolia S. Wats.	45		3 5-10%
Bromus rubens L.	5		3 5-10%
Bromus rubens L.	15		2 1-5%
Bromus rubens L.	35		2 1-5%
Bromus rubens L.	45		2 1-5%
Cercis orbiculata Greene	15		3 5-10%
Chrysothamnus spp.	15		2 1-5%
Ephedra spp.	5		2 1-5%
Equisetum ×ferrissii Clute (pro sp.)	5		2 1-5%
Gutierrezia sarothrae (Pursh) Britt. & Rusby	15		2 1-5%
Gutierrezia sarothrae (Pursh) Britt. & Rusby	25		1 <1%
Machaeranthera spp.	15		2 1-5%
Oenothera spp.	5		1 <1%
Populus fremontii S. Wats.	25	M Mature	4 10-25%
Purshia mexicana (D. Don) Henrickson	5	M Mature	2 1-5%
Purshia mexicana (D. Don) Henrickson	15	S Seedling	1 <1%
Sporobolus flexuosus (Thurb. ex Vasey) Rydb.	35		2 1-5%
Stephanomeria pauciflora (Torr.) A. Nels.	15		2 1-5%
Stephanomeria pauciflora (Torr.) A. Nels.	25		2 1-5%
Stephanomeria pauciflora (Torr.) A. Nels.	35		2 1-5%
Stephanomeria pauciflora (Torr.) A. Nels.	45		1 <1%
Tamarix ramosissima Ledeb.	5	M Mature	4 10-25%
Tamarix ramosissima Ledeb.	25	M Mature	4 10-25%

Vegetation Structure Data

type	Species Name	Meters	# of Hits	Height
Tamarisk area	Equisetum ×ferrissii Clute (pro sp.)	5	2	0-1.0
Tamarisk area	Tamarix ramosissima Ledeb.	5	5	0-1.0
Tamarisk area	Brickellia longifolia S. Wats.	15	5	0-1.0
Tamarisk area	Aster species	45	1	0-1.0

Soil Data

Crews did not collect soil data for this transect.

Canyon/Park	**Nankoweap Creek (middle)**	River mile:	52.1 R
Transect Name:	Nankoweap Creek Transect 3	Type:	Reference
Date:	10/3/2004	Weather:	Clear, warm
Start point:		End point:	
Easting	420994	Easting	421039
Northing	4016678	Northing	4016704
GPS accuracy (m)	4.3	GPS accuracy (m)	5.5
Bearing:	61	Elevation (m):	
Aspect (0-360):		Slope (degrees):	

Transect description: Transect next to 2 house-sized limestone boulders. Transect start near 2 large house size boulders closest to creekbed. On NW side of creekbed (creek left). Start point on NW corner of 3x4m large flat gray limestone boulder tucked between white and red rocks. End point ~2m from POPFRE 15m tall, 15cm dbh, near 1m red sandstone boulder.

Geological layer: Muav limestone

Habitat type: Riparian Great Basin desert scrub

Dominant species: Brickellia longifolia S. Wats., Baccharis emoryi Gray, Artemisia ludoviciana Nutt.

Associated species: Juniperus osteosperma (Torr.) Little, Stephanomeria pauciflora (Torr.) A. Nels., Sporobolus flexuosus (Thurb. ex Vasey) Rydb., Aster species, Artemisia ludoviciana Nutt., Bromus rubens L., Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Ephedra spp., Agave utahensis Engelm., Machaeranthera spp., Equisetum ×ferrissii Clute (pro sp.), Oenothera spp., Encelia frutescens (Gray) Gray, Aristida spp.

Surface water within 25 m? Surface water type: Surface rocks: limestone sandstone

Landform: Drainage channel Interfluve Light exposure: open partial-shade

Soil type: sand Soil moisture: dry

Point Intercept Transect (50m)	% Cover
Bare Soil	66
Cobble	51
Litter (duff)	22
Artemisia ludoviciana Nutt.	2
Baccharis emoryi Gray	5
Brickellia longifolia S. Wats.	14
Sporobolus flexuosus (Thurb. ex Vasey) Rydb.	1
Stephanomeria pauciflora (Torr.) A. Nels.	3

Daubenmire Scale Cover Data from 50m Transect

Crews did not collect ground cover data for this transect.

Species Name	Meters	Tree Age	Cover Scale
Agave utahensis Engelm.	15		1 <1%
Aristida spp.	15		2 1-5%
Aristida spp.	25		2 1-5%
Aristida spp.	35		1 <1%
Aristida spp.	45		1 <1%
Artemisia ludoviciana Nutt.	25		3 5-10%
Artemisia ludoviciana Nutt.	35		2 1-5%
Artemisia ludoviciana Nutt.	45		1 <1%
Aster species	35		2 1-5%
Aster species	35		6 50-75%
Baccharis emoryi Gray	5		2 1-5%
Baccharis emoryi Gray	15		2 1-5%
Baccharis emoryi Gray	25		3 5-10%
Brickellia longifolia S. Wats.	5		3 5-10%
Brickellia longifolia S. Wats.	15		3 5-10%
Brickellia longifolia S. Wats.	25		3 5-10%
Brickellia longifolia S. Wats.	35		3 5-10%
Brickellia longifolia S. Wats.	45		4 10-25%
Bromus rubens L.	25		1 <1%
Bromus rubens L.	45		2 1-5%

Echinocereus spp.	5		2 1-5%
Encelia frutescens (Gray) Gray	45		1 <1%
Ephedra spp.	5		1 <1%
Equisetum ×ferrissii Clute (pro sp.)	5		1 <1%
Erioneuron pulchellum	25		1 <1%
Juniperus osteosperma (Torr.) Little	15		2 1-5%
Machaeranthera spp.	15		2 1-5%
Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	5		2 1-5%
Oenothera spp.	5		1 <1%
Purshia spp.	5		3 5-10%
Sporobolus flexuosus (Thurb. ex Vasey) Rydb.	35		2 1-5%
Sporobolus flexuosus (Thurb. ex Vasey) Rydb.	45		2 1-5%
Stephanomeria pauciflora (Torr.) A. Nels.	25		2 1-5%
Stephanomeria pauciflora (Torr.) A. Nels.	35		2 1-5%
Stephanomeria pauciflora (Torr.) A. Nels.	45		1 <1%

Vegetation Structure Data

Species Name	Meters	# of Hits	Height
Brickellia longifolia S. Wats.	5	5	0-1.0
Baccharis emoryi Gray	25	1	0-1.0

Soil Data

Crews did not collect soil data for this transect.

Canyon/Park	**South Canyon**	River mile:	31.5 R
Transect Name:	South Canyon Transect 1	Type:	Tamarisk area
Date:	5/6/2005	Weather:	Dense cloud cover ~70F, raining
Start point:		End point:	
Easting	421084	Easting	421130
Northing	4039457	Northing	4039471
GPS accuracy (m)	9	GPS accuracy (m)	5
Bearing:	79	Elevation (m):	1029
Aspect (0-360):	76	Slope (degrees):	5

Transect description: Start point is on boulder on creek left just below mouth of bedrock canyon (fork on creek left). Endpoint is down canyon. From camp, head up S. Canyon Trail. Transect 1A start point is at the mouth of fork of bedrock canyon on creek left ~0.6km from where trail drops into the drainage.

Geological layer: Supai

Habitat type: Mojave desert scrub

Dominant species: Tamarix ramosissima Ledeb., Brickellia longifolia S. Wats., Stephanomeria pauciflora (Torr.) A. Nels.

Associated species: Atriplex canescens (Pursh) Nutt., Opuntia basilaris Engelm. & Bigelow, Amaranthus albus L., Chenopodium album L., Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth, Stanleya pinnata (Pursh) Britt., Mirabilis multiflora (Torr.) Gray, Cryptantha spp., Stephanomeria exigua Nutt., Aster species, Sphaeralcea spp., Descurainia pinnata (Walt.) Britt., Machaeranthera pinnatifida (Hook.) Shinners, Bromus rigidus, Mentzelia spp., Phacelia crenulata Torr. ex S. Wats., Gutierrezia spp., Nicotiana obtusifolia Mertens & Galeotti, Sisymbrium altissimum L., Thymophylla pentachaeta (DC.) Small, Ephedra spp., Salsola tragus L., Bromus tectorum L., Datura wrightii Regel, melilotus spp., Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Cryptantha angustifolia (Torr.) Greene, Plagiobothrys arizonicus (Gray) Greene ex Gray, Camissonia walkeri (A. Nels.) Raven, Aristida spp., Stephanomeria pauciflora (Torr.) A. Nels., Tiquilia latior (I.M. Johnston) A. Richards., Phacelia rotundifolia Torr. ex S. Wats., Sporobolus cryptandrus (Torr.) Gray, Erodium cicutarium (L.) L'Hér. ex Ait., Loeseliastrum schottii (Torr.) Timbrook, Lepidium perfoliatum L., Allionia spp., Dasyochloa pulchella (Kunth) Willd. ex Rydb., Sisymbrium irio L., Schismus spp., Lycium spp., Gilia spp.

Surface water within 25 m? Surface water type: pothole Surface rocks: sandstone

Landform: Side slope Light exposure: open

Soil type: sand Soil moisture: moist

Point Intercept Transect (50m)	% Cover
Boulder	20
Cobble	10
Gravel	11
Litter (duff)	20
Sand	38
Stone	11
Aristida spp.	1
Brickellia longifolia S. Wats.	11
Bromus rubens L.	6
Bromus tectorum L.	3
Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake	1
Ephedra spp.	2
Gutierrezia spp.	1
Sphaeralcea spp.	2
Stephanomeria pauciflora (Torr.) A. Nels.	6
Tamarix ramosissima Ledeb.	18

Daubenmire Scale Cover Data from 50m Transect

Ground Cover Category	Meters	Cover Scale
Boulder	5	6 50-75%
Boulder	15	5 25-50%
Boulder	25	5 25-50%
Boulder	35	3 5-10%
Boulder	45	5 25-50%
Cobble	5	4 10-25%
Cobble	15	4 10-25%
Cobble	25	3 5-10%
Cobble	35	4 10-25%

Cobble	45	3 5-10%
Gravel	15	4 10-25%
Gravel	25	3 5-10%
Gravel	35	3 5-10%
Gravel	45	4 10-25%
Sand	5	4 10-25%
Sand	15	4 10-25%
Sand	25	4 10-25%
Sand	35	7 75-100%
Sand	45	6 50-75%
Stone	15	4 10-25%
Stone	25	3 5-10%
Stone	35	3 5-10%
Stone	45	2 1-5%

Species Name	Meters	Tree Age	Cover Scale
Aristida spp.	15		1 <1%
Aster species	35		1 <1%
Astragalus spp.	35		1 <1%
Atriplex canescens (Pursh) Nutt.	15		2 1-5%
Atriplex canescens (Pursh) Nutt.	25		2 1-5%
Atriplex canescens (Pursh) Nutt.	35		1 <1%
Atriplex spp.	45		1 <1%
Brickellia longifolia S. Wats.	5		2 1-5%
Brickellia longifolia S. Wats.	15		2 1-5%
Brickellia longifolia S. Wats.	25		2 1-5%
Brickellia longifolia S. Wats.	45		2 1-5%
Bromus rigidus	45		1 <1%
Bromus rubens L.	5		1 <1%
Bromus rubens L.	15		2 1-5%
Bromus rubens L.	25		2 1-5%
Bromus rubens L.	35		2 1-5%
Bromus rubens L.	45		1 <1%
Bromus tectorum L.	5		2 1-5%
Bromus tectorum L.	15		2 1-5%
Bromus tectorum L.	25		2 1-5%
Bromus tectorum L.	35		1 <1%
Bromus tectorum L.	45		1 <1%
Camissonia walkeri (A. Nels.) Raven	15		1 <1%
Camissonia walkeri (A. Nels.) Raven	25		1 <1%
Camissonia walkeri (A. Nels.) Raven	35		1 <1%
Camissonia walkeri (A. Nels.) Raven	45		1 <1%
Chrysothamnus spp.	15		2 1-5%
Chrysothamnus spp.	25		2 1-5%
Cryptantha angustifolia (Torr.) Greene	25		1 <1%
Cryptantha angustifolia (Torr.) Greene	35		1 <1%
Cryptobiotic soil	15		1 <1%
Cryptobiotic soil	25		1 <1%
Cryptobiotic soil	35		1 <1%
Dasyochloa pulchella (Kunth) Willd. ex Rydb.	15		1 <1%
Datura wrightii Regel	5		1 <1%
Descurainia pinnata (Walt.) Britt.	15		2 1-5%
Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake	15		2 1-5%
Ephedra spp.	25		1 <1%
Ephedra spp.	45		1 <1%

Erigeron speciosus (Lindl.) DC. var. macranthus (Nutt.) Cronq.	35		1 <1%
Erodium cicutarium (L.) L'Hér. ex Ait.	15		1 <1%
Erodium cicutarium (L.) L'Hér. ex Ait.	35		2 1-5%
Gilia spp.	45		1 <1%
Gutierrezia spp.	5		2 1-5%
Lepidium perfoliatum L.	15		2 1-5%
Lepidium perfoliatum L.	25		2 1-5%
Lepidium perfoliatum L.	35		1 <1%
Lepidium perfoliatum L.	45		1 <1%
Lithophragma tenellum Nutt.	5		3 5-10%
Lithophragma tenellum Nutt.	15		4 10-25%
Lithophragma tenellum Nutt.	25		4 10-25%
Lithophragma tenellum Nutt.	35		4 10-25%
Lithophragma tenellum Nutt.	45		3 5-10%
Loeseliastrum schottii (Torr.) Timbrook	45		1 <1%
Lycium spp.	15		1 <1%
Lycium spp.	25		1 <1%
melilotus spp.	25		1 <1%
melilotus spp.	45		1 <1%
Mentzelia spp.	35		1 <1%
Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	15		1 <1%
Nicotiana obtusifolia Mertens & Galeotti	35		1 <1%
Opuntia basilaris Engelm. & Bigelow	25		2 1-5%
Phacelia crenulata Torr. ex S. Wats.	15		1 <1%
Phacelia crenulata Torr. ex S. Wats.	25		1 <1%
Phacelia crenulata Torr. ex S. Wats.	45		1 <1%
Phacelia rotundifolia Torr. ex S. Wats.	5		1 <1%
Plagiobothrys arizonicus (Gray) Greene ex Gray	15		1 <1%
Plagiobothrys arizonicus (Gray) Greene ex Gray	25		1 <1%
Plagiobothrys arizonicus (Gray) Greene ex Gray	45		1 <1%
Salsola tragus L.	45		1 <1%
Schismus spp.	15		2 1-5%
Schismus spp.	25		1 <1%
Schismus spp.	35		1 <1%
Schismus spp.	45		1 <1%
Sisymbrium altissimum L.	25		1 <1%
Sisymbrium altissimum L.	35		1 <1%
Sisymbrium irio L.	15		2 1-5%
Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.	25		2 1-5%
Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.	35		2 1-5%
Sporobolus cryptandrus (Torr.) Gray	5		1 <1%
Sporobolus cryptandrus (Torr.) Gray	35		2 1-5%
Sporobolus cryptandrus (Torr.) Gray	45		2 1-5%
Stephanomeria exigua Nutt.	25		1 <1%
Stephanomeria pauciflora (Torr.) A. Nels.	5		1 <1%
Stephanomeria pauciflora (Torr.) A. Nels.	15		2 1-5%
Stephanomeria pauciflora (Torr.) A. Nels.	35		3 5-10%
Stephanomeria pauciflora (Torr.) A. Nels.	45		2 1-5%
Tamarix ramosissima Ledeb.	5	M Mature	5 25-50%
Tamarix ramosissima Ledeb.	25	M Mature	5 25-50%
Tamarix ramosissima Ledeb.	35	P Sapling	4 10-25%
Tamarix ramosissima Ledeb.	45	P Sapling	2 1-5%
Thymophylla pentachaeta (DC.) Small	25		1 <1%
Thymophylla pentachaeta (DC.) Small	45		1 <1%
Tiquilia latior (I.M. Johnston) A. Richards.	25		1 <1%
Tiquilia latior (I.M. Johnston) A. Richards.	45		1 <1%

Vegetation Structure Data

Species Name	Meters	# of Hits	Height
Tamarix ramosissima Ledeb.	5	4	0-1.0
Tamarix ramosissima Ledeb.	25	6	0-1.0
Bromus tectorum L.	35	1	0-1.0
Tamarix ramosissima Ledeb.	35	3	0-1.0

Soil Data

Meters	Probe depth (cm)	Reading 1	Reading 2	Reading 3	Average Reading
5	0	0	0	0	0.00
15	0	0	0	0	0.00
25	0	0	0	0	0.00
35	0	0.03	0	0.01	0.01
45	0	0	0	0	0.00

Canyon/Park	**South Canyon**	River mile:	31.5 R
Transect Name:	South Canyon Transect 1	Type:	Reference
Date:	5/6/2005	Weather:	Rainy, with spots of sun, major cloud cover
Start point:		End point:	
Easting	421031	Easting	421053
Northing	4039417	Northing	4039450
GPS accuracy (m)	11	GPS accuracy (m)	13
Bearing:	31	Elevation (m):	1043
Aspect (0-360):	130	Slope (degrees):	8

Transect description: Begins less than 100m above transect 1A in stream bed on creek left. Goes through nook in large boulders. Follows along sediment deposit on creek left. Start is on slanted 2x2m boulder.

Geological layer: Supai

Habitat type: Great Basin desert scrub

Dominant species: Ephedra spp., Bromus rubens L.

Associated species: Cryptantha spp., Schismus spp., Descurainia pinnata (Walt.) Britt., Allionia incarnata L., Dasyochloa pulchella (Kunth) Willd. ex Rydb., Sporobolus cryptandrus (Torr.) Gray, Tiquilia latior (I.M. Johnston) A. Richards., Aristida spp., Thamnosma montana Torr. & Frém., Phacelia crenulata Torr. ex S. Wats., Brickellia atractyloides Gray, Gutierrezia sarothrae (Pursh) Britt. & Rusby, Sisymbrium irio L., Atriplex canescens (Pursh) Nutt., Thymophylla pentachaeta (DC.) Small, Stephanomeria pauciflora (Torr.) A. Nels., Erodium cicutarium (L.) L'Hér. ex Ait., Sisymbrium altissimum L., Sphaeralcea spp., Machaeranthera pinnatifida (Hook.) Shinners, Cryptantha muricata (Hook. & Arn.) A. Nels. & J.F. Macbr. var. jonesii (Gray) I.M. Johnston, Ephedra spp., Camissonia walkeri (A. Nels.) Raven, Brickellia longifolia S. Wats., Cryptantha angustifolia (Torr.) Greene, Cryptobiotic soil, Opuntia basilaris Engelm. & Bigelow, Bromus tectorum L., Lappula redowski

Surface water within 25 m? Surface water type: pothole Surface rocks: sandstone

Landform: Lower slope Light exposure: open

Soil type: sand Soil moisture: dry

Point Intercept Transect (50m)	% Cover
Bedrock	12
Boulder	36
Cobble	6
Gravel	8
Litter (duff)	17
Sand	44
Atriplex canescens (Pursh) Nutt.	1
Bromus rubens L.	11
Bromus tectorum L.	2
Camissonia walkeri (A. Nels.) Raven	2
Cryptantha muricata (Hook. & Arn.) A. Nels. & J.F. Macbr. var. jonesii (Gray) I.M. Johnston	1
Ephedra spp.	8
Erodium cicutarium (L.) L'Hér. ex Ait.	1
Lepidium perfoliatum L.	1
Opuntia basilaris Engelm. & Bigelow	1
Sphaeralcea spp.	3
Stephanomeria pauciflora (Torr.) A. Nels.	1
Thymophylla pentachaeta (DC.) Small	1

Daubenmire Scale Cover Data from 50m Transect

Ground Cover Category	Meters	Cover Scale
Bedrock	5	5 25-50%
Bedrock	15	5 25-50%
Bedrock	25	6 50-75%
Bedrock	35	6 50-75%
Boulder	5	4 10-25%
Boulder	15	3 5-10%
Boulder	35	3 5-10%
Boulder	45	4 10-25%
Cobble	5	4 10-25%

Cobble	15	2 1-5%
Cobble	25	3 5-10%
Cobble	35	2 1-5%
Cobble	45	2 1-5%
Gravel	15	2 1-5%
Gravel	25	2 1-5%
Gravel	35	1 <1%
Gravel	45	2 1-5%
Litter (duff)	5	1 <1%
Litter (duff)	15	2 1-5%
Litter (duff)	25	1 <1%
Litter (duff)	35	1 <1%
Litter (duff)	45	2 1-5%
Sand	5	2 1-5%
Sand	15	2 1-5%
Sand	25	3 5-10%
Sand	35	2 1-5%
Sand	45	4 10-25%
Stone	15	2 1-5%
Stone	25	2 1-5%
Stone	35	2 1-5%
Stone	45	2 1-5%

Species Name	Meters	Tree Age	Cover Scale
Allionia incarnata L.	35		1 <1%
Aristida spp.	5		1 <1%
Aristida spp.	45		1 <1%
Atriplex canescens (Pursh) Nutt.	5		1 <1%
Atriplex canescens (Pursh) Nutt.	15		1 <1%
Atriplex canescens (Pursh) Nutt.	25		1 <1%
Atriplex canescens (Pursh) Nutt.	35		1 <1%
Atriplex canescens (Pursh) Nutt.	45		1 <1%
Brickellia atractyloides Gray	45		1 <1%
Brickellia longifolia S. Wats.	5		3 5-10%
Brickellia longifolia S. Wats.	15		1 <1%
Bromus rubens L.	5		1 <1%
Bromus rubens L.	15		1 <1%
Bromus rubens L.	25		2 1-5%
Bromus rubens L.	35		1 <1%
Bromus rubens L.	45		2 1-5%
Bromus tectorum L.	5		1 <1%
Bromus tectorum L.	15		1 <1%
Bromus tectorum L.	35		1 <1%
Bromus tectorum L.	45		1 <1%
Camissonia walkeri (A. Nels.) Raven	15		1 <1%
Cryptantha angustifolia (Torr.) Greene	45		1 <1%
Cryptantha spp.	45		1 <1%
Cryptobiotic soil	25		2 1-5%
Cryptobiotic soil	35		1 <1%
Cryptobiotic soil	45		2 1-5%
Dasyochloa pulchella (Kunth) Willd. ex Rydb.	35		1 <1%
Dasyochloa pulchella (Kunth) Willd. ex Rydb.	45		1 <1%
Descurainia pinnata (Walt.) Britt.	15		1 <1%

Descurainia pinnata (Walt.) Britt.	45		2 1-5%
Ephedra spp.	15		1 <1%
Ephedra spp.	25		1 <1%
Ephedra spp.	35		2 1-5%
Ephedra spp.	45		1 <1%
Erodium cicutarium (L.) L'Hér. ex Ait.	45		1 <1%
Gutierrezia sarothrae (Pursh) Britt. & Rusby	25		1 <1%
Gutierrezia sarothrae (Pursh) Britt. & Rusby	35		1 <1%
Lepidium spp.	25		1 <1%
Lepidium spp.	35		1 <1%
Machaeranthera pinnatifida (Hook.) Shinners	35		2 1-5%
Machaeranthera pinnatifida (Hook.) Shinners	45		1 <1%
Opuntia basilaris Engelm. & Bigelow	45		1 <1%
Phacelia crenulata Torr. ex S. Wats.	25		1 <1%
Phacelia crenulata Torr. ex S. Wats.	35		1 <1%
Phacelia crenulata Torr. ex S. Wats.	45		1 <1%
Sisymbrium irio L.	15		1 <1%
Sphaeralcea spp.	5		1 <1%
Sphaeralcea spp.	15		1 <1%
Sphaeralcea spp.	45		2 1-5%
Sporobolus cryptandrus (Torr.) Gray	15		1 <1%
Sporobolus cryptandrus (Torr.) Gray	25		1 <1%
Sporobolus cryptandrus (Torr.) Gray	35		1 <1%
Sporobolus cryptandrus (Torr.) Gray	45		1 <1%
Stephanomeria pauciflora (Torr.) A. Nels.	5		1 <1%
Stephanomeria pauciflora (Torr.) A. Nels.	15		1 <1%
Thamnosma montana Torr. & Frém.	5		2 1-5%
Thymophylla pentachaeta (DC.) Small	25		1 <1%
Thymophylla pentachaeta (DC.) Small	35		1 <1%
Thymophylla pentachaeta (DC.) Small	45		2 1-5%
Tiquilia latior (I.M. Johnston) A. Richards.	5		1 <1%
Tiquilia latior (I.M. Johnston) A. Richards.	25		1 <1%
Tiquilia latior (I.M. Johnston) A. Richards.	35		1 <1%
Tiquilia latior (I.M. Johnston) A. Richards.	45		1 <1%

Vegetation Structure Data

type	Species Name	Meters	# of Hits	Height
Reference	Stephanomeria pauciflora (Torr.) A. Nels.	5	7	0-1.0
Reference	Bromus rubens L.	15	2	0-1.0
Reference	Plagiobothrys arizonicus (Gray) Greene ex Gray	15	2	0-1.0
Reference	Bromus rubens L.	45	1	0-1.0
Reference	Ephedra spp.	45	1	0-1.0

Soil Data

Meters	Probe depth (cm)	Reading 1	Reading 2	Reading 3	Average Reading
5	0	0	0	0	0.00
15	0	0	0.01	0	0.00
25	0	0	0	0	0.00
35	0	0	0	0	0.00
45	0	0	0	0	0.00

Canyon/Park	**South Canyon**	River mile:	31.5 R
Transect Name:	South Canyon Transect 2	Type:	Tamarisk area
Date:	5/6/2005	Weather:	75% clouds with rain intermittent, 65F
Start point:		End point:	
Easting	419769	Easting	419811
Northing	4038117	Northing	4038126
GPS accuracy (m)	9	GPS accuracy (m)	5
Bearing:	85	Elevation (m):	1203
Aspect (0-360):	170	Slope (degrees):	12

Transect description: Less than 100m past 25m boulder on creek left. Just opposite 8m tall sheer supai face - look for 4x7m pock-marked supai boulder.

Geological layer: Supai

Habitat type: Great Basin desert scrub

Dominant species: Fallugia paradoxa (D. Don) Endl. ex Torr., Stanleya pinnata (Pursh) Britt., Brickellia longifolia S. Wats., Tamarix ramosissima Ledeb.

Associated species: Bromus tectorum L., Sisymbrium altissimum L., Aristida spp., Stephanomeria pauciflora (Torr.) A. Nels., Gilia spp., Pectocarya recurvata I.M. Johnston, Streptanthella longirostris (S. Wats.) Rydb., Tiquilia latior (I.M. Johnston) A. Richards., Erigeron spp., Schismus spp., Elymus elymoides (Raf.) Swezey, Gilia polycladon, Gutierrezia spp., Salsola tragus L., Astragalus spp., Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth, Atriplex canescens (Pursh) Nutt., Hesperostipa comata (Trin. & Rupr.) Barkworth ssp. comata, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Lupinus spp., Artemisia ludoviciana Nutt., Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb., Oenothera cavernae Munz, Bromus rubens L., Erodium cicutarium (L.) L'Hér. ex Ait., Melilotus spp.

Surface water within 25 m? Surface water type: Surface rocks: sandstone

Landform: Lower slope Light exposure: open

Soil type: sand Soil moisture: dry

Point Intercept Transect (50m)	% Cover
Bedrock	2
Boulder	30
Cobble	7
Gravel	13
Litter (duff)	16
Sand	44
Stone	7
Brickellia longifolia S. Wats.	7
Bromus rubens L.	1
Bromus tectorum L.	15
Sisymbrium altissimum L.	1
Tamarix ramosissima Ledeb.	40

Daubenmire Scale Cover Data from 50m Transect

Ground Cover Category	Meters	Cover Scale
Boulder	5	5 25-50%
Boulder	15	2 1-5%
Boulder	25	5 25-50%
Boulder	35	3 5-10%
Boulder	45	2 1-5%
Cobble	15	3 5-10%
Cobble	25	2 1-5%
Cobble	35	4 10-25%
Cobble	45	2 1-5%
Gravel	5	1 <1%
Gravel	15	2 1-5%
Gravel	25	2 1-5%
Gravel	35	4 10-25%
Gravel	45	3 5-10%
Litter (duff)	5	2 1-5%

Litter (duff)	15	5 25-50%
Litter (duff)	25	2 1-5%
Litter (duff)	35	1 <1%
Litter (duff)	45	2 1-5%
Sand	5	4 10-25%
Sand	15	3 5-10%
Sand	25	6 50-75%
Sand	35	5 25-50%
Sand	45	4 10-25%
Stone	5	2 1-5%
Stone	15	4 10-25%
Stone	25	1 <1%
Stone	35	3 5-10%
Stone	45	1 <1%

Species Name	Meters	Tree Age	Cover Scale
Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth	5		1 <1%
Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth	25		1 <1%
Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth	35		1 <1%
Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth	45		1 <1%
Artemisia ludoviciana Nutt.	45		1 <1%
Astragalus spp.	35		1 <1%
Atriplex canescens (Pursh) Nutt.	45		1 <1%
Brickellia longifolia S. Wats.	5		4 10-25%
Brickellia longifolia S. Wats.	15		1 <1%
Brickellia longifolia S. Wats.	45		1 <1%
Bromus rubens L.	5		1 <1%
Bromus rubens L.	15		2 1-5%
Bromus rubens L.	25		1 <1%
Bromus rubens L.	35		1 <1%
Bromus rubens L.	45		2 1-5%
Bromus tectorum L.	5		2 1-5%
Bromus tectorum L.	15		5 25-50%
Bromus tectorum L.	25		2 1-5%
Bromus tectorum L.	35		2 1-5%
Bromus tectorum L.	45		4 10-25%
Elymus elymoides (Raf.) Swezey	25		1 <1%
Elymus elymoides (Raf.) Swezey	35		1 <1%
Erigeron spp.	45		1 <1%
Erodium cicutarium (L.) L'Hér. ex Ait.	15		1 <1%
Erodium cicutarium (L.) L'Hér. ex Ait.	35		1 <1%
Fallugia paradoxa (D. Don) Endl. ex Torr.	5		2 1-5%
Fallugia paradoxa (D. Don) Endl. ex Torr.	25		3 5-10%
Fallugia paradoxa (D. Don) Endl. ex Torr.	35		2 1-5%
Gilia spp.	35		1 <1%
Gutierrezia spp.	35		1 <1%
Gutierrezia spp.	45		1 <1%
Hesperostipa comata (Trin. & Rupr.) Barkworth ssp. comata	5		1 <1%
Hesperostipa comata (Trin. & Rupr.) Barkworth ssp. comata	35		1 <1%
Lupinus spp.	5		1 <1%
Lupinus spp.	15		1 <1%
Lupinus spp.	35		1 <1%
melilotus spp.	15		1 <1%
melilotus spp.	25		1 <1%
melilotus spp.	35		1 <1%

melilotus spp.	45		1 <1%
Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	5		1 <1%
Oenothera cavernae Munz	35		1 <1%
Pectocarya recurvata I.M. Johnston	5		1 <1%
Salsola tragus L.	5		1 <1%
Schismus spp.	45		1 <1%
Sisymbrium altissimum L.	5		1 <1%
Sisymbrium altissimum L.	15		1 <1%
Sisymbrium altissimum L.	25		1 <1%
Sisymbrium altissimum L.	45		1 <1%
Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.	35		1 <1%
Stanleya pinnata (Pursh) Britt.	25		2 1-5%
Stanleya pinnata (Pursh) Britt.	35		2 1-5%
Stanleya pinnata (Pursh) Britt.	45		1 <1%
Stephanomeria pauciflora (Torr.) A. Nels.	35		2 1-5%
Streptanthella longirostris (S. Wats.) Rydb.	35		1 <1%
Tamarix ramosissima Ledeb.	15	M Mature	5 25-50%
Tamarix ramosissima Ledeb.	25	M Mature	5 25-50%
Tamarix ramosissima Ledeb.	35	P Sapling	1 <1%
Tamarix ramosissima Ledeb.	45	P Sapling	5 25-50%
Tiquilia latior (I.M. Johnston) A. Richards.	15		1 <1%
Tiquilia latior (I.M. Johnston) A. Richards.	45		1 <1%

Vegetation Structure Data

Species Name	Meters	# of Hits	Height
Brickellia longifolia S. Wats.	5	3	0-1.0
Tamarix ramosissima Ledeb.	15	1	1-2
Tamarix ramosissima Ledeb.	15	3	2-3
Tamarix ramosissima Ledeb.	15	6	0-1.0
Tamarix ramosissima Ledeb.	25	9	1-2
Tamarix ramosissima Ledeb.	25	13	0-1.0
Tamarix ramosissima Ledeb.	45	3	1-2

Soil Data

Meters	Probe depth (cm)	Reading 1	Reading 2	Reading 3	Average Reading
5	0	0	0	0	0.00
15	0	0	0.01	0	0.00
25	0	0	0	0	0.00
35	0	0	0	0	0.00
45	8	0.63	0.64	0.65	0,64

Canyon/Park	**South Canyon**	River mile:	31.5 R
Transect Name:	South Canyon Transect 2	Type:	Reference
Date:	5/6/2005	Weather:	Sunny, some clouds with intermittent rain
Start point:		End point:	
Easting	419726	Easting	419766
Northing	4038100	Northing	4038109
GPS accuracy (m)	7	GPS accuracy (m)	6
Bearing:	88	Elevation (m):	1164
Aspect (0-360):	350	Slope (degrees):	5

Transect description: Transect is on creek right near T2A. Start point on NW side of 8x6m boulder within 1m of Ptelia directly on top of roundish smaller boulder. End point heads toward Ptelia nestled among delivery truck sized boulders.

Geological layer: Supai

Habitat type: Great Basin desert scrub

Dominant species: Bromus rubens L., Bromus tectorum L., Ephedra spp., Fallugia paradoxa (D. Don) Endl. ex Torr., Atriplex canescens (Pursh) Nutt.

Associated species: Cirsium neomexicanum Gray, Moss spp., Stanleya pinnata (Pursh) Britt., Descurainia pinnata (Walt.) Britt., Lappula redowski, Cryptantha spp., Mirabilis multiflora (Torr.) Gray, Brickellia longifolia S. Wats., Opuntia polyacantha, Tiquilia latior (I.M. Johnston) A. Richards., Sporobolus cryptandrus (Torr.) Gray, Sporobolus cryptandrus (Torr.) Gray

Surface water within 25 m? Surface water type: seep Surface rocks: limestone

Landform: Lower slope Light exposure: open partial-shade

Soil type: sand Soil moisture: dry

Point Intercept Transect (50m)	% Cover
	0
Boulder	21
Litter (duff)	60
Sand	76
Woody debris structure	1
Atriplex canescens (Pursh) Nutt.	13
Bromus rubens L.	28
Bromus tectorum L.	49
Descurainia pinnata (Walt.) Britt.	1
Ephedra spp.	5
Fallugia paradoxa (D. Don) Endl. ex Torr.	27
Lappula redowski	2
Mirabilis multiflora (Torr.) Gray	1
Stanleya pinnata (Pursh) Britt.	6

Daubenmire Scale Cover Data from 50m Transect

Ground Cover Category	Meters	Cover Scale
Boulder	5	6 50-75%
Boulder	15	6 50-75%
Boulder	35	2 1-5%
Boulder	45	2 1-5%
Coarse woody debris	25	1 <1%
Coarse woody debris	35	1 <1%
Cobble	35	1 <1%
Cobble	45	2 1-5%
Gravel	35	1 <1%
Gravel	45	2 1-5%
Litter (duff)	5	2 1-5%
Litter (duff)	15	2 1-5%
Litter (duff)	25	1 <1%
Litter (duff)	45	2 1-5%
Sand	5	2 1-5%
Sand	25	1 <1%

Sand	35	2 1-5%
Sand	45	3 5-10%
Stone	5	1 <1%
Stone	35	1 <1%

Species Name	Meters	Tree Age	Cover Scale
Aristida spp.	15		1 <1%
Atriplex canescens (Pursh) Nutt.	25		4 10-25%
Atriplex canescens (Pursh) Nutt.	35		3 5-10%
Atriplex canescens (Pursh) Nutt.	45		1 <1%
Brickellia longifolia S. Wats.	45		1 <1%
Bromus rubens L.	5		3 5-10%
Bromus rubens L.	15		2 1-5%
Bromus rubens L.	25		3 5-10%
Bromus rubens L.	35		3 5-10%
Bromus rubens L.	45		2 1-5%
Bromus tectorum L.	5		3 5-10%
Bromus tectorum L.	15		2 1-5%
Bromus tectorum L.	25		3 5-10%
Bromus tectorum L.	35		3 5-10%
Bromus tectorum L.	45		6 50-75%
Cirsium neomexicanum Gray	25		1 <1%
Cryptantha spp.	15		1 <1%
Ephedra spp.	5		4 10-25%
Ephedra spp.	35		2 1-5%
Ephedra spp.	45		1 <1%
Fallugia paradoxa (D. Don) Endl. ex Torr.	15		5 25-50%
Fallugia paradoxa (D. Don) Endl. ex Torr.	25		5 25-50%
Fallugia paradoxa (D. Don) Endl. ex Torr.	45		4 10-25%
Lappula redowski	25		1 <1%
Mirabilis multiflora (Torr.) Gray	35		2 1-5%
Opuntia polyacantha Haw.	15		1 <1%
Sisymbrium altissimum L.	45		1 <1%
Sporobolus cryptandrus (Torr.) Gray	35		1 <1%
Stanleya pinnata (Pursh) Britt.	5		1 <1%
Stanleya pinnata (Pursh) Britt.	25		1 <1%
Stanleya pinnata (Pursh) Britt.	35		1 <1%
Stanleya pinnata (Pursh) Britt.	45		2 1-5%
Tiquilia latior (I.M. Johnston) A. Richards.	35		1 <1%

Vegetation Structure Data

Species Name	Meters	# of Hits	Height
Fallugia paradoxa (D. Don) Endl. ex Torr.	15	2	1-2
Fallugia paradoxa (D. Don) Endl. ex Torr.	15	6	0-1.0
Bromus tectorum L.	25	3	0-1.0
Fallugia paradoxa (D. Don) Endl. ex Torr.	25	3	0-1.0
Bromus tectorum L.	35	8	0-1.0
Ephedra spp.	35	6	0-1.0
Bromus tectorum L.	45	2	0-1.0
Fallugia paradoxa (D. Don) Endl. ex Torr.	45	10	0-1.0

Soil Data

Crews did not collect soil data for this transect.

Canyon/Park **Trail Canyon** River mile: 219 R

Transect Name:	Trail Canyon Transect 1	Type:	Tamarisk area
Date:	5/18/2005	Weather:	Sunny, high clouds, 90F
Start point:		End point:	
Easting	289295	Easting	289334
Northing	3968587	Northing	3968567
GPS accuracy (m)	2	GPS accuracy (m)	7
Bearing:	102	Elevation (m):	465
Aspect (0-360):	193	Slope (degrees):	6

Transect description: Transect is ~850m from mouth of canyon on creek left, about 1m from creek and ~8m down canyon from 1m tall conglomerate pourover. Transect is ~1m above stream on bench.

Geological layer: Zoroaster granite and tapeats

Habitat type: Riparian Mojave desert scrub

Dominant species: Pluchea sericea (Nutt.) Coville, Tamarix ramosissima Ledeb., Baccharis salicifolia (Ruiz & Pavón) Pers., Acacia greggii Gray

Associated species: Cryptantha spp., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Cryptantha pterocarya (Torr.) Greene, Cryptobiotic soil, Atriplex canescens (Pursh) Nutt., Isocoma acradenia (Greene) Greene, Sporobolus cryptandrus (Torr.) Gray, Polypogon monspeliensis (L.) Desf., Sphaeralcea spp., Porophyllum gracile Benth., Bromus rubens L., Encelia farinosa Gray ex Torr., Aristida spp., Draba cuneifolia Nutt. ex Torr. & Gray, Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb., Pleurocoronis pluriseta (Gray) King & H.E. Robins., Sporobolus spp., Vulpia octoflora, Prosopis glandulosa Torr., Sonchus asper (L.) Hill, Plantago patagonica Jacq., Descurainia pinnata (Walt.) Britt., Ephedra spp., Baccharis sarothroides Gray, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi

Surface water within 25 m? Surface water type: stream Surface rocks: granite

Landform: Lower slope Drainage channel Light exposure: partial-shade

Soil type: sandy loam Soil moisture: dry

Point Intercept Transect (50m)	% Cover
Bedrock	2
Coarse woody debris	5
Cobble	12
Gravel	42
Litter (duff)	76
Sand	10
Stone	1
Acacia greggii Gray	4
Aristida spp.	4
Baccharis salicifolia (Ruiz & Pavón) Pers.	20
Baccharis spp.	2
Bromus rubens L.	19
Cryptantha spp.	1
Draba cuneifolia Nutt. ex Torr. & Gray	2
Encelia farinosa Gray ex Torr.	3
Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	14
Polypogon monspeliensis (L.) Desf.	1
Sonchus asper (L.) Hill	1
Sporobolus contractus A.S. Hitchc.	1
Sporobolus cryptandrus (Torr.) Gray	1
Tamarix ramosissima Ledeb.	56
Vulpia microstachys	8
Vulpia octoflora	9

Daubenmire Scale Cover Data from 50m Transect

Ground Cover Category	Meters	Cover Scale
Bedrock	25	2 1-5%
Bedrock	35	1 <1%
Bedrock	45	3 5-10%
Boulder	5	2 1-5%
Boulder	15	1 <1%
Coarse woody debris	15	2 1-5%
Coarse woody debris	25	2 1-5%

Coarse woody debris	35	1 <1%
Coarse woody debris	45	2 1-5%
Cobble	5	2 1-5%
Cobble	15	4 10-25%
Cobble	25	4 10-25%
Cobble	35	4 10-25%
Cobble	45	4 10-25%
Gravel	5	4 10-25%
Gravel	15	4 10-25%
Gravel	25	5 25-50%
Gravel	35	5 25-50%
Gravel	45	5 25-50%
Litter (duff)	5	4 10-25%
Litter (duff)	15	4 10-25%
Litter (duff)	25	5 25-50%
Litter (duff)	35	4 10-25%
Litter (duff)	45	4 10-25%
Sand	5	4 10-25%
Sand	15	4 10-25%
Sand	25	2 1-5%
Sand	35	2 1-5%
Sand	45	4 10-25%
Stone	5	1 <1%
Stone	15	2 1-5%
Stone	25	2 1-5%
Stone	35	2 1-5%
Stone	45	2 1-5%

Species Name	Meters	Tree Age	Cover Scale
Acacia greggii Gray	5	P Sapling	2 1-5%
Acacia greggii Gray	15	P Sapling	2 1-5%
Aristida spp.	5		1 <1%
Aristida spp.	15		1 <1%
Aristida spp.	25		1 <1%
Aristida spp.	35		2 1-5%
Aristida spp.	45		1 <1%
Artemisia ludoviciana Nutt.	45		1 <1%
Baccharis salicifolia (Ruiz & Pavón) Pers.	5		1 <1%
Baccharis salicifolia (Ruiz & Pavón) Pers.	15		4 10-25%
Baccharis salicifolia (Ruiz & Pavón) Pers.	25		3 5-10%
Baccharis salicifolia (Ruiz & Pavón) Pers.	35		2 1-5%
Baccharis sarothroides Gray	5		2 1-5%
Brickellia longifolia S. Wats.	45		1 <1%
Bromus rubens L.	5		4 10-25%
Bromus rubens L.	25		3 5-10%
Bromus rubens L.	35		1 <1%
Bromus rubens L.	45		2 1-5%
Cryptantha maritima (Greene) Greene	25		1 <1%
Cryptantha pterocarya (Torr.) Greene	15		1 <1%
Cryptantha spp.	5		1 <1%
Cryptantha spp.	15		1 <1%

Cryptantha spp.	25		2 1-5%
Cryptantha spp.	35		1 <1%
Cryptantha spp.	45		1 <1%
Cryptobiotic soil	5		4 10-25%
Cryptobiotic soil	15		2 1-5%
Cynodon dactylon (L.) Pers.	5		2 1-5%
Cynodon dactylon (L.) Pers.	15		2 1-5%
Cynodon dactylon (L.) Pers.	35		5 25-50%
Cynodon dactylon (L.) Pers.	45		1 <1%
Dasyochloa pulchella (Kunth) Willd. ex Rydb.	45		1 <1%
Descurainia pinnata (Walt.) Britt.	5		1 <1%
Descurainia pinnata (Walt.) Britt.	25		1 <1%
Draba cuneifolia Nutt. ex Torr. & Gray	25		1 <1%
Draba cuneifolia Nutt. ex Torr. & Gray	35		1 <1%
Draba cuneifolia Nutt. ex Torr. & Gray	45		1 <1%
Encelia farinosa Gray ex Torr.	5		2 1-5%
Encelia farinosa Gray ex Torr.	15		3 5-10%
Encelia farinosa Gray ex Torr.	25		2 1-5%
Encelia farinosa Gray ex Torr.	35		3 5-10%
Encelia farinosa Gray ex Torr.	45		2 1-5%
Eucnide urens (Parry ex Gray) Parry	45		2 1-5%
Hedeoma spp.	45		1 <1%
Isocoma acradenia (Greene) Greene	5		2 1-5%
Isocoma acradenia (Greene) Greene	15		1 <1%
Lepidium lasiocarpum Nutt. var. lasiocarpum	5		1 <1%
Lepidium lasiocarpum Nutt. var. lasiocarpum	35		1 <1%
Lepidium lasiocarpum Nutt. var. lasiocarpum	45		1 <1%
Linanthus bigelovii (Gray) Greene	25		1 <1%
Linanthus bigelovii (Gray) Greene	45		1 <1%
Linum lewisii Pursh	45		1 <1%
Machaeranthera pinnatifida (Hook.) Shinners	45		1 <1%
Nemacladus glanduliferus Jepson	25		1 <1%
Nemacladus glanduliferus Jepson	45		1 <1%
Nicotiana obtusifolia Mertens & Galeotti var. obtusifolia	25		1 <1%
Oenothera caespitosa Nutt.	5		1 <1%
Oenothera caespitosa Nutt.	25		1 <1%
Oenothera caespitosa Nutt.	45		1 <1%
Plantago patagonica Jacq.	5		1 <1%
Pleurocoronis pluriseta (Gray) King & H.E. Robins.	35		1 <1%
Pluchea sericea (Nutt.) Coville	25		2 1-5%
Pluchea sericea (Nutt.) Coville	35		4 10-25%
Pluchea sericea (Nutt.) Coville	45		3 5-10%
Poa bigelovii Vasey & Scribn.	5		1 <1%
Poa bigelovii Vasey & Scribn.	15		1 <1%
Poa bigelovii Vasey & Scribn.	25		1 <1%
Poa bigelovii Vasey & Scribn.	35		1 <1%
Poa bigelovii Vasey & Scribn.	45		2 1-5%
Polypogon monspeliensis (L.) Desf.	5		1 <1%
Polypogon monspeliensis (L.) Desf.	15		1 <1%
Polypogon monspeliensis (L.) Desf.	25		1 <1%
Polypogon monspeliensis (L.) Desf.	35		1 <1%
Polypogon monspeliensis (L.) Desf.	45		1 <1%
Porophyllum gracile Benth.	35		2 1-5%
Porophyllum gracile Benth.	45		1 <1%
Prosopis glandulosa Torr.	5	M Mature	5 25-50%
Prosopis glandulosa Torr.	15	M Mature	2 1-5%
Silene antirrhina L.	35		1 <1%

Silene antirrhina L.	45		1 <1%
Sonchus asper (L.) Hill	5		1 <1%
Sonchus asper (L.) Hill	15		1 <1%
Sonchus asper (L.) Hill	25		1 <1%
Sonchus asper (L.) Hill	35		1 <1%
Sonchus asper (L.) Hill	45		1 <1%
Sphaeralcea spp.	25		1 <1%
Sporobolus spp.	5		3 5-10%
Sporobolus spp.	15		2 1-5%
Sporobolus spp.	25		1 <1%
Stephanomeria exigua Nutt.	25		1 <1%
Stylocline micropoides Gray	35		1 <1%
Stylocline micropoides Gray	45		1 <1%
Tamarix ramosissima Ledeb.	5		5 25-50%
Tamarix ramosissima Ledeb.	15		5 25-50%
Tamarix ramosissima Ledeb.	25		5 25-50%
Tamarix ramosissima Ledeb.	35	M Mature	4 10-25%
Tamarix ramosissima Ledeb.	45	M Mature	5 25-50%

Vegetation Structure Data

Species Name	Meters	# of Hits	Height
Sporobolus cryptandrus (Torr.) Gray	5	1	0-1.0
Baccharis salicifolia (Ruiz & Pavón) Pers.	15	1	0-1.0
Tamarix ramosissima Ledeb.	15	5	0-1.0
Tamarix ramosissima Ledeb.	25	2	2-3
Tamarix ramosissima Ledeb.	25	4	0-1.0
Cryptantha spp.	35	5	0-1.0
Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	35	3	0-1.0
Tamarix ramosissima Ledeb.	35	2	0-1.0
Tamarix ramosissima Ledeb.	45	5	1-2

Soil Data

Meters	Probe depth (cm)	Reading 1	Reading 2	Reading 3	Average Reading
5	1	0	0	0	0.00
15	2	0.01	0.03	0.02	0.02
25	1.5	0.01	0.02	0.03	0.02
35	1	0.01	0.05	0.03	0.03
45	3.5	0.01	0.01	0.01	0.01

Canyon/Park	**Trail Canyon**	River mile:	219 R
Transect Name:	Trail Canyon Transect 1	Type:	Reference
Date:	5/18/2005	Weather:	Clear, warm with high cirrus clouds
Start point:		End point:	
Easting	289222	Easting	289225
Northing	3968621	Northing	3968610
GPS accuracy (m)	8	GPS accuracy (m)	25
Bearing:	157	Elevation (m):	536
Aspect (0-360):	236	Slope (degrees):	5

Transect description: Transect is ~983m upstream from mouth of trail canyon on creek left, near first dense BACSAL area. When hiking up canyon, forge through two granite slickrock waterfalls. Drainage channel widens to ~25m in transect area.

Geological layer: Zoroaster granite

Habitat type: Riparian

Dominant species: Baccharis salicifolia (Ruiz & Pavón) Pers., Isocoma acradenia (Greene) Greene

Associated species: Tamarix ramosissima Ledeb., Prosopis glandulosa Torr., Typha angustifolia L., Loeseliastrum schottii (Torr.) Timbrook, Gutierrezia sarothrae (Pursh) Britt. & Rusby, Daucus spp., Rorippa nasturtium-aquaticum (L.) Hayek, Maurandya antirrhiniflora, Poa bigelovii Vasey & Scribn., Isocoma acradenia (Greene) Greene, Allionia incarnata L., Encelia farinosa Gray ex Torr., Linanthus bigelovii (Gray) Greene, Eriogonum spp., Stylocline micropoides Gray, Bromus tectorum L., Mimulus guttatus DC., Descurainia pinnata (Walt.) Britt., Penstemon spp., Polypogon monspeliensis (L.) Desf., Astragalus nuttallianus DC., Baccharis salicifolia (Ruiz & Pavón) Pers., Sonchus asper (L.) Hill, Nemacladus glanduliferus Jepson, Camissonia spp., Artemisia ludoviciana Nutt., Hedeoma oblongifolia (Gray) Heller, Gnaphalium chilense, Datura wrightii Regel, Parietaria hespera Hinton, Cynodon dactylon (L.) Pers., Draba cuneifolia Nutt. ex Torr. & Gray, Vulpia octoflora, Bromus japonicus Thunb. ex Murr., Silene antirrhina L., Cryptantha pterocarya (Torr.) Greene, Conyza canadensis (L.) Cronq., Acacia greggii Gray, Funastrum cynanchoides (Dcne.) Schlechter ssp. cynanchoides, Cirsium spp., Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb., Mirabilis bigelovii Gray, Galium spp., Erigeron divergens Torr. & Gray, Lepidium lasiocarpum Nutt. var. lasiocarpum, Sporobolus cryptandrus (Torr.) Gray, Cryptantha spp., Plantago patagonica Jacq., Trixis californica Kellogg, Aristida spp., Erigeron spp., Pluchea sericea (Nutt.) Coville, Senna covesii (Gray) Irwin & Barneby, Linum lewisii Pursh, Oenothera caespitosa Nutt., Juncus torreyi Coville, Brickellia longifolia S. Wats., Bromus rubens L., Bebbia juncea (Benth.) Greene var. aspera Greene

Surface water within 25 m? Surface water type: stream Surface rocks: granite

Landform: Drainage channel Light exposure: open

Soil type: loamy sand Soil moisture: moist

Point Intercept Transect (50m)	% Cover
Boulder	10
Coarse woody debris	9
Cobble	4
Gravel	38
Litter (duff)	37
Sand	55
Stone	2
Aristida spp.	1
Baccharis salicifolia (Ruiz & Pavón) Pers.	27
Bebbia juncea (Benth.) Greene var. aspera Greene	6
Bromus rubens L.	2
Funastrum cynanchoides (Dcne.) Schlechter	1
Gutierrezia sarothrae (Pursh) Britt. & Rusby	2
Isocoma acradenia (Greene) Greene	11
Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	3
Polypogon monspeliensis (L.) Desf.	1
Tamarix ramosissima Ledeb.	4

Daubenmire Scale Cover Data from 50m Transect

Ground Cover Category	Meters	Cover Scale
Boulder	5	4 10-25%
Boulder	35	3 5-10%
Boulder	45	4 10-25%
Coarse woody debris	5	3 5-10%
Coarse woody debris	15	1 <1%
Coarse woody debris	35	1 <1%

Cobble	5	4 10-25%
Cobble	15	4 10-25%
Cobble	25	3 5-10%
Cobble	35	4 10-25%
Cobble	45	3 5-10%
Gravel	5	3 5-10%
Gravel	15	5 25-50%
Gravel	25	5 25-50%
Gravel	35	6 50-75%
Gravel	45	5 25-50%
Litter (duff)	5	5 25-50%
Litter (duff)	15	2 1-5%
Litter (duff)	25	2 1-5%
Litter (duff)	35	3 5-10%
Sand	5	2 1-5%
Sand	15	4 10-25%
Sand	25	5 25-50%
Sand	35	4 10-25%
Sand	45	5 25-50%
Stone	5	4 10-25%
Stone	15	2 1-5%
Stone	25	2 1-5%
Stone	35	3 5-10%
Stone	45	3 5-10%
Woody debris structure	25	1 <1%

Species Name	Meters	Tree Age	Cover Scale
Acacia greggii Gray	5	S Seedling	1 <1%
Acacia greggii Gray	25		1 <1%
Allionia incarnata L.	5		1 <1%
Aristida spp.	5		1 <1%
Aristida spp.	15		1 <1%
Aristida spp.	35		1 <1%
Artemisia ludoviciana Nutt.	5		1 <1%
Artemisia ludoviciana Nutt.	25		1 <1%
Baccharis salicifolia (Ruiz & Pavón) Pers.	5		4 10-25%
Baccharis salicifolia (Ruiz & Pavón) Pers.	15		5 25-50%
Baccharis salicifolia (Ruiz & Pavón) Pers.	25		5 25-50%
Baccharis salicifolia (Ruiz & Pavón) Pers.	35		4 10-25%
Baccharis salicifolia (Ruiz & Pavón) Pers.	45		4 10-25%
Bebbia juncea (Benth.) Greene var. aspera Greene	35		1 <1%
Brickellia longifolia S. Wats.	35		2 1-5%
Bromus japonicus Thunb. ex Murr.	5		1 <1%
Bromus japonicus Thunb. ex Murr.	45		1 <1%
Bromus rubens L.	5		2 1-5%
Bromus rubens L.	15		2 1-5%
Bromus rubens L.	25		2 1-5%
Bromus rubens L.	35		2 1-5%
Bromus rubens L.	45		1 <1%
Bromus tectorum L.	25		1 <1%
Bromus tectorum L.	35		1 <1%
Bromus tectorum L.	45		1 <1%
Cirsium spp.	15		1 <1%

Cirsium spp.	35		1 <1%
Conyza canadensis (L.) Cronq.	5		1 <1%
Cryptantha maritima (Greene) Greene	5		1 <1%
Cryptantha pterocarya (Torr.) Greene	5		1 <1%
Cryptantha spp.	5		1 <1%
Cryptantha spp.	15		1 <1%
Cryptantha spp.	25		1 <1%
Cryptantha spp.	35		1 <1%
Cryptantha spp.	45		1 <1%
Cryptobiotic soil	15		2 1-5%
Cryptobiotic soil	25		2 1-5%
Cryptobiotic soil	35		2 1-5%
Cryptobiotic soil	45		1 <1%
Cynodon dactylon (L.) Pers.	15		1 <1%
Cynodon dactylon (L.) Pers.	25		2 1-5%
Cynodon dactylon (L.) Pers.	35		3 5-10%
Cynodon dactylon (L.) Pers.	45		1 <1%
Datura wrightii Regel	15		1 <1%
Datura wrightii Regel	45		1 <1%
Daucus pusillus Michx.	35		1 <1%
Daucus pusillus Michx.	45		1 <1%
Daucus spp.	35		1 <1%
Descurainia pinnata (Walt.) Britt.	5		1 <1%
Descurainia pinnata (Walt.) Britt.	15		1 <1%
Draba cuneifolia Nutt. ex Torr. & Gray	45		1 <1%
Encelia farinosa Gray ex Torr.	15		1 <1%
Encelia farinosa Gray ex Torr.	45		1 <1%
Erigeron divergens Torr. & Gray	5		1 <1%
Erigeron divergens Torr. & Gray	35		1 <1%
Erigeron spp.	5		1 <1%
Eriogonum spp.	45		1 <1%
Erodium cicutarium (L.) L'Hér. ex Ait.	25		1 <1%
Funastrum cynanchoides (Dcne.) Schlechter	5		2 1-5%
Galium spp.	5		1 <1%
Galium spp.	15		1 <1%
Galium spp.	25		1 <1%
Galium spp.	45		1 <1%
Gilia spp.	25		1 <1%
Gilia spp.	45		1 <1%
Gnaphalium chilense	25		1 <1%
Hedeoma oblongifolia (Gray) Heller	15		1 <1%
Hedeoma oblongifolia (Gray) Heller	25		1 <1%
Hedeoma oblongifolia (Gray) Heller	45		1 <1%
Isocoma acradenia (Greene) Greene	5		3 5-10%
Isocoma acradenia (Greene) Greene	15		5 25-50%
Isocoma acradenia (Greene) Greene	25		4 10-25%
Isocoma acradenia (Greene) Greene	35		3 5-10%
Isocoma acradenia (Greene) Greene	45		4 10-25%
Lepidium lasiocarpum Nutt. var. lasiocarpum	5		1 <1%
Lepidium lasiocarpum Nutt. var. lasiocarpum	15		1 <1%
Lepidium lasiocarpum Nutt. var. lasiocarpum	25		1 <1%
Lepidium lasiocarpum Nutt. var. lasiocarpum	35		1 <1%
Lepidium lasiocarpum Nutt. var. lasiocarpum	45		1 <1%
Linanthus bigelovii (Gray) Greene	45		1 <1%
Loeseliastrum schottii (Torr.) Timbrook	45		1 <1%
Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm.	5		1 <1%
Mimulus guttatus DC.	25		1 <1%

Nemacladus glanduliferus Jepson	45		1 <1%
Oenothera caespitosa Nutt.	5		1 <1%
Oenothera caespitosa Nutt.	15		1 <1%
Oenothera caespitosa Nutt.	25		1 <1%
Oenothera caespitosa Nutt.	35		1 <1%
Oenothera caespitosa Nutt.	45		1 <1%
Parietaria hespera Hinton	5		1 <1%
Parietaria hespera Hinton	15		1 <1%
Penstemon spp.	5		1 <1%
Penstemon spp.	45		1 <1%
Plantago patagonica Jacq.	5		1 <1%
Plantago patagonica Jacq.	15		1 <1%
Plantago patagonica Jacq.	45		1 <1%
Poa bigelovii Vasey & Scribn.	5		1 <1%
Poa bigelovii Vasey & Scribn.	15		1 <1%
Poa bigelovii Vasey & Scribn.	25		1 <1%
Poa bigelovii Vasey & Scribn.	35		1 <1%
Poa bigelovii Vasey & Scribn.	45		1 <1%
Polypogon monspeliensis (L.) Desf.	5		1 <1%
Polypogon monspeliensis (L.) Desf.	15		2 1-5%
Polypogon monspeliensis (L.) Desf.	25		2 1-5%
Polypogon monspeliensis (L.) Desf.	35		3 5-10%
Polypogon monspeliensis (L.) Desf.	45		2 1-5%
Prosopis glandulosa Torr.	5	M Mature	2 1-5%
Rorippa nasturtium-aquaticum (L.) Hayek	25		1 <1%
Senna covesii (Gray) Irwin & Barneby	5		2 1-5%
Silene antirrhina L.	5		1 <1%
Silene antirrhina L.	15		1 <1%
Silene antirrhina L.	25		1 <1%
Silene antirrhina L.	35		1 <1%
Silene antirrhina L.	45		1 <1%
Sonchus asper (L.) Hill	25		1 <1%
Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.	5		1 <1%
Sporobolus cryptandrus (Torr.) Gray	5		2 1-5%
Sporobolus cryptandrus (Torr.) Gray	15		1 <1%
Sporobolus cryptandrus (Torr.) Gray	25		1 <1%
Stylocline micropoides Gray	5		1 <1%
Stylocline micropoides Gray	25		1 <1%
Tamarix ramosissima Ledeb.	15	P Sapling	2 1-5%
Tamarix ramosissima Ledeb.	25	P Sapling	2 1-5%
Tamarix ramosissima Ledeb.	35	P Sapling	3 5-10%
Tamarix ramosissima Ledeb.	45	P Sapling	2 1-5%
Vulpia octoflora	5		1 <1%
Vulpia octoflora	15		1 <1%
Vulpia octoflora	25		1 <1%
Vulpia octoflora	35		1 <1%
Vulpia octoflora	45		1 <1%

Vegetation Structure Data

Species Name	Meters	# of Hits	Height
Baccharis salicifolia (Ruiz & Pavón) Pers.	25	3	0-1.0
Bebbia juncea (Benth.) Greene var. aspera Greene	35	4	0-1.0
Tamarix ramosissima Ledeb.	35	3	0-1.0

Soil Data

type	Meters	Probe depth (cm)	Reading 1	Reading 2	Reading 3	Average Reading
Reference	5	8	0.01	0.02	0.02	0.02
Reference	15	4	0.04	0.03	0.04	0.04
Reference	25	5	0.05	0.07	0.08	0.07
Reference	35	5	0.05	0.04	0.03	0.04
Reference	45	2.5	0.02	0.01	0.01	0.01

Canyon/Park	**Trail Canyon**	River mile:	219 R
Transect Name:	Trail Canyon Transect 2	Type:	Tamarisk area
Date:	5/18/2005	Weather:	Sunny, hot, no clouds
Start point:		End point:	
Easting	289454	Easting	289487
Northing	3968453	Northing	3968490
GPS accuracy (m)	4	GPS accuracy (m)	5
Bearing:	47	Elevation (m):	453
Aspect (0-360):	123	Slope (degrees):	5

Transect description: Down canyon from trail T1A and T1B. Start point is within 125m of small waterfall that you climb over on creek right (2m climb). Granite cliffs on creek right, sloping granite creek left. 100m straight away - 10 to 15m wide. 20m below where creek makes a turn to creek left.

Geological layer: Granite, tapeats

Habitat type: Riparian Mojave desert scrub

Dominant species: Tamarix ramosissima Ledeb., Polypogon monspeliensis (L.) Desf., Bromus rubens L., Prosopis glandulosa

Associated species: Cryptantha spp., Maurandya antirrhiniflora, Nemacladus glanduliferus Jepson, Camissonia spp., Aristida spp., Polypogon monspeliensis (L.) Desf., Sonchus asper (L.) Hill, Juncus spp., Sporobolus spp., Lepidium lasiocarpum Nutt. var. lasiocarpum, Vulpia octoflora, Draba cuneifolia Nutt. ex Torr. & Gray, Pseudognaphalium chilense, Penstemon palmeri Gray, Stylocline micropoides Gray, Loeseliastrum schottii (Torr.) Timbrook, Cirsium neomexicanum Gray, Encelia farinosa Gray ex Torr., Isocoma acradenia (Greene) Greene, Bebbia juncea (Benth.) Greene var. aspera Greene, Sporobolus contractus A.S. Hitchc., Plantago patagonica Jacq., Sphaeralcea spp., Galium spp., Eucrypta micrantha (Torr.) Heller, Gilia spp., Bromus japonicus Thunb. ex Murr., Oenothera caespitosa Nutt., Cryptobiotic soil, Vulpia microstachys, Linanthus bigelovii (Gray) Greene, Erodium cicutarium (L.) L'Hér. ex Ait., Erigeron divergens Torr. & Gray, Allionia incarnata L., Hedeoma oblongifolia (Gray) Heller, Parietaria hespera Hinton, Cynodon dactylon (L.) Pers., Poa bigelovii Vasey & Scribn., Baccharis salicifolia (Ruiz & Pavón) Pers., Acacia greggii Gray, Mirabilis bigelovii Gray, Gutierrezia sarothrae (Pursh) Britt. & Rusby, Silene antirrhina L.

Surface water within 25 m? Surface water type: stream Surface rocks: granite

Landform: Drainage channel Light exposure: open

Soil type: sand Soil moisture: dry

Point Intercept Transect (50m)	% Cover
Bedrock	19
Boulder	6
Cobble	12
Gravel	32
Litter (duff)	13
Sand	31
Stone	1
Bromus rubens L.	4
Cynodon dactylon (L.) Pers.	11
Isocoma acradenia (Greene) Greene	1
Polypogon monspeliensis (L.) Desf.	21
Sonchus asper (L.) Hill	2
Tamarix ramosissima Ledeb.	32
Vulpia microstachys	1
Vulpia octoflora	1

Daubenmire Scale Cover Data from 50m Transect

Ground Cover Category	Meters	Cover Scale
Bedrock	5	4 10-25%
Bedrock	15	5 25-50%
Bedrock	25	6 50-75%
Bedrock	35	5 25-50%
Boulder	45	2 1-5%
Coarse woody debris	15	2 1-5%
Coarse woody debris	45	1 <1%
Cobble	5	4 10-25%
Cobble	15	4 10-25%
Cobble	25	3 5-10%

Cobble	35	4 10-25%
Cobble	45	4 10-25%
Gravel	5	6 50-75%
Gravel	15	5 25-50%
Gravel	25	4 10-25%
Gravel	35	5 25-50%
Gravel	45	4 10-25%
Litter (duff)	5	2 1-5%
Litter (duff)	15	3 5-10%
Litter (duff)	25	2 1-5%
Litter (duff)	35	2 1-5%
Litter (duff)	45	4 10-25%
Sand	5	3 5-10%
Sand	15	4 10-25%
Sand	25	3 5-10%
Sand	35	3 5-10%
Sand	45	3 5-10%
Stone	5	2 1-5%
Stone	15	4 10-25%
Stone	25	2 1-5%
Stone	35	2 1-5%
Stone	45	4 10-25%

Species Name	Meters	Tree Age	Cover Scale
Acacia greggii Gray	35	P Sapling	1 <1%
Acacia greggii Gray	45	P Sapling	1 <1%
Allionia incarnata L.	35		1 <1%
Aristida spp.	5		1 <1%
Artemisia ludoviciana Nutt.	25		1 <1%
Artemisia ludoviciana Nutt.	35		1 <1%
Artemisia ludoviciana Nutt.	45		1 <1%
Baccharis salicifolia (Ruiz & Pavón) Pers.	15		1 <1%
Baccharis salicifolia (Ruiz & Pavón) Pers.	25		1 <1%
Baccharis salicifolia (Ruiz & Pavón) Pers.	35		1 <1%
Baccharis salicifolia (Ruiz & Pavón) Pers.	45		2 1-5%
Bebbia juncea (Benth.) Greene var. aspera Greene	5		2 1-5%
Bromus japonicus Thunb. ex Murr.	25		1 <1%
Bromus rubens L.	5		2 1-5%
Bromus rubens L.	15		2 1-5%
Bromus rubens L.	25		2 1-5%
Bromus rubens L.	35		2 1-5%
Bromus rubens L.	45		2 1-5%
Cirsium neomexicanum Gray	45		1 <1%
Cryptantha spp.	5		1 <1%
Cryptantha spp.	15		1 <1%
Cryptantha spp.	25		1 <1%
Cryptantha spp.	35		2 1-5%
Cryptantha spp.	45		1 <1%
Cryptobiotic soil	25		1 <1%
Cryptobiotic soil	35		1 <1%
Cryptobiotic soil	45		1 <1%
Cynodon dactylon (L.) Pers.	5		1 <1%
Cynodon dactylon (L.) Pers.	15		3 5-10%

Cynodon dactylon (L.) Pers.	25		3 5-10%
Cynodon dactylon (L.) Pers.	35		1 <1%
Cynodon dactylon (L.) Pers.	45		3 5-10%
Draba cuneifolia Nutt. ex Torr. & Gray	25		1 <1%
Draba cuneifolia Nutt. ex Torr. & Gray	35		1 <1%
Draba cuneifolia Nutt. ex Torr. & Gray	45		1 <1%
Encelia farinosa Gray ex Torr.	5		2 1-5%
Encelia farinosa Gray ex Torr.	15		1 <1%
Erigeron divergens Torr. & Gray	5		1 <1%
Erigeron divergens Torr. & Gray	25		1 <1%
Erigeron divergens Torr. & Gray	45		1 <1%
Erodium cicutarium (L.) L'Hér. ex Ait.	15		1 <1%
Erodium cicutarium (L.) L'Hér. ex Ait.	35		1 <1%
Erodium cicutarium (L.) L'Hér. ex Ait.	45		1 <1%
Eucrypta micrantha (Torr.) Heller	35		1 <1%
Galium spp.	35		1 <1%
Galium spp.	45		1 <1%
Gilia spp.	25		1 <1%
Gilia spp.	35		1 <1%
Gilia spp.	45		1 <1%
Gutierrezia sarothrae (Pursh) Britt. & Rusby	5		2 1-5%
Gutierrezia sarothrae (Pursh) Britt. & Rusby	35		1 <1%
Hedeoma oblongifolia (Gray) Heller	35		1 <1%
Hedeoma oblongifolia (Gray) Heller	45		1 <1%
Isocoma acradenia (Greene) Greene	5		1 <1%
Isocoma acradenia (Greene) Greene	15		1 <1%
Isocoma acradenia (Greene) Greene	35		2 1-5%
Isocoma acradenia (Greene) Greene	45		2 1-5%
Juncus spp.	15		1 <1%
Juncus spp.	45		2 1-5%
Lepidium lasiocarpum Nutt. var. lasiocarpum	15		1 <1%
Lepidium lasiocarpum Nutt. var. lasiocarpum	25		1 <1%
Lepidium lasiocarpum Nutt. var. lasiocarpum	35		1 <1%
Lepidium lasiocarpum Nutt. var. lasiocarpum	45		1 <1%
Linanthus bigelovii (Gray) Greene	25		1 <1%
Linanthus bigelovii (Gray) Greene	35		1 <1%
Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm.	5		3 5-10%
Mimulus rubellus Gray	45		1 <1%
Mirabilis bigelovii Gray	45		1 <1%
Nemacladus glanduliferus Jepson	35		1 <1%
Parietaria hespera Hinton	5		1 <1%
Parietaria hespera Hinton	35		1 <1%
Parietaria hespera Hinton	45		1 <1%
Penstemon palmeri Gray	45		1 <1%
Plantago patagonica Jacq.	25		1 <1%
Plantago patagonica Jacq.	35		1 <1%
Plantago patagonica Jacq.	45		1 <1%
Poa bigelovii Vasey & Scribn.	15		1 <1%
Poa bigelovii Vasey & Scribn.	25		1 <1%
Poa bigelovii Vasey & Scribn.	35		1 <1%
Poa bigelovii Vasey & Scribn.	45		1 <1%
Polypogon monspeliensis (L.) Desf.	5		3 5-10%
Polypogon monspeliensis (L.) Desf.	15		3 5-10%
Polypogon monspeliensis (L.) Desf.	25		2 1-5%
Polypogon monspeliensis (L.) Desf.	35		2 1-5%
Polypogon monspeliensis (L.) Desf.	45		4 10-25%
Silene antirrhina L.	5		1 <1%

Silene antirrhina L.	15		1 <1%
Silene antirrhina L.	25		1 <1%
Silene antirrhina L.	35		1 <1%
Silene antirrhina L.	45		1 <1%
Sonchus asper (L.) Hill	5		1 <1%
Sonchus asper (L.) Hill	45		1 <1%
Sphaeralcea spp.	5		2 1-5%
Sporobolus spp.	15		1 <1%
Sporobolus spp.	35		1 <1%
Sporobolus spp.	45		1 <1%
Stylocline micropoides Gray	45		1 <1%
Tamarix ramosissima Ledeb.	5		3 5-10%
Tamarix ramosissima Ledeb.	15		4 10-25%
Tamarix ramosissima Ledeb.	25		4 10-25%
Tamarix ramosissima Ledeb.	35		2 1-5%
Tamarix ramosissima Ledeb.	45		5 25-50%
Tidestromia spp.	5		1 <1%
Vulpia microstachys	25		1 <1%
Vulpia microstachys	35		1 <1%
Vulpia microstachys	45		1 <1%
Vulpia octoflora	5		1 <1%
Vulpia octoflora	15		1 <1%
Vulpia octoflora	25		1 <1%
Vulpia octoflora	35		1 <1%
Vulpia octoflora	45		1 <1%

Vegetation Structure Data

Species Name	Meters	# of Hits	Height
Bromus rubens L.	5	2	0-1.0
Tamarix ramosissima Ledeb.	15	3	0-1.0
Tamarix ramosissima Ledeb.	25	9	0-1.0
Tamarix ramosissima Ledeb.	35	10	0-1.0
Artemisia ludoviciana Nutt.	45	1	0-1.0
Tamarix ramosissima Ledeb.	45	1	1-2
Tamarix ramosissima Ledeb.	45	20	0-1.0

Soil Data

Probe depth (cm)	Reading 1	Reading 2	Reading 3	Average Reading
2	0	0	0	0.00
5	0.02	0.01	0	0.01
3.5	0.1	0.07	0.09	0.09
3.5	0.05	0.02	0.03	0.03
8	0.05	0.05	0.07	0.06
4	0.08	0.08	0.06	0.07
4	0.2	0.13	0.14	0.16

Canyon/Park	**Unkar Creek**	River mile:	72.3 R
Transect Name:	Unkar Creek Transect 1	Type:	Tamarisk area
Date:	10/8/2004	Weather:	Clear, warm, some clouds
Start point:		End point:	
Easting	419435	Easting	419469
Northing	3994664	Northing	3994631
GPS accuracy (m)	6	GPS accuracy (m)	5
Bearing:	128	Elevation (m):	
Aspect (0-360):		Slope (degrees):	

Transect description: Top is in middle of PROGLA. Bottom at red dox wall.

Geological layer: Dox

Habitat type: Riparian Great Basin desert scrub

Dominant species: Encelia farinosa Gray ex Torr., Salix exigua Nutt., Prosopis glandulosa Torr., Tamarix ramosissima Ledeb.

Associated species: Bromus rubens L., Erodium cicutarium (L.) L'Hér. ex Ait., Encelia frutescens (Gray) Gray, Baccharis emoryi Gray, Eriogonum inflatum Torr. & Frém., Carex hystericina Muhl. ex Willd., Sphaeralcea ambigua Gray, Isocoma acradenia (Greene) Greene, Isocoma acradenia (Greene) Greene, Pluchea sericea (Nutt.) Coville

Surface water within 25 m? Surface water type: Surface rocks: sandstone

Landform: Drainage channel Light exposure: open partial-shade

Soil type: sandy loam Soil moisture: dry

Point Intercept Transect (50m)	% Cover
Bare Soil	26
Cobble	7
Litter (duff)	65
Woody debris structure	23
Baccharis emoryi Gray	4
Encelia farinosa Gray ex Torr.	10
Eriogonum inflatum Torr. & Frém.	1
Isocoma acradenia (Greene) Greene	16
Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	4
Pluchea sericea (Nutt.) Coville	4
Prosopis glandulosa Torr.	15
Salix exigua Nutt.	23
Tamarix ramosissima Ledeb.	8

Daubenmire Scale Cover Data from 50m Transect

Crews did not collect ground cover data for this transect.

Species Name	Meters	Tree Age	Cover Scale
Baccharis emoryi Gray	45	M Mature	3 5-10%
Bromus rubens L.	35		1 <1%
Bromus rubens L.	45		2 1-5%
Carex hystericina Muhl. ex Willd.	5		2 1-5%
Encelia farinosa Gray ex Torr.	15		2 1-5%
Encelia farinosa Gray ex Torr.	25		3 5-10%
Encelia farinosa Gray ex Torr.	35		2 1-5%
Encelia farinosa Gray ex Torr.	45		2 1-5%
Encelia frutescens (Gray) Gray	25		1 <1%
Eriogonum inflatum Torr. & Frém.	25		2 1-5%
Erodium cicutarium (L.) L'Hér. ex Ait.	25		2 1-5%
Isocoma acradenia (Greene) Greene	35		3 5-10%
Isocoma acradenia (Greene) Greene	45		4 10-25%
Prosopis glandulosa Torr.	5	M Mature	2 1-5%
Prosopis glandulosa Torr.	15	M Mature	6 50-75%
Prosopis glandulosa Torr.	25		1 <1%
Salix exigua Nutt.	15		4 10-25%
Salix exigua Nutt.	25		3 5-10%
Salix exigua Nutt.	35		6 50-75%

Salix exigua Nutt.	45		5 25-50%
Sphaeralcea ambigua Gray	35		1 <1%
Tamarix ramosissima Ledeb.	5	M Mature	2 1-5%
Tamarix ramosissima Ledeb.	25	M Mature	2 1-5%
Tamarix ramosissima Ledeb.	45	M Mature	3 5-10%

Vegetation Structure Data

Species Name	Meters	# of Hits	Height
Tamarix ramosissima Ledeb.	5	1	1-2
Tamarix ramosissima Ledeb.	5	2	0-1.0
Tamarix ramosissima Ledeb.	5	3	2-3
Tamarix ramosissima Ledeb.	5	3	3-4
Prosopis glandulosa Torr.	15	3	2-3
Prosopis glandulosa Torr.	15	4	1-2
Prosopis glandulosa Torr.	15	4	0-1.0
Encelia farinosa Gray ex Torr.	25	2	0-1.0
Encelia farinosa Gray ex Torr.	35	2	0-1.0
Salix exigua Nutt.	35	1	1-2
Salix exigua Nutt.	35	6	2-3
Baccharis emoryi Gray	45	1	1-2
Isocoma acradenia (Greene) Greene	45	3	0-1.0

Soil Data

Crews did not collect soil data for this transect.

Canyon/Park	**Unkar Creek**	River mile:	72.3 R
Transect Name:	Unkar Creek Transect 1	Type:	Reference
Date:	10/8/2004	Weather:	Clear, warm, some clouds
Start point:		End point:	
Easting	419422	Easting	419461
Northing	3994642	Northing	3994617
GPS accuracy (m)	4.7	GPS accuracy (m)	7
Bearing:		Elevation (m):	
Aspect (0-360):		Slope (degrees):	

Transect description: On edge of wash, right side, through riparian bank.

Geological layer: Dox

Habitat type: Riparian Great Basin desert scrub

Dominant species: Prosopis glandulosa Torr., Salix exigua Nutt., Baccharis emoryi Gray, Isocoma acradenia (Greene) Greene

Associated species: Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Carex hystericina Muhl. ex Willd., Phragmites australis (Cav.) Trin. ex Steud., Cladium californicum (S. Wats.) O'Neill

Surface water within 25 m? Surface water type: Surface rocks: sandstone

Landform: Drainage channel Light exposure: open

Soil type: sandy loam Soil moisture: dry

Point Intercept Transect (50m)	% Cover
Bare Soil	63
Cobble	28
Litter (duff)	14
Baccharis emoryi Gray	6
Cladium californicum (S. Wats.) O'Neill	6
Isocoma acradenia (Greene) Greene	1
Phragmites australis (Cav.) Trin. ex Steud.	1
Salix exigua Nutt.	19

Daubenmire Scale Cover Data from 50m Transect

Crews did not collect ground cover data for this transect.

Species Name	Meters	Tree Age	Cover Scale
Baccharis emoryi Gray	5		2 1-5%
Baccharis emoryi Gray	15		3 5-10%
Baccharis emoryi Gray	25		3 5-10%
Baccharis emoryi Gray	35		3 5-10%
Baccharis emoryi Gray	45		1 <1%
Carex hystericina Muhl. ex Willd.	5		1 <1%
Cladium californicum (S. Wats.) O'Neill	35		5 25-50%
Isocoma acradenia (Greene) Greene	5		1 <1%
Isocoma acradenia (Greene) Greene	15		2 1-5%
Isocoma acradenia (Greene) Greene	25		2 1-5%
Isocoma acradenia (Greene) Greene	45		1 <1%
Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	5		2 1-5%
Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	25		1 <1%
Phragmites australis (Cav.) Trin. ex Steud.	5		2 1-5%
Prosopis glandulosa Torr.	15	S Seedling	1 <1%
Salix exigua Nutt.	5		1 <1%
Salix exigua Nutt.	15		3 5-10%
Salix exigua Nutt.	25		3 5-10%
Salix exigua Nutt.	35		5 25-50%
Salix exigua Nutt.	45		3 5-10%

Vegetation Structure Data

Species Name	Meters	# of Hits	Height
Baccharis emoryi Gray	15	2	0-1.0

Salix exigua Nutt.	15	2	1-2
Salix exigua Nutt.	15	2	0-1.0
Cladium californicum (S. Wats.) O'Neill	35	1	1-2
Cladium californicum (S. Wats.) O'Neill	35	9	0-1.0

Soil Data

Crews did not collect soil data for this transect.

Canyon/Park	**Unkar Creek**	River mile:	72.3 R
Transect Name:	Unkar Creek Transect 2	Type:	Tamarisk area
Date:	10/8/2004	Weather:	Clear, warm, some clouds
Start point:		End point:	
Easting	419039	Easting	419075
Northing	3994608	Northing	3994568
GPS accuracy (m)	5	GPS accuracy (m)	12
Bearing:	140	Elevation (m):	
Aspect (0-360):		Slope (degrees):	

Transect description: On wash, right side, through line of TAMRAMs.

Geological layer: Dox

Habitat type: Riparian Great Basin desert scrub

Dominant species: Tamarix ramosissima Ledeb., Acacia greggii Gray, Prosopis glandulosa Torr.

Associated species: Eriogonum deflexum Torr., Datura wrightii Regel, Isocoma acradenia (Greene) Greene

Surface water within 25 m? Surface water type: Surface rocks: sandstone

Landform: Drainage channel Light exposure: open partial-shade

Soil type: sandy loam Soil moisture: dry

Point Intercept Transect (50m)	% Cover
Bare Soil	61
Cobble	39
Litter (duff)	8
Isocoma acradenia (Greene) Greene	4
Prosopis glandulosa Torr.	1
Tamarix ramosissima Ledeb.	20

Daubenmire Scale Cover Data from 50m Transect

Crews did not collect ground cover data for this transect.

Species Name	Meters	Tree Age	Cover Scale
Acacia greggii Gray	25	M Mature	2 1-5%
Datura wrightii Regel	5		2 1-5%
Eriogonum deflexum Torr.	5		2 1-5%
Isocoma acradenia (Greene) Greene	5		3 5-10%
Prosopis glandulosa Torr.	45	M Mature	4 10-25%
Tamarix ramosissima Ledeb.	35	M Mature	6 50-75%
Tamarix ramosissima Ledeb.	45	M Mature	4 10-25%

Vegetation Structure Data

Species Name	Meters	# of Hits	Height
Acacia greggii Gray	5	3	1-2

Soil Data

Crews did not collect soil data for this transect.

Canyon/Park	**Unkar Creek**	River mile:	72.3 R
Transect Name:	Unkar Creek Transect 2	Type:	Reference
Date:	10/8/2004	Weather:	Clear, warm, some clouds
Start point:		End point:	
Easting	419064	Easting	419106
Northing	3994603	Northing	3994586
GPS accuracy (m)	4	GPS accuracy (m)	5
Bearing:	310	Elevation (m):	
Aspect (0-360):		Slope (degrees):	

Transect description: Opposite Transect 2A on the left side of the wash.

Geological layer: Dox

Habitat type: Riparian Great Basin desert scrub

Dominant species: Acacia greggii Gray, Prosopis glandulosa Torr., Encelia farinosa Gray ex Torr.

Associated species: Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Erodium cicutarium (L.) L'Hér. ex Ait., Pleuraphis rigida Thurb., Ephedra nevadensis S. Wats., Dasyochloa pulchella (Kunth) Willd. ex Rydb.

Surface water within 25 m? Surface water type: Surface rocks: sandstone

Landform: Drainage channel Light exposure: open

Soil type: sand Soil moisture: dry

Point Intercept Transect (50m)	% Cover
Bare Soil	42
Cobble	60
Litter (duff)	3
Woody debris structure	1
Acacia greggii Gray	3
Ephedra nevadensis S. Wats.	3
Prosopis glandulosa Torr.	16

Daubenmire Scale Cover Data from 50m Transect

Crews did not collect ground cover data for this transect.

Species Name	Meters	Tree Age	Cover Scale
Acacia greggii Gray	5	M Mature	4 10-25%
Encelia farinosa Gray ex Torr.	5		2 1-5%
Encelia farinosa Gray ex Torr.	15		2 1-5%
Encelia farinosa Gray ex Torr.	35		2 1-5%
Ephedra nevadensis S. Wats.	5		2 1-5%
Erioneuron pulchellum	15		1 <1%
Erodium cicutarium (L.) L'Hér. ex Ait.	15		1 <1%
Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	5		2 1-5%
Pleuraphis rigida Thurb.	15		2 1-5%
Prosopis glandulosa Torr.	15	M Mature	4 10-25%
Prosopis glandulosa Torr.	25	M Mature	5 25-50%
Prosopis glandulosa Torr.	35	M Mature	5 25-50%
Prosopis glandulosa Torr.	45	M Mature	5 25-50%
Vulpia octoflora	15		1 <1%

Vegetation Structure Data

No hits.

Soil Data

Crews did not collect soil data for this transect.

Appendix C - Tamarisk Mapping Data

Canyon/Park	**112 Mile Canyon**	River mile:	112.2 L
Location	112 Mile 1	Date:	5/14/2005
Start point:		End point:	
Easting	373782	Easting	0
Northing	4011085	Northing	0
GPS Accuracy (m)		GPS Accuracy (m)	
Elevation (m)		Elevation (m)	
Site description:	Steep narrow canyon in gneiss at second cliff out ~500m from high water line.		
Site access:	Sketchy bouldering up canyon. This is upstream from mouth: 373782, 4011085		
Tamarisk	1 at ~500m up		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 1
Tamarisk control:	1-2 persons with 1 can Garlon. 1/4 day - people must be experienced hikers / good boulderers or climbers.		

Canyon/Park	**112 Mile Canyon**	River mile:	112.2 L
Location	112 Mile 2	Date:	5/14/2005
Start point:		End point:	
Easting	373782	Easting	0
Northing	4011085	Northing	0
GPS Accuracy (m)	6	GPS Accuracy (m)	
Elevation (m)		Elevation (m)	
Site description:	112 mile canyon is narrow in the schist, probably dry most of the year, although there was a trickle of water after our wet 2005 winter. End point was at chalk stone in the water fall ~100m from old high water mark. Associated species: ACAGRE, PLEJAM, HESSAL, BACSAL, STEPAU, GALSTE, BRORUB, HEDNAN, BEBJUN, EPHFAS, GUTSAR, MACPIN, ARTLUD.		
Site access:	Park boats ~150m upstream of canyon mouth on sandy spit. Almost across from Waltenberg beach, but just upstream. Canyon cliffs out with large waterfall and chalkstone 99m from old high water zone. Surveyors made it up waterfall with a climbing rope anchored in two places fro a crude belay / safety system and used a webbing climbing harness. Move is still above an average climbing level and would not be recommended for most people unless an experienced climber could set ropes.		
Tamarisk	One TAMRAM found ~60m from high water mark.		
Tamarisk numbers:	Seedlings: 0	Saplings: 1	Mature: 0
Tamarisk control:	Should be a quickie if crew only does lower section below falls.		

Canyon/Park	**130 Mile - 30 Second Waterfall**	River mile:	130 R
Location	130 Mile 1	Date:	5/14/2005
Start point:		End point:	
Easting	0	Easting	0
Northing	0	Northing	0
GPS Accuracy (m)		GPS Accuracy (m)	
Elevation (m)		Elevation (m)	
Site description:	300m canyon in schist with a short waterfall, then ending in a bowl with a huge waterfall at the top end.		
Site access:	On canyon right of 5m fall is a short climb - slippery and a bit technical. Need to pass up packs and tools. Would be a great idea to have some ropes.		
Tamarisk	Some below, some above short fall. Would also be a good area to remove ones right on beach.		
Tamarisk numbers:	Seedlings: 8 Saplings: 6 Mature: 12		
Tamarisk control:	All are within 1-4m of water. Use Garlon 3A. 5 person crew, 3-4 hours. Nice place to have a lunch break.		

Canyon/Park	**220 Mile Canyon**	River mile:	220 R
Location	220 Mile 1	Date:	5/19/2005
Start point:		End point:	
Easting	289747	Easting	289345
Northing	3967507	Northing	3967517
GPS Accuracy (m)	8	GPS Accuracy (m)	6
Elevation (m)	427	Elevation (m)	451
Site description:	Easy walk from river - this canyon is dry and has little vegetation, and no flowing water. Mostly ACAGRE and ENCFAR line this drainage.		
Site access:	Access is simple.		
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0 Saplings: 0 Mature: 0		
Tamarisk control:	No TAMRAM		

Canyon/Park	**220 Mile Canyon**	River mile:	220 R
Location	220 Mile 2	Date:	5/19/2005
Start point:		End point:	
Easting	289345	Easting	289034
Northing	3967517	Northing	3967371
GPS Accuracy (m)	6	GPS Accuracy (m)	9
Elevation (m)	451	Elevation (m)	474
Site description:	This section runs from 500-1000m up from mouth. The creek bed in the lower section is lined with granite bedrock and lots of polished conglomerate that would make a nice patio. Assoc spp: ACAGRE, ENCFAR, LARTRI, TRICAL.		
Site access:	Easy access - warm dry hiking.		
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	No TAMRAM		

Canyon/Park	**220 Mile Canyon**	River mile:	220 R
Location	220 Mile 3	Date:	5/19/2005
Start point:		End point:	
Easting	289034	Easting	288342
Northing	3967371	Northing	3967260
GPS Accuracy (m)	9	GPS Accuracy (m)	5
Elevation (m)	474	Elevation (m)	521
Site description:	Easy walk up from the tapeats and BA shale. This site spans 1km, beginning 1km from mouth. Assoc spp: ACAGRE, PORGRA, ENCFAR, PROGLA		
Site access:	Nothing difficult but dry - no water for drinking.		
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	No TAMRAM		

Canyon/Park	**220 Mile Canyon**	River mile:	220 R
Location	220 Mile 4	Date:	5/19/2005
Start point:		End point:	
Easting	288342	Easting	287482
Northing	3967260	Northing	3967138
GPS Accuracy (m)	5	GPS Accuracy (m)	7
Elevation (m)	521	Elevation (m)	566
Site description:	Site runs from 2.2 - 3.3km from mouth through dry cobbley creek bed in Bright Angel shale. ACAGRE is dominant plant. Assoc spp: EROCIC, ACAGRE, ENCFAR, SENCOV, DATWRI, SILANT, BRORUB, PLAPAT, PORGRA, LYCPAL, LACTRI, EUCARE.		
Site access:	Quick walk from river and not very steep at all.		
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	No TAMRAM		

Canyon/Park	**220 Mile Canyon**	River mile:	220 R
Location	220 Mile 5	Date:	5/19/2005
Start point:		End point:	
Easting	287482	Easting	286307
Northing	3967138	Northing	3966218
GPS Accuracy (m)	7	GPS Accuracy (m)	10
Elevation (m)	566	Elevation (m)	723
Site description:	5.14km from mouth. At about 4km from mouth, the canyon forks. We went up left fork. At the next fork, we went right into a steep section of Muav with crumbly walls. We did not scout up the major right fork at 4km or the opposite fork in the left (south side) but both no doubt cliff out within 1km. Assoc spp: acagre, linumspp (collected at photopoint 5 on BA shelf), porgra, encfar, lartri, nolmic, bebjun, rhutri, trical, vergla.		
Site access:	Simply walk from river with boulder walking up the creek. Bring a gallon+ of water in the warmer months.		
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	No TAMRAM		

Canyon/Park	**225 1/2 Mile**	River mile:	225.4 R
Location	225 1/2 Mile 1	Date:	5/19/2005
Start point:		End point:	
Easting	285751	Easting	285624
Northing	3960884	Northing	3961035
GPS Accuracy (m)	5	GPS Accuracy (m)	9
Elevation (m)	404	Elevation (m)	436
Site description:	At beginning of granite narrows, approximately 250m from river. Granite canyon sides are 10m apart (in about 250m get to water fall) there are more TAMRAM above water fall.		
Site access:	Water fall poses difficulty - need ropes to get higher. Can free climb but dangerous - have 1 person set up ropes.		
Tamarisk	Scattered - already pulled some from here, recorded on data sheets		
Tamarisk numbers:	Seedlings: 0 Saplings: 2 Mature: 16		
Tamarisk control:	Crew of 4, 1 hour, 1/2 sprayer - Garlon 3A (water present). Above water fall: ????		

Canyon/Park	**225 1/2 Mile**	River mile:	225.4 R
Location	225 1/2 Mile 2	Date:	5/19/2005
Start point:		End point:	
Easting	285574	Easting	285592
Northing	3961331	Northing	3961013
GPS Accuracy (m)	7	GPS Accuracy (m)	10
Elevation (m)	488	Elevation (m)	435
Site description:	Downstream ~300m from photopoint 4, curving drainage with granite walls, end point is about 1km.		
Site access:	End point is first cliff out that is described in 225 1/2 1 - need ropes to get over that.		
Tamarisk	Sparse		
Tamarisk numbers:	Seedlings: 300 Saplings: 180 Mature: 10		
Tamarisk control:	Easy pulling of seedlings and saplings in midstream - 5-10 people, 2 cans herbicide, 1/2 day.		

Canyon/Park	**225 1/2 Mile**	River mile:	225.4 R
Location	225 1/2 Mile 3	Date:	5/19/2005
Start point:		End point:	
Easting	285241	Easting	285574
Northing	3961383	Northing	3961331
GPS Accuracy (m)	4	GPS Accuracy (m)	7
Elevation (m)	523	Elevation (m)	488
Site description:	Upstream to downstream end point. Surface water - mostly narrow canyon with steep granite walls and pourovers.		
Site access:	Drainage walking on cobbles and granite.		
Tamarisk	Many saplings and seedlings evenly distributed. No TAMRAM where drainage narrows to 3.5m width which is only a 50m stretch.		
Tamarisk numbers:	Seedlings: 300 Saplings: 250 Mature: 27		
Tamarisk control:	Many of saplings and seedlings are growing in midstream and are easily hand pulled- Recommend crew of 7 with 3 spray cans for 1/2 day.		

Canyon/Park	**225 1/2 Mile**	River mile:	225.4 R
Location	225 1/2 Mile 4	Date:	5/19/2005
Start point:		End point:	
Easting	285178	Easting	285241
Northing	3961766	Northing	3961383
GPS Accuracy (m)	3	GPS Accuracy (m)	4
Elevation (m)	560	Elevation (m)	523
Site description:	~1.75km from 1st cliff out, on creek left. After stretch of an open creek bed. About 300m without TAMRAM. There is a 300m from a side canyon downstream on creek right to ~200m downstream from confluence.		
Site access:	Steep hiking, some boulder climbing, some flat walking.		
Tamarisk	Close to end point which is downstream, then stream flattens and opens, becoming		
Tamarisk numbers:	Seedlings: 4 Saplings: 3 Mature: 1		
Tamarisk control:	Creek starts to dry and distribution decreases - so can cut and spray. 1/2 can, 1 person and saw.		

Canyon/Park	**60 Mile**	River mile:	59.8 R
Location	60 Mile 1	Date:	5/8/2005
Start point:		End point:	
Easting	427237	Easting	426877
Northing	4007776	Northing	4007817
GPS Accuracy (m)	12	GPS Accuracy (m)	10
Elevation (m)	888	Elevation (m)	
Site description:	Gravel bottomed dry wash that becomes progressively more boulder-choked upstream. One small dry pourover at Tapeats sandstone. Sparse vegetation in wash. ACAGRE scattered on banks of alluvial fan. Many scattered BRILON, ENCFAR, SPHCRO, BRORUB, ARTLUD, ARIspp.		
Site access:	Access from eddy below 60 mile rapid , river right - big safe eddy with beach.		
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	No TAMRAM		

Canyon/Park	**60 Mile**	River mile:	59.8 R
Location	60 Mile 2	Date:	5/8/2005
Start point:		End point:	
Easting	425877	Easting	426460
Northing	4007617	Northing	4007505
GPS Accuracy (m)	10	GPS Accuracy (m)	7
Elevation (m)	880	Elevation (m)	949
Site description:	Very similar to section 1 but encfar replaced by E.resinosus. Canyon narrows as you go upstream through Bright Angel shale. A few short pourovers with micro seeps (too small to measure hydrology). Same species composition as 1 overall.		
Site access:	Easy hike up - a few boulder scrambles.		
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	No TAMRAM		

Canyon/Park	**60 Mile**	River mile:	59.8 R
Location	60 Mile 3	Date:	5/8/2005
Start point:		End point:	
Easting	426460	Easting	0
Northing	4007505	Northing	0
GPS Accuracy (m)	7	GPS Accuracy (m)	
Elevation (m)	949	Elevation (m)	

Site description: Starts at 4m pourover in narrow Bright Angel shale gorge. Mostly sparse vegetation, BRILON (scattered), ARTLUD, ARTDRA, ENCRES, etc. in gravel shale bottomed wash with boulders.

Site access: 4m+ tall pourover on shale is scrambly. A large 10m falls obstructs the way ~135m up from start (photo at ~100m of falls) Go up steep draw (bouldery and loose) to go over falls, then another falls blocks the way.

Tamarisk: None

Tamarisk numbers: Seedlings: 0 Saplings: 0 Mature: 0

Tamarisk control: No TAMRAM

Canyon/Park	**70.2 Cardenas Hillside Spring**	River mile:	70.2 L
Location	Cardenas Hillside Spring 1	Date:	5/10/2005
Start point:		End point:	
Easting	423262	Easting	423263
Northing	3993519	Northing	3993496
GPS Accuracy (m)	5	GPS Accuracy (m)	6
Elevation (m)	880	Elevation (m)	

Site description: Small narrow dry drainage at base of hillside seep / spring (upriver from Cardenas creek on river left - you can see it from camp) located immediately upstream of seep. Drainage is mostly dominated by ACAGRE and seep weed with BRORUB, patch PHRAUS, occasional ATRCAN, STAPIN, ISOspp, etc. Upslope is PHRAUS, CLACAR, SPOAIR and others. (Near old ACAGRE next to TAMRAM is small Mt. Lion? Scull)

Two mature TAMRAM visible from above spring. No water visible. Lots of phragmites, wolfberry, stapin, progla, atrcan, erginf, ACAGRE, around margins. Community mosaic in seep: CLACAL, PHRAUS, SPOAIR.

Site access: Easy walk up bajada from Escalante trail (about 200m).
Follow Escalante trail about 800-900m upstream of Cardenas drainage, go up slope and around spring to lookers right to get on top .

Tamarisk: 3 clusters (see hillside spring 1 and 2) two at base of seep and one on top.
Two mature TAMRAM accessible from above spring area (near photopoint Hillside spring 1. One old mature TAMRAM in drainage at base of seep in drainage immediately to upstream side.) New photo point done for information in parenthesis.
10x10m mass below spring area

Tamarisk numbers: Seedlings: 0 Saplings: 0 Mature: 9

Tamarisk control: One very large old TAMRAM with broad canopy and ~6 stems and one smaller but also old TAMRAM with 1-2 stems. Will need saws, one Garlon girl with about a gallon or so. Need about 4 people. There is a 10x10 mass with about 4-7 mature. Altogether you will need at least a couple of more people and enough Garlon to spray up to 9 matures and possibly smaller stumps. The lower mass is gnarly, and will be a cut through as you go, hellacious area for some lucky people :).

Canyon/Park	**70.8 mile drainage**	River mile:	70.8 L
Location	70.8 Mile 1	Date:	5/10/2005
Start point:		End point:	
Easting	423076	Easting	422964
Northing	3992849	Northing	3993123
GPS Accuracy (m)	4	GPS Accuracy (m)	4
Elevation (m)	925	Elevation (m)	
Site description:	Steep dry creek bed in Dox sandstone. Tons of Acacia, ATRCAN, AROINF, BRORUB, PHAspp, CRYspp. And TAMRAM. Drainage upriver on RL from Cardenas creek.		
Site access:	Flat walking - easy		
Tamarisk	TAMRAM are lining a small seep on drainage left. It is an isolated group about 10m long.		
Tamarisk numbers:	Seedlings: 5	Saplings: 20	Mature: 13
Tamarisk control:	Easily accessible, should take about 3-4 people and enough Garlon for smallish matures in a 10x2m area.		

Canyon/Park	**Badger**	River mile:	8 R
Location	Badger 1	Date:	5/4/2005
Start point:		End point:	
Easting	441358	Easting	441110
Northing	4069828	Northing	4069937
GPS Accuracy (m)	13	GPS Accuracy (m)	7
Elevation (m)		Elevation (m)	
Site description:	Dry side canyon that gets scoured regularly. Sparse vegetation in drainage bottom with large boulders some gravel dominated by sand. This section begins at the canyon mouth. Pluchea sericea scattered in canyon bottom along with BRILON. Few pockets of water.		
Site access:	Easy walking in beginning of canyon bottom. Few boulders to be careful of.		
Tamarisk	None within 1st 300m but there are a few just beyond 300m.		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	None in this section.		

Canyon/Park	**Badger**	River mile:	8 R
Location	Badger 2	Date:	5/4/2005
Start point:		End point:	
Easting	441110	Easting	440829
Northing	4069973	Northing	4069989
GPS Accuracy (m)	7	GPS Accuracy (m)	7
Elevation (m)		Elevation (m)	

Site description: Dry open 10-25m wide canyon bottom, begin to see small bedrock on canyon bottom with a bit more water. BRATOU dead & detached plant found. Scattered trash found in canyon bottom.

Site access: A bit more bouldery but still relatively easy to walk. Use caution.

Tamarisk: A few scattered TAMRAM along stretch in a 2 patches close together.

Tamarisk numbers: Seedlings: 0 Saplings: 3 Mature: 8

Tamarisk control: Some of TAMRAM bases are buried in sediment. Shovels and saws are needed. Matures with multiple branches. 10s of 1000s of seeds are distributed as we speak, so seedlings to come.

Canyon/Park	**Badger**	River mile:	8 R
Location	Badger 3	Date:	5/4/2005
Start point:		End point:	
Easting	440829	Easting	440579
Northing	4069989	Northing	4070021
GPS Accuracy (m)	7	GPS Accuracy (m)	11
Elevation (m)		Elevation (m)	

Site description: Slick rock bottom / sandy becoming bouldery. A little more difficult to ascend. Returning to cobbles. Entering hermit shale.

Site access: Relatively easy. One area where ascent requires arms and legs.

Tamarisk: Spotty, scattered and only mature plants present, but they are all seeding. Last mature is 12m up creek (creek right) from photopoint 4

Tamarisk numbers: Seedlings: 0 Saplings: 0 Mature: 5

Tamarisk control: Saws. Look for seedlings when work occurs, creek seems dry with some moist soil. Most likely Garlon 4 would be sufficient.

Canyon/Park	**Badger**	River mile:	8 R
Location	Badger 4	Date:	5/4/2005
Start point:		End point:	
Easting	440579	Easting	440354
Northing	4070021	Northing	4070141
GPS Accuracy (m)	11	GPS Accuracy (m)	14
Elevation (m)		Elevation (m)	982
Site description:	Pools of mud, sloppy creek bottom, stair-stepping up in Hermit. BRILON STAPIN etc. More stair-stepping canyon bottom around 20m across, entirely in hermit shale.		
Site access:	Stair steps become more difficult but still relatively traversable		
Tamarisk	More abundant than the last section. Still primarily mature not very dense in		
Tamarisk numbers:	Seedlings: 0	Saplings: 5	Mature: 16
Tamarisk control:	Some standing water this time of year. More muddy than wet and sandy. Saws - looks like canyon has flashed and these are partially buried. Shovels. Look for		

Canyon/Park	**Badger**	River mile:	8 R
Location	Badger 5	Date:	5/4/2005
Start point:		End point:	
Easting	440354	Easting	440268
Northing	4070141	Northing	4070219
GPS Accuracy (m)	14	GPS Accuracy (m)	
Elevation (m)		Elevation (m)	
Site description:	Above Badger 4 ends @ 7m waterfall with no safe ascent. About 120m above B4 photopoint Area above could be accessed from road.		
Site access:			
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	No TAMRAM		

Canyon/Park	**Boulder**	River mile:	82.8 L
Location	Boulder 1	Date:	6/10/2005
Start point:		End point:	
Easting	406800	Easting	406109
Northing	3990793	Northing	3990674
GPS Accuracy (m)	8	GPS Accuracy (m)	10
Elevation (m)	0	Elevation (m)	0
Site description:	Starts at confluence and follows up the west fork of Boulder Canyon.		
Site access:	Easy		
Tamarisk	Only one sapling located at 406660, 3990763 (8).		
Tamarisk numbers:	Seedlings: 0	Saplings: 1	Mature: 0
Tamarisk control:	Small crew		

Canyon/Park	**Boulder**	River mile:	82.8 L
Location	Boulder 2	Date:	6/10/2005
Start point:		End point:	
Easting	406664	Easting	406867
Northing	3990358	Northing	3990840
GPS Accuracy (m)	8	GPS Accuracy (m)	11
Elevation (m)	0	Elevation (m)	0
Site description:	Middle fork of Boulder Creek.		
Site access:	Easy		
Tamarisk	All TAMRAMs at upper end of transect. None were found up east fork, but this area should be scouted in the future.		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 4
Tamarisk control:	Small crew		

Canyon/Park	**Boulder**	River mile:	82.8 L
Location	Boulder 3	Date:	6/10/2005
Start point:		End point:	
Easting	407139	Easting	407428
Northing	3991023	Northing	3991187
GPS Accuracy (m)	7	GPS Accuracy (m)	6
Elevation (m)	0	Elevation (m)	0
Site description:	In Tapeats gorge.		
Site access:	East trail around pour-off on west side of canyon. Short, but steep scramble to get to TAMRAMs on ledge. Ledge is within 100m downstream of pour-off.		
Tamarisk	Dense		
Tamarisk numbers:	Seedlings: 10 Saplings: 40 Mature: 60		
Tamarisk control:	Many many people.		

Canyon/Park	**Boulder**	River mile:	82.8 L
Location	Boulder 4	Date:	6/10/2005
Start point:		End point:	
Easting	406867	Easting	407603
Northing	3990840	Northing	3991335
GPS Accuracy (m)	6	GPS Accuracy (m)	7
Elevation (m)	0	Elevation (m)	0
Site description:	Below Tapeats gorge.		
Site access:	Easy scramble to get through gorge to unclimbable pour-off. Pour-off is approximately 200m below end point of transect. Access would require a significant		
Tamarisk	TAMRAMs below unclimbable pour-off.		
Tamarisk numbers:	Seedlings: 40 Saplings: 65 Mature: 60		
Tamarisk control:	Large crew and much time.		

Canyon/Park	**Carbon Canyon**	River mile:	64.7 R
Location	Carbon 15	Date:	5/9/2005
Start point:		End point:	
Easting	425047	Easting	424797
Northing	4001271	Northing	4001477
GPS Accuracy (m)	7	GPS Accuracy (m)	4
Elevation (m)		Elevation (m)	
Site description:	In main drainage. 500 m west of narrows where gold formation begins - outcropping on creek left (gold strata at 45 angle)		
Site access:	Good		
Tamarisk	Clumped at beginning of mapping unit.		
Tamarisk numbers:	Seedlings: 20 Saplings: 5 Mature: 15		
Tamarisk control:	Crew of 4 - 40 minutes. 1/4 to 1/2 sprayer of Garlon 3A - water present but probably not in the fall.		

Canyon/Park	**Carbon Canyon**	River mile:	64.7 R
Location	Carbon 16	Date:	5/9/2005
Start point:		End point:	
Easting	424797	Easting	424731
Northing	4001477	Northing	4001860
GPS Accuracy (m)	4	GPS Accuracy (m)	4
Elevation (m)		Elevation (m)	
Site description:	In main drainage. 800m west of narrow where Dox formation comes out.		
Site access:	Good		
Tamarisk	Clumped at end of mapping section.		
Tamarisk numbers:	Seedlings: 20 Saplings: 15 Mature: 60		
Tamarisk control:	May take at least several hours to a day.		

Canyon/Park	**Carbon Canyon**	River mile:	64.7 R
Location	Carbon 17	Date:	5/9/2005
Start point:		End point:	
Easting	424731	Easting	424754
Northing	4001860	Northing	4002003
GPS Accuracy (m)	4	GPS Accuracy (m)	4
Elevation (m)		Elevation (m)	
Site description:	Last site + 200m to confluence of East and West forks.		
Site access:	Good		
Tamarisk	Spread evenly		
Tamarisk numbers:	Seedlings: 20	Saplings: 9	Mature: 60
Tamarisk control:	Crew of 4 - 2 hours, 1.5 sprayers of Garlon.		

Canyon/Park	**Carbon Canyon**	River mile:	64.7 R
Location	Carbon East Fork 1	Date:	5/9/2005
Start point:		End point:	
Easting	424754	Easting	424765
Northing	4002003	Northing	4002516
GPS Accuracy (m)	4	GPS Accuracy (m)	5
Elevation (m)		Elevation (m)	
Site description:	Up drainage.		
Site access:	Good		
Tamarisk	Throughout drainage, but large thicket at end.		
Tamarisk numbers:	Seedlings: 30	Saplings: 10	Mature: 82
Tamarisk control:	Crew of 4 - 4hours. 1.5 sprayers of Garlon. Water is present in spring.		

Canyon/Park	**Carbon Canyon**	River mile:	64.7 R
Location	Carbon East Fork 2	Date:	5/9/2005
Start point:		End point:	
Easting	424765	Easting	424835
Northing	4002376	Northing	4002702
GPS Accuracy (m)	5	GPS Accuracy (m)	5
Elevation (m)		Elevation (m)	
Site description:			
Site access:	Good		
Tamarisk	3 at beginning		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 3
Tamarisk control:	Crew of 4, about 30 minutes.		

Canyon/Park	**Carbon Canyon**	River mile:	64.7 R
Location	Carbon East Fork 3	Date:	5/9/2005
Start point:		End point:	
Easting	424835	Easting	424863
Northing	4002702	Northing	4003077
GPS Accuracy (m)	5	GPS Accuracy (m)	6
Elevation (m)		Elevation (m)	
Site description:			
Site access:	Good		
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	No TAMRAM		

Canyon/Park	**Carbon Canyon**	River mile:	64.7 R
Location	Carbon East Fork 4	Date:	5/9/2005
Start point:		End point:	
Easting	424863	Easting	424781
Northing	4003077	Northing	4003433
GPS Accuracy (m)	5	GPS Accuracy (m)	4
Elevation (m)		Elevation (m)	
Site description:	Beginning of boulder choked area.		
Site access:	Good		
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	No TAMRAM		

Canyon/Park	**Carbon Canyon**	River mile:	64.7 R
Location	Carbon East Fork 5	Date:	5/9/2005
Start point:		End point:	
Easting	424781	Easting	424673
Northing	4003433	Northing	4003644
GPS Accuracy (m)	4	GPS Accuracy (m)	
Elevation (m)		Elevation (m)	
Site description:			
Site access:	Good		
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	No TAMRAM		

Canyon/Park	**Carbon Canyon**	River mile:	64.7 R
Location	Carbon West Fork 1	Date:	5/9/2005
Start point:		End point:	
Easting	423167	Easting	423308
Northing	4003626	Northing	4002775
GPS Accuracy (m)	3	GPS Accuracy (m)	6
Elevation (m)	1287	Elevation (m)	
Site description:	Started toward top of drainage and mapped on walk back. Approximately 1.7km down canyon from first photopoint. Large (3x4m) sandstone boulder in middle of wash. Galeros Butte is visible in upstream distance. Lots of cliff rose. Flat open wash.		
Site access:	Mild grade, flat open wash, easy walking.		
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	No TAMRAM		

Canyon/Park	**Carbon Canyon**	River mile:	64.7 R
Location	Carbon West Fork 2	Date:	5/9/2005
Start point:		End point:	
Easting	422889	Easting	423167
Northing	4004825	Northing	4003626
GPS Accuracy (m)	4	GPS Accuracy (m)	3
Elevation (m)	1156	Elevation (m)	
Site description:	The end of the west fork, where the drainage becomes super steep. 5.7km away from main fork of the east/west junction of carbon. Hillside is dotted with juniper trees - situated in GC Supergroup rocks.		
Site access:	Flat until about 3 large boulder chocked areas - easy to climb up or around.		
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	No TAMRAM		

Canyon/Park	**Carbon Canyon**	River mile:	64.7 R
Location	Carbon West Fork 3	Date:	5/9/2005
Start point:		End point:	
Easting	423308	Easting	423720
Northing	4002775	Northing	4002483
GPS Accuracy (m)	6	GPS Accuracy (m)	6
Elevation (m)	1119	Elevation (m)	
Site description:	Wide open drainage. 2x3m boulder of sandstone near creek left. Sharp curve in drainage on creek left. Area - winding flat creek bed. Lots of natives - ENCFAR, DALspp., OPUspp., COLRAM.		
Site access:	Flat walking.		
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	No TAMRAM		

Canyon/Park	**Carbon Canyon**	River mile:	64.7 R
Location	Carbon West Fork 4	Date:	5/9/2005
Start point:		End point:	
Easting	423720	Easting	424302
Northing	4002483	Northing	4002098
GPS Accuracy (m)	6	GPS Accuracy (m)	3
Elevation (m)	1080	Elevation (m)	
Site description:	Winding flat wash. Dry. Lots of native plants: YUCspp., OPUspp., ACAGRE, ENCFAR.		
Site access:	Flat walking.		
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	No TAMRAM		

Canyon/Park	**Carbon Canyon**	River mile:	64.7 R
Location	Carbon West Fork 5	Date:	5/9/2005
Start point:		End point:	
Easting	424302	Easting	424578
Northing	4002098	Northing	4001994
GPS Accuracy (m)	3	GPS Accuracy (m)	3
Elevation (m)	1043	Elevation (m)	
Site description:	Flat winding creek bed. Lots of natives: wolf-berry, PROGLA. Lots of invasives such as BRORUB. Yucca abounds.		
Site access:	Flat walking.		
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	No TAMRAM		

Canyon/Park	**Carbon Canyon**	River mile:	64.7 R
Location	Carbon West Fork 6	Date:	5/9/2005
Start point:		End point:	
Easting	424578	Easting	424735
Northing	4001994	Northing	4001964
GPS Accuracy (m)	3	GPS Accuracy (m)	4
Elevation (m)	1023	Elevation (m)	
Site description:	Flat winding creek bed. About 140m from the end (i.e. main fork)		
Site access:	Flat walking		
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	No TAMRAM		

Canyon/Park	**Carbon Canyon**	River mile:	64.7 R
Location	Lone TAMRAM Site	Date:	5/9/2005
Start point:		End point:	
Easting	0	Easting	0
Northing	0	Northing	0
GPS Accuracy (m)		GPS Accuracy (m)	
Elevation (m)		Elevation (m)	
Site description:	TAMRAM location in creek right fork of west fork: Three quarters of the way up the creek right fork (the left fork as you look up the canyon) there is a tilted slap of Dox formation. It is about 300m long and at the end there is a spring with willow and phragmites. Half way up this slab is a single TAMRAM on the left behind a large boulder. It is 150m before the spring.		
Site access:			
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	No TAMRAM		

Canyon/Park	**Cardenas Creek**	River mile:	72 L
Location	Cardenas 1	Date:	5/10/2005
Start point:		End point:	
Easting	422872	Easting	422318
Northing	3990978	Northing	3991654
GPS Accuracy (m)	7	GPS Accuracy (m)	5
Elevation (m)		Elevation (m)	
Site description:	Site is 1km in length and ends at the fork 4km up Cardenas. Easy walking through colorful dox on both sides. About 1.5km from river is a fork - follow right fork, and continue until you are 3.5-4km from river.		
Site access:	Easy, gradual walking after dryfall at 750m from river.		
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	No TAMRAM		

Canyon/Park	**Cardenas Creek**	River mile:	72 L
Location	Cardenas 1st left fork	Date:	5/10/2005
Start point:		End point:	
Easting	422833	Easting	422319
Northing	3991730	Northing	3991999
GPS Accuracy (m)	5	GPS Accuracy (m)	6
Elevation (m)		Elevation (m)	
Site description:	Side canyon of Cardenas on creek right towards the top ~600m from base of Cardenas butte at junction of creek. This is a really dry wash with no surface water. From right fork of Cardenas canyon to junction is ~.92km.		
Site access:	From Cardenas canyon (from the river) take the first fork (creek right) to junction of right and left fork. 600m from base of Cardenas butte.		
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	No TAMRAM		

Canyon/Park	**Cardenas Creek**	River mile:	72 L
Location	Cardenas 2	Date:	5/10/2005
Start point:		End point:	
Easting	422318	Easting	422338
Northing	3991654	Northing	3992471
GPS Accuracy (m)	5	GPS Accuracy (m)	5
Elevation (m)		Elevation (m)	
Site description:	Creek bed is gravelly. No TAMRAM. Very sparse vegetation, and no running or standing water. Red & blue dox lines the creek. Site is 1.5-2km from river.		
Site access:	Use caution at dryfall, otherwise, easy walking.		
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	No TAMRAM		

Canyon/Park	**Cardenas Creek**	River mile:	72 L
Location	Cardenas 3	Date:	5/10/2005
Start point:		End point:	
Easting	422338	Easting	422134
Northing	3992471	Northing	3993205
GPS Accuracy (m)	5	GPS Accuracy (m)	14
Elevation (m)		Elevation (m)	
Site description:	Goes from dryfall to the broad straight and wide section of Cardenas creek that is 1km from river.		
Site access:	Cardenas creek is gradual and easy walking once you negotiate the dryfall 750m above river. Dry and often hot canyon - bring water.		
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	No TAMRAM		

Canyon/Park	**Cardenas Creek**	River mile:	72 L
Location	Cardenas 4	Date:	5/10/2005
Start point:		End point:	
Easting	422134	Easting	422257
Northing	3993205	Northing	3993524
GPS Accuracy (m)	14	GPS Accuracy (m)	8
Elevation (m)		Elevation (m)	
Site description:	Goes from mouth at Cardenas creek and upstream for 750m. Sparse vegetation, no water or TAMRAM.		
Site access:	Upper end of site has potentially dangerous dryfall scramble. Use caution - but should be no problem. But in summer - dry creek. Bring water.		
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	No TAMRAM		

Canyon/Park	**Copper Canyon**	River mile:	110.5 L
Location	Copper 1	Date:	5/14/2005
Start point:		End point:	
Easting	377389	Easting	0
Northing	4011487	Northing	0
GPS Accuracy (m)	20	GPS Accuracy (m)	
Elevation (m)		Elevation (m)	

Site description: Very narrow canyon in schist. Only went ~700m from mouth. Average width 6m. Some small pools with diverse invertebrates. Several small climbs. At 700m reach 5m pour off that can be climbed, but right above is another pour off that would need ropes to ascend.

Site access: Go past 110 camp, thru left side of small riffle, pull into small eddy just at canyon mouth. Only 2 boats will fit, water is somewhat surging at 7000cfs. Canyon is narrow in schist. Some climbing involved, with higher water, eddy might not be there.

Tamarisk: None

Tamarisk numbers: Seedlings: 0 Saplings: 0 Mature: 0

Tamarisk control: No TAMRAM, but there were hundreds of Sonchus - could return for a few years to pull that! Keep its in the project as a site.

Canyon/Park	**Cottonwood**	River mile:	80.6 L
Location	Cottonwood 1	Date:	6/9/2005
Start point:		End point:	
Easting	410871	Easting	410725
Northing	3988030	Northing	3988674
GPS Accuracy (m)	8	GPS Accuracy (m)	15
Elevation (m)	0	Elevation (m)	0

Site description: Starts at Upper Tapeats and goes down through Tapeats gorge. No TAMRAMs above this location.

Site access: Easy access from the Tonto Trail and a little bit scramble through the Tapeats.

Tamarisk: Sparse

Tamarisk numbers: Seedlings: 0 Saplings: 10 Mature: 2

Tamarisk control: Small crew

Canyon/Park	**Cottonwood**	River mile:	80.6 L
Location	Cottonwood 2	Date:	6/9/2005
Start point:		End point:	
Easting	410725	Easting	411001
Northing	3988674	Northing	3989020
GPS Accuracy (m)	15	GPS Accuracy (m)	14
Elevation (m)	0	Elevation (m)	0
Site description:	Starts at bottom of Tapeats sandstone.		
Site access:	Scrambly reach that ends at Zoroaster granite pour-off which is probably passable on either side at the base of the Tapeats. No TAMRAMs seen below this pour-off.		
Tamarisk	Sparse. Many divided channels which should all be checked for TAMRAMs.		
Tamarisk numbers:	Seedlings: 0 Saplings: 14 Mature: 4		
Tamarisk control:	Small crew		

Canyon/Park	**Crystal Canyon**	River mile:	99 R
Location	Crystal 1	Date:	5/12/2005
Start point:		End point:	
Easting	388153	Easting	388515
Northing	3999517	Northing	3999786
GPS Accuracy (m)	5	GPS Accuracy (m)	6
Elevation (m)		Elevation (m)	
Site description:	At river mouth where 1st Vishnu schist ledge comes up on creek right. Upstream ~500m.		
Site access:	Trail from camp to creek - creek flowing rapidly in May.		
Tamarisk	~40m from creek left to slope (at creek mouth) densely populated, continues dense population for 500m mainly on creek left.		
Tamarisk numbers:	Seedlings: 2500 Saplings: 1500 Mature: 500		
Tamarisk control:	Group of 12+ for 1-2 days. 1 large jug of herbicide + 4 spray cans.		

Canyon/Park	**Crystal Canyon**	River mile:	99 R
Location	Crystal 2	Date:	5/12/2005
Start point:		End point:	
Easting	388515	Easting	388740
Northing	3999786	Northing	4000170
GPS Accuracy (m)	6	GPS Accuracy (m)	7
Elevation (m)		Elevation (m)	752
Site description:	Creek right on 5 x 3 x 5m Schist boulder on mid-slope between 2 creek bends, directly across from Zoroaster pink granite wall is end point with start point ~500m downstream.		
Site access:	Walk up. Very cobbley and narrow canyon.		
Tamarisk	Sparse distribution of mature majority are on banks, not in creek so spraying is advisable.		
Tamarisk numbers:	Seedlings: 250 Saplings: 70 Mature: 36		
Tamarisk control:	7 people, 2-3 spray cans, 1/4 day.		

Canyon/Park	**Crystal Canyon**	River mile:	99 R
Location	Crystal 3	Date:	5/12/2005
Start point:		End point:	
Easting	388740	Easting	389002
Northing	4000170	Northing	4000259
GPS Accuracy (m)	7	GPS Accuracy (m)	8
Elevation (m)		Elevation (m)	
Site description:	Canyon narrows more - ~15-20m wide. Car-sized stacked boulder water fall and creek bend. Then canyon starts opening to ~50m wide after about 350m.		
Site access:	When creek is running, going up water fall is sketchy, so go up and over side slope of creek left.		
Tamarisk	Sparse distribution is amore open area, mostly on side banks.		
Tamarisk numbers:	Seedlings: 150 Saplings: 137 Mature: 52		
Tamarisk control:	7 people, 3 spray cans, 1/4 day.		

Canyon/Park	**Crystal Canyon**	River mile:	99 R
Location	Crystal 4	Date:	5/13/2005
Start point:		End point:	
Easting	389002	Easting	389202
Northing	4000259	Northing	4000582
GPS Accuracy (m)	8	GPS Accuracy (m)	15
Elevation (m)		Elevation (m)	774

Site description: 2 km up Crystal creek. 1km past the triple waterfall that is 6m tall. BACEMO, ENCFAR, ACAGRE, are main species in the site, but TAMRAM is the dominant plant by far. This site is much more dense of a thicket than 500m stretch below waterfall (Crystal 2).

Site access: Easy walk up from river. Tight working conditions.

Tamarisk: The creek is lined continuously with TAMRAM. Patches are bare with rare cobble, but look in backwash areas for TAMRAM in wide areas. MANY saplings of 3m height average, with mature trees occurring every few meters, often strung together in a line of 5-10 matures.

Tamarisk numbers: Seedlings: 373 Saplings: 228 Mature: 208

Tamarisk control: This will take perhaps 1-2 days with 6-7 person crew. The creek gets wide (to 50m) and is pretty continuous with TAMRAM. Mostly hand saw work (should go fairly quick) but there are about 20 good sized matures averaging 15m each.

Canyon/Park	**Crystal Canyon**	River mile:	99 R
Location	Crystal 5	Date:	5/13/2005
Start point:		End point:	
Easting	389202	Easting	389447
Northing	4000582	Northing	4000869
GPS Accuracy (m)	15	GPS Accuracy (m)	8
Elevation (m)	774	Elevation (m)	796

Site description: At 2.5 km up crystal (from mouth) is a VERY dense thicket of TAMRAM saplings / matures at a hairpin turn in the creek, Vishnu schist and talus is north of the creek where it makes the curve. Very pretty tributary that could benefit from TAMRAM removal. Species present: ISOACR, BACSPP, AVAGRE, ENCFAR, TYPLAT, PLUSER, MUHASP, TRICAL PORGRA, POPFRE <-(one mature at lower end of site)

Site access: Easy walk. Lots of creek crossings - great sandal hike. Use caution when sawing close in thick areas.

Tamarisk: Dense for the entire 500m stretch, to very dense at the last (upstream) 60m before the bend in the creek.

Tamarisk numbers: Seedlings: 150 Saplings: 194 Mature: 141

Tamarisk control: This stretch is quite similar in terms of working hours to Crystal 4 downstream: 2 days for a 5-7 person team. There is lots of work. Similar to, and perhaps more dense than Bright Angel creek. Multiple Garlon Girls® and many enthusiastic sawyers needed.

Canyon/Park	**Crystal Canyon**	River mile:	99 R
Location	Crystal 6	Date:	5/13/2005
Start point:		End point:	
Easting	389447	Easting	389716
Northing	4000869	Northing	4000699
GPS Accuracy (m)	8	GPS Accuracy (m)	14
Elevation (m)	796	Elevation (m)	811
Site description:	Site goes from hairpin curve in creek at 2.6km from river upstream to 3km from river. Many sapling and mature trees, mostly on alluvial buildups where creek turns. TAMRAM dominant - also: ISOACR, BACSAL, TYPLAT, MUHASP, OPUPHA, ACAGRE. Upstream looks like good TAMRAM habitat (opens up) but we did not scout past 3km mark.		
Site access:	Easy walking. Hot in summer - cool off in creek, and dink lots of water.		
Tamarisk	Many sapling and mature trees, mostly on alluvial buildups where creek turns. Perhaps slightly less dense, but TAMRAM dominates. No end in sight.		
Tamarisk numbers:	Seedlings: 220 Saplings: 165 Mature: 104		
Tamarisk control:	Several sprayers of herbicide needed to follow cutters - many small diameter stumps will be difficult to find.		

Canyon/Park	**Grapevine**	River mile:	81.5 L
Location	Grapevine 1	Date:	6/9/2005
Start point:		End point:	
Easting	409169	Easting	409385
Northing	3989560	Northing	3989485
GPS Accuracy (m)	30	GPS Accuracy (m)	6
Elevation (m)	0	Elevation (m)	0
Site description:	Salty seep on Tonto Platform on the west side of Grapevine Canyon.		
Site access:	Easy		
Tamarisk	Occur both above and below trail.		
Tamarisk numbers:	Seedlings: 20 Saplings: 30 Mature: 4		
Tamarisk control:	Medium crew		

Canyon/Park	**Grapevine**	River mile:	81.5 L
Location	Grapevine 2	Date:	6/9/2005
Start point:		End point:	
Easting	408639	Easting	408707
Northing	3989174	Northing	3989046
GPS Accuracy (m)	12	GPS Accuracy (m)	12
Elevation (m)	0	Elevation (m)	0
Site description:	At spring, shown on map, on east rim of Grapevine Canyon.		
Site access:	Easy		
Tamarisk	Two mature trees just next to trail and one is a monster.		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 2
Tamarisk control:	Small crew		

Canyon/Park	**Grapevine**	River mile:	81.5 L
Location	Grapevine 3	Date:	6/9/2005
Start point:		End point:	
Easting	408491	Easting	408491
Northing	3989044	Northing	3989044
GPS Accuracy (m)	8	GPS Accuracy (m)	8
Elevation (m)	0	Elevation (m)	0
Site description:	At salty seep on east rim of canyon.		
Site access:	Easy.		
Tamarisk	Sparse		
Tamarisk numbers:	Seedlings: 0	Saplings: 2	Mature: 0
Tamarisk control:	Small crew		

Canyon/Park	**Grapevine**	River mile:	81.5 L
Location	Grapevine 4	Date:	6/10/2005
Start point:		End point:	
Easting	407444	Easting	407825
Northing	3988615	Northing	3988682
GPS Accuracy (m)	7	GPS Accuracy (m)	16
Elevation (m)	0	Elevation (m)	0
Site description:	Uppermost Tapeats in west arm of Grapevine Canyon. Upper end of transect is above trail. Transect ends at Tapeats pour off.		
Site access:	Easy		
Tamarisk	Steady		
Tamarisk numbers:	Seedlings: 20	Saplings: 5	Mature: 20
Tamarisk control:	Several hours		

Canyon/Park	**Grapevine**	River mile:	81.5 L
Location	Grapevine 5	Date:	6/10/2005
Start point:		End point:	
Easting	407825	Easting	408616
Northing	3988682	Northing	3989381
GPS Accuracy (m)	16	GPS Accuracy (m)	27
Elevation (m)	0	Elevation (m)	0
Site description:	Upper Tapeats gorge.		
Site access:	Better to walk around west arm, but can easily descend east arm. To access east arm, go past juniper on left bank and continue downstream on trail through spring		
Tamarisk	One mature and 5 saplings on right hand at bend. Look up ~25m at salty seep to find these plants.		
Tamarisk numbers:	Seedlings: 30	Saplings: 30	Mature: 36
Tamarisk control:	Will need to spend much time in Grapevine.		

Canyon/Park	**Grapevine**	River mile:	81.5 L
Location	Grapevine 6	Date:	6/10/2005
Start point:		End point:	
Easting	408616	Easting	408973
Northing	3989381	Northing	3989691
GPS Accuracy (m)	27	GPS Accuracy (m)	30
Elevation (m)	0	Elevation (m)	0
Site description:			
Site access:	Easy with a little scrambling necessary.		
Tamarisk	Number of saplings was left blank.		
Tamarisk numbers:	Seedlings: 0	Saplings: 60	Mature: 60
Tamarisk control:	May take at least several hours to a day.		

Canyon/Park	**Grapevine**	River mile:	81.5 L
Location	Grapevine 7	Date:	6/10/2005
Start point:		End point:	
Easting	408973	Easting	409206
Northing	3989691	Northing	3989750
GPS Accuracy (m)	12	GPS Accuracy (m)	10
Elevation (m)	0	Elevation (m)	0
Site description:	Narrow schist gorge.		
Site access:	A bit of scrambling and some water.		
Tamarisk	Not too many TAMRAMs. Number of seedlings was not noted.		
Tamarisk numbers:	Seedlings: 0	Saplings: 10	Mature: 12
Tamarisk control:	Several hours		

Canyon/Park	**Grapevine**	River mile:	81.5 L
Location	Grapevine 8	Date:	6/10/2005
Start point:		End point:	
Easting	409206	Easting	409780
Northing	3989691	Northing	3990320
GPS Accuracy (m)	10	GPS Accuracy (m)	10
Elevation (m)	0	Elevation (m)	0
Site description:	Starts with a very straight and narrow Zoroaster alley.		
Site access:	A bit scrambly.		
Tamarisk	Zoroaster alley has TAMRAMs, then no presence for a distance and then thick down to the pour-off.		
Tamarisk numbers:	Seedlings: 20 Saplings: 50 Mature: 75		
Tamarisk control:	Plan on spending much time.		

Canyon/Park	**Grapevine**	River mile:	81.5 L
Location	Grapevine 9	Date:	6/10/2005
Start point:		End point:	
Easting	407899	Easting	407171
Northing	3988422	Northing	3987424
GPS Accuracy (m)	7	GPS Accuracy (m)	8
Elevation (m)	0	Elevation (m)	0
Site description:	Start at Tonto Trail crossing of east arm of Grapevine and go up into main arm.		
Site access:	Easy except for chock stone pour-off. The pour-off can probably be navigated to the left with a 7-8m length of rope to pass packs and tools.		
Tamarisk	One at bottom of transect and second just above pour-off in upper Tapeats gorge.		
Tamarisk numbers:	Seedlings: 0 Saplings: 0 Mature: 2		
Tamarisk control:	Small crew		

Canyon/Park	**Hance**	River mile:	76.6 L
Location	Hance 1	Date:	6/8/2005
Start point:		End point:	
Easting	413577	Easting	413412
Northing	3986230	Northing	3986374
GPS Accuracy (m)	10	GPS Accuracy (m)	13
Elevation (m)	0	Elevation (m)	0
Site description:	Start at uppermost Tapeats ledges, just upstream of Tonto Trail crossing.		
Site access:	Easily reached from Horseshoe Mesa, right off the trail.		
Tamarisk	Steady		
Tamarisk numbers:	Seedlings: 10	Saplings: 40	Mature: 12
Tamarisk control:	May take at least several hours.		

Canyon/Park	**Hance**	River mile:	76.6 L
Location	Hance 2	Date:	6/8/2005
Start point:		End point:	
Easting	413412	Easting	413210
Northing	3986374	Northing	3986580
GPS Accuracy (m)	13	GPS Accuracy (m)	30
Elevation (m)	0	Elevation (m)	0
Site description:	Start where creek bumps into Tapeats on creek right.		
Site access:	Easy with a scrambly section to access salty seep from creek bed (413171, 3986626). Can access salty seep easier via Tonto Trail.		
Tamarisk	Salty seep on west side near top of Tapeats has several saplings and one mature TAMRAM tree. Number of seedlings specified at "some."		
Tamarisk numbers:	Seedlings: 30	Saplings: 20	Mature: 30
Tamarisk control:	Large crew		

Canyon/Park	**Hance**	River mile:	76.6 L
Location	Hance 3	Date:	6/8/2005
Start point:		End point:	
Easting	413210	Easting	413090
Northing	3986580	Northing	3987060
GPS Accuracy (m)	30	GPS Accuracy (m)	30
Elevation (m)	0	Elevation (m)	0
Site description:	Start in middle of Tapeats gorge.		
Site access:	Easy		
Tamarisk	Number of seedlings specified as "some."		
Tamarisk numbers:	Seedlings: 30	Saplings: 70	Mature: 20
Tamarisk control:	May take at least several hours.		

Canyon/Park	**Hance**	River mile:	76.6 L
Location	Hance 4	Date:	6/8/2005
Start point:		End point:	
Easting	413090	Easting	413395
Northing	3987060	Northing	3987790
GPS Accuracy (m)	30	GPS Accuracy (m)	9
Elevation (m)	0	Elevation (m)	0
Site description:	Starts at riparian area in Archean rocks.		
Site access:	Easy with a scramble to the photopoint.		
Tamarisk	Mostly in upper part of this reach. Number of seedlings specified as "few."		
Tamarisk numbers:	Seedlings: 5	Saplings: 25	Mature: 8
Tamarisk control:	May take at least several hours.		

Canyon/Park	**Hance**	River mile:	76.6 L
Location	Hance 5	Date:	6/8/2005
Start point:		End point:	
Easting	413395	Easting	413406
Northing	3987790	Northing	3988356
GPS Accuracy (m)	9	GPS Accuracy (m)	7
Elevation (m)	0	Elevation (m)	0
Site description:	Starts half way between river and Tapeats sandstone.		
Site access:	Easy, may need to get feet wet to access the downstream section of this reach.		
Tamarisk	Number of seedlings specified as "few."		
Tamarisk numbers:	Seedlings: 5	Saplings: 35	Mature: 18
Tamarisk control:	Medium crew.		

Canyon/Park	**Hance**	River mile:	76.6 L
Location	Hance 6	Date:	6/8/2005
Start point:		End point:	
Easting	413406	Easting	413500
Northing	3988356	Northing	3988400
GPS Accuracy (m)	7	GPS Accuracy (m)	30
Elevation (m)	0	Elevation (m)	0
Site description:	Riparian area in granite gorge.		
Site access:	Ended survey due to climbs and waterfalls.		
Tamarisk	Number of seedlings specified as "few."		
Tamarisk numbers:	Seedlings: 5	Saplings: 48	Mature: 21
Tamarisk control:	Will take time		

Canyon/Park	**Little Nankoweap**	River mile:	52 R
Location	Little Nankoweap 1	Date:	5/8/2005
Start point:		End point:	
Easting	422080	Easting	422831
Northing	4018241	Northing	4018325
GPS Accuracy (m)	5	GPS Accuracy (m)	5
Elevation (m)		Elevation (m)	
Site description:	From last point to mouth of canyon		
Site access:	Easy walk up cobbley dry streambed.		
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0 Saplings: 0 Mature: 0		
Tamarisk control:	No TAMRAM		

Canyon/Park	**Little Nankoweap**	River mile:	52 R
Location	Little Nankoweap 2	Date:	5/8/2005
Start point:		End point:	
Easting	421745	Easting	422080
Northing	4018241	Northing	4018241
GPS Accuracy (m)	5	GPS Accuracy (m)	5
Elevation (m)		Elevation (m)	
Site description:	Large boulder garden down stream to marble streaked boulder below.		
Site access:	Easy walk up lower section of canyon. Less than 1km up you reach some large boulders. Take caution scrambling up them or else take the detour trails (always on creek left).		
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0 Saplings: 0 Mature: 0		
Tamarisk control:	No TAMRAM		

Canyon/Park	**Little Nankoweap**	River mile:	52 R
Location	Little Nankoweap 3	Date:	5/8/2005
Start point:		End point:	
Easting	421317	Easting	421745
Northing	4018310	Northing	4018316
GPS Accuracy (m)	10	GPS Accuracy (m)	7
Elevation (m)		Elevation (m)	
Site description:	Large boulder garden creating a steep difference in elevation at short distance starting at 6m tall limestone butt sliding boulder. Started from junction of Bedrock canyon.		
Site access:			
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	No TAMRAM		

Canyon/Park	**Little Nankoweap**	River mile:	52 R
Location	Little Nankoweap 4	Date:	5/8/2005
Start point:		End point:	
Easting	0	Easting	421317
Northing	0	Northing	4018310
GPS Accuracy (m)		GPS Accuracy (m)	10
Elevation (m)		Elevation (m)	
Site description:	Upper narrows of canyon ~100m from very steep end, but below first pour off, all the way to junction with bedrock canyon.		
Site access:	Follow canyon several steep boulder climbs and at 1st pour off steep traverse / climb to canyon end at very steep drop-off.		
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	No TAMRAM		

Canyon/Park	**Papago Lower**	River mile:	76 L
Location	Papago Lower 1	Date:	4/22/2005
Start point:		End point:	
Easting	0	Easting	0
Northing	0	Northing	0
GPS Accuracy (m)		GPS Accuracy (m)	
Elevation (m)	0	Elevation (m)	0
Site description:	Need to get GPS readings from map - could not get in field.		
Site access:	Escalante trail from Red Canyon going east hits a point at the mouth of Papago that one climbs down a cliff 15-20m - DO NOT CLIMB DOWN. Stay high, go south along Papago and look for cairn route that will go up away from Papago for several meters and go along ledge along Papago that leads to a place one can climb down into drainage. Route from Colorado River up Papago is blocked by a couple of dry falls. There is a map attached to tamarisk mapping form.		
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	No TAMRAM in this short, lower section of drainage.		

Canyon/Park	**Pipe Creek**	River mile:	0
Location	Pipe Creek Upper 1	Date:	4/21/2005
Start point:		End point:	
Easting	400766	Easting	400782
Northing	3992388	Northing	3992135
GPS Accuracy (m)	5	GPS Accuracy (m)	6
Elevation (m)	0	Elevation (m)	0
Site description:	Upper Pipe Creek area, in main drainage from Tonto trail going upstream.		
Site access:	Very brushy.		
Tamarisk	Some trees are 5-10m away from the running water.		
Tamarisk numbers:	Seedlings: 14	Saplings: 17	Mature: 23
Tamarisk control:	Should be able to finish with small team in 1 day from Indian Garden.		

Canyon/Park	**Pipe Creek**	River mile:	0
Location	Pipe Creek Upper 2	Date:	4/21/2005
Start point:		End point:	
Easting	400766	Easting	400892
Northing	3992388	Northing	3992135
GPS Accuracy (m)	5	GPS Accuracy (m)	5
Elevation (m)	0	Elevation (m)	0
Site description:	Upper section of Pipe Creek in main drainage, from Tonto Trail heading downstream to waterfall.		
Site access:	Brushy		
Tamarisk	Need to scour area, some look to be away from creek. Some are by trail going east from creek.		
Tamarisk numbers:	Seedlings: 12	Saplings: 11	Mature: 16
Tamarisk control:	Several hours		

Canyon/Park	**Pipe Creek**	River mile:	0
Location	Pipe Creek Upper 3	Date:	4/21/2005
Start point:		End point:	
Easting	400917	Easting	401011
Northing	3992798	Northing	3992811
GPS Accuracy (m)		GPS Accuracy (m)	
Elevation (m)	0	Elevation (m)	0
Site description:	Upper Pipe Creek, east branch. From trail to end of surface water. See Pipe Upper photos.		
Site access:			
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	No TAMRAM		

Canyon/Park	**Pipe Creek**	River mile:	0
Location	Pipe Creek Upper 4	Date:	4/21/2005
Start point:		End point:	
Easting	400917	Easting	400778
Northing	3992798	Northing	3992821
GPS Accuracy (m)		GPS Accuracy (m)	
Elevation (m)	0	Elevation (m)	0
Site description:	Upper Pipe Creek, east branch. Downstream from trail to waterfall.		
Site access:			
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0 Saplings: 0 Mature: 0		
Tamarisk control:	No TAMRAM		

Canyon/Park	**Red Canyon**	River mile:	76.6 L
Location	Red Canyon 1	Date:	4/14/2005
Start point:		End point:	
Easting	416001	Easting	416341
Northing	3986503	Northing	3986985
GPS Accuracy (m)	10	GPS Accuracy (m)	7
Elevation (m)	0	Elevation (m)	0
Site description:	Upriver from where New Hance trail drops into streambed. Wide open area, not much vegetation to block access.		
Site access:	Waterfall at upstream end - may be possible to scramble up on steep loose slope over cliffs with exposure. Did not attempt. Downstream is easy walk, wide open with not much vegetation.		
Tamarisk	Patchy all the way to the waterfall.		
Tamarisk numbers:	Seedlings: 12 Saplings: 57 Mature: 58		
Tamarisk control:	Likely need a 6 person team, possibly for 2 days after the hike in.		

Canyon/Park	**Red Canyon**	River mile:	76.6 L
Location	Red Canyon 2	Date:	4/14/2005
Start point:		End point:	
Easting	416476	Easting	416798
Northing	3987137	Northing	3987166
GPS Accuracy (m)	6	GPS Accuracy (m)	6
Elevation (m)	0	Elevation (m)	0
Site description:	Middle of streambed where New Hance Trail drops into drainage - heading downstream.		
Site access:	Easy walking.		
Tamarisk	Sparse vegetation, little water in stream.		
Tamarisk numbers:	Seedlings: 0 Saplings: 0 Mature: 5		
Tamarisk control:	TAMRAM are close to the start point of this section, 3 in close proximity and 2 just downstream, no additional ones below that to the river.		

Canyon/Park	**Saddle Canyon**	River mile:	47 L
Location	Saddle Canyon Bottom 1	Date:	5/7/2005
Start point:		End point:	
Easting	420069	Easting	419771
Northing	4024913	Northing	4024759
GPS Accuracy (m)	7	GPS Accuracy (m)	7
Elevation (m)	845	Elevation (m)	1271
Site description:	Enter mouth of drainage from campsite beach on point. Start this section at netleaf hackberry creek left. Boulder behind tree ~175m from river. Drainage gets difficult to ascend - maybe go up and around. Section ends at junction with trail.		
Site access:	All four limbs needed. Boulder climbing and some loose conglomerate mudstone.		
Tamarisk	First sapling below delivery van sized boulders almost, but not choking canyon.		
Tamarisk numbers:	Seedlings: 0 Saplings: 1 Mature: 1		
Tamarisk control:	Probably more trees present - site surveyed from above. 2 people go up canyon get 1 sapling - small group go up trail (those comfortable with boulder climbing, bring a piece of webbing hand line) and work down drainage. Water present in drainage.		

Canyon/Park	**Saddle Canyon**	River mile:	47 L
Location	Saddle Canyon Bottom 2	Date:	5/7/2005
Start point:		End point:	
Easting	419771	Easting	419317
Northing	4024759	Northing	4024441
GPS Accuracy (m)	7	GPS Accuracy (m)	9
Elevation (m)	1271	Elevation (m)	
Site description:	From trail junction to ~500 m up canyon. Drainage in redwall limestone. Saddle Canyon Upper 2 ends ~40m up canyon from here.		
Site access:	Easy to follow drainage. Water present, difficult to keep feet dry unless you hiked on side of creek.		
Tamarisk	1 mature in drainage.		
Tamarisk numbers:	Seedlings: 0 Saplings: 0 Mature: 1		
Tamarisk control:	1 mature that has been flashed - may need geology pick, handsaws and Garlon 3a if water level remains.		

Canyon/Park	**South Canyon**	River mile:	31.5 R
Location	South Canyon 1	Date:	5/6/2005
Start point:		End point:	
Easting	417413	Easting	417413
Northing	4036685	Northing	4036685
GPS Accuracy (m)	7	GPS Accuracy (m)	7
Elevation (m)	1331	Elevation (m)	
Site description:	Side canyon 200 meters down creek from trail going up and out. 1 mile from rim - 6 mile from river 100m from gamble oak stand. Site is about 100m long - creek in Hermit shale.		
Site access:	Good from both river and rim		
Tamarisk	One every 3m or so.		
Tamarisk numbers:	Seedlings: 0 Saplings: 10 Mature: 22		
Tamarisk control:	Water present - Garlon 3A - picks needed, hand saws. One sprayer (or less). Work time estimate: one hour crew of 4.		

Canyon/Park	**South Canyon**	River mile:	31.5 R
Location	South Canyon 2	Date:	5/6/2005
Start point:		End point:	
Easting	418244	Easting	418423
Northing	4037211	Northing	4037380
GPS Accuracy (m)	8	GPS Accuracy (m)	4
Elevation (m)	1274	Elevation (m)	1262
Site description:	Beginning site 250 meters down canyon from Hermit spire with Coconino cap rock at mouth of side wash (creek left). Creek is in Hermit shale strata, ending site at major wash creek right.		
Site access:	Good from both river and rim		
Tamarisk	One every 20-60 meters		
Tamarisk numbers:	Seedlings: 0	Saplings: 18	Mature: 27
Tamarisk control:	Sparse - only a couple of large adults (diameter 6 inches) crew of 4 1/2 hour - water present - less than one sprayer of Garlon 3A.		

Canyon/Park	**South Canyon**	River mile:	31.5 R
Location	South Canyon 3	Date:	5/6/2005
Start point:		End point:	
Easting	418423	Easting	418899
Northing	4037380	Northing	4037572
GPS Accuracy (m)	4	GPS Accuracy (m)	7
Elevation (m)	1262	Elevation (m)	1227
Site description:	Beginning at major wash creek right in Hermit shale. Ending in top of Esplanade near (tank?) 3m up - 1 big rock - section covers contact point between Hermit and Supai.		
Site access:	Good from river to rim.		
Tamarisk	1 every 20-60 meters		
Tamarisk numbers:	Seedlings: 3	Saplings: 45	Mature: 40
Tamarisk control:	Good amount of flashed individuals that are difficult . Crew of 4 for 1.5 hours. One whole sprayer of Garlon 3A (water present)		

Canyon/Park	**South Canyon**	River mile:	31.5 R
Location	South Canyon 4	Date:	5/6/2005
Start point:		End point:	
Easting	418899	Easting	419538
Northing	4037572	Northing	4037921
GPS Accuracy (m)	7	GPS Accuracy (m)	6
Elevation (m)	1227	Elevation (m)	1186
Site description:	Creek runs through Esplanade section of Supai ending at contact point between Esplanade and second layer in Supai. At 10m dry fall - trail goes up and around creek right - reading at first cairn going up.		
Site access:	Good from rim or river.		
Tamarisk	Sparse		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 3
Tamarisk control:	Crew of 4 - 10minutes. 1 sprayer (much less)		

Canyon/Park	**South Canyon**	River mile:	31.5 R
Location	South Canyon 5	Date:	5/6/2005
Start point:		End point:	
Easting	419538	Easting	419815
Northing	4037921	Northing	4038124
GPS Accuracy (m)	6	GPS Accuracy (m)	7
Elevation (m)	1186	Elevation (m)	
Site description:	At contact point between second layer of Supai and Esplanade. Trail goes up creek right. Reading taken at first cairn going up. Ending point above a dry fall where trail goes up on creek right. There is a 40 foot dry fall, first boulder on white bedrock Supai.		
Site access:	Good from river or rim.		
Tamarisk	1 every 10 meters toward ending point		
Tamarisk numbers:	Seedlings: 0	Saplings: 18	Mature: 32
Tamarisk control:	Difficult flashed adults. Crew of 4 - 1 hour. Less than one sprayer full of Garlon 3A (water present).		

Canyon/Park	**South Canyon**	River mile:	31.5 R
Location	South Canyon 6	Date:	5/6/2005
Start point:		End point:	
Easting	419815	Easting	421150
Northing	4038124	Northing	4039457
GPS Accuracy (m)	7	GPS Accuracy (m)	8
Elevation (m)	1159	Elevation (m)	1026

Site description: Ends at junction with side canyon on creek left, first major side drainage. From here to transect 1 in Supai layer entire time.

Site access: Access possible from river or rim. Bouldery drainage with bedrock a couple of small pourovers to traverse around.

Tamarisk: Few dense clumps with long lengths of no TAMRAM some scattered many have been flashed and will require digging.

Tamarisk numbers: Seedlings: 0 Saplings: 23 Mature: 25

Tamarisk control: Handsaws, geology picks, for digging flashed TAMRAM. 1.5 sprayers full at most - maybe 1. Garlon 3A not needed in this section. 2 hours with 4 person crew.

Canyon/Park	**South Canyon**	River mile:	31.5 R
Location	South Canyon 7	Date:	5/6/2005
Start point:		End point:	
Easting	421150	Easting	422091
Northing	4039457	Northing	4039552
GPS Accuracy (m)	8	GPS Accuracy (m)	6
Elevation (m)	1026	Elevation (m)	959

Site description: Traverses up and over a pour over - side drainage comes in on creek right. Otherwise same cobbles and boulders. Ends at juncture with trail.

Site access: Relatively easy. Watch ankles, if packs are heavy - boots necessary.

Tamarisk: Sparse

Tamarisk numbers: Seedlings: 1 Saplings: 9 Mature: 7

Tamarisk control: Not much work in this section - few hands- some Garlon 4, handsaws.

Canyon/Park	**Trail Canyon**	River mile:	219 R
Location	Trail 1	Date:	5/18/2005
Start point:		End point:	
Easting	289763	Easting	289467
Northing	3968388	Northing	3968452
GPS Accuracy (m)	10	GPS Accuracy (m)	10
Elevation (m)	394	Elevation (m)	451

Site description: This is a 520m stretch in lower Trail with a running creek (wet year) lots of schist walls and granite bedrock. TAMRAM is dominant species. Assoc sp: BEBJUN, ACAGRE, ENCFAR, DATMET, PROGLA, NICTRI, EUCURE, PORGRA, CONCAN, ISOACR, SONASP, BRORUB, TYPLAT.

Site access: Easy walk from river. One small water pour over to scramble up with slick granite walking. Bring water.

Tamarisk: Steady distribution of mature and saplings from the mouth up to the 520m mark. North of huge diameter, but still a considerable amount of work to be done. Almost as dense as crystal or bright angel.

Tamarisk numbers: Seedlings: 6 Saplings: 115 Mature: 80

Tamarisk control: Hand saws should be sufficient. Water is running in creek close to some TAMRAM. Trail 1-3 have very large numbers of TAMRAM. Count on multiple days with a large crew, perhaps a team of 8-10 working 5-6 days.

Canyon/Park	**Trail Canyon**	River mile:	219 R
Location	Trail 2	Date:	5/18/2005
Start point:		End point:	
Easting	289467	Easting	289274
Northing	3968452	Northing	3968714
GPS Accuracy (m)	10	GPS Accuracy (m)	12
Elevation (m)	451	Elevation (m)	478

Site description: Stretch from 600-1200meters from mouth becomes slightly more open with very dense riparian growth. A 50/50 ratio of native vegetation vs. TAMRAM. AT 980m is a vegetation transect with good photo documentation. Site ends 1200m from canyon mouth near a bend to the west in creek, and 200m upstream from a couple of small waterfalls over conglomerate rock. The creek is about to leave the schist and up into tapeats. Assoc spp: TYPLAT, PHRspp, PLUSER, ALOWRI, GUTSER, BACSAL, POLMON, CYNDAC, BRILON, BEBJUN, ACAGRE, ISOACR, POPFRE

Site access: As vegetation becomes thick, walking upstream becomes difficult. One must walk up the stream or get high and walk above the creek in spiny desert terrain.

Tamarisk: Consistently thick TAMRAM populations for site.

Tamarisk numbers: Seedlings: 200 Saplings: 750 Mature: 150

Tamarisk control: TAMRAM mixed with BACSAL and PLUSER making them harder to spot and much more difficult for Garlon sprayers to find cut stumps. Good communication is needed between cutters and sprayers.

Canyon/Park	**Trail Canyon**	River mile:	219 R
Location	Trail 3	Date:	5/18/2005
Start point:		End point:	
Easting	289274	Easting	289069
Northing	3968741	Northing	3969017
GPS Accuracy (m)	12	GPS Accuracy (m)	9
Elevation (m)	478	Elevation (m)	492

Site description: Site stretches from 1.2m to 1.7km away from mouth of canyon. Only the lowest 30m stretch has strongly flowing water and dense plant growth within the drainage. Above that, the water disappears below ground, resurfacing only for a tickle or small pool. This makes walking easy, as creek bed is dry and cobbley and free of thick vegetation.

Site access: Summer heat is biggest safety concern

Tamarisk: The lowest 30m section (still schist at bend in creek) has numerous mature/saplings clustered together. Past that, there are 2 or 3 matures only in a 500m stretch until you get to the narrowest spot in the tapeats section of the canyon. This site ends there.

Tamarisk numbers: Seedlings: 10 Saplings: 20 Mature: 10

Tamarisk control: There is lots of work in the first 1200m of the canyon. Then the water leaves, and there are few TAMRAM. Small group of 3 could travel up canyon to get the stray TAMRAM that have survived upstream.

Canyon/Park	**Trail Canyon**	River mile:	219 R
Location	Trail 4	Date:	5/18/2005
Start point:		End point:	
Easting	289069	Easting	288887
Northing	3969017	Northing	3969276
GPS Accuracy (m)	9	GPS Accuracy (m)	10
Elevation (m)	492	Elevation (m)	516

Site description: This site goes 400m from the narrowest spot in tapeats to the top of the Tapeats where the canyon opens into Bright Angel shale section. Water starts flowing again, through this entire stretch, but vegetation is quite sparse. From the river it is 1.7-2.2km to this site. At 2.2km is the narrow sandstone bedrock above a few pour offs that form a beautiful desert creek. environment.

Site access: Easy access - no climbing of much difficulty involved.

Tamarisk: There is 1 TAMRAM in this section at the top of the tapeats just above the final pour off where the creek flattens out again.

Tamarisk numbers: Seedlings: 0 Saplings: 0 Mature: 1

Tamarisk control: One mature at the top of Tapeats layer on creek left. Hand saw only - one cutter/sprayer task.

Canyon/Park	**Trail Canyon**	River mile:	219 R
Location	Trail 5	Date:	5/18/2005
Start point:		End point:	
Easting	288887	Easting	288324
Northing	3969276	Northing	3970012
GPS Accuracy (m)	10	GPS Accuracy (m)	4
Elevation (m)	516	Elevation (m)	557

Site description: This site spans 1.1km in total from the top of the tapeats layer at 2.2km from river to a couple of hundred meters shy of the first major fork in Trail canyon, ending at a boulder laying in the center of the DRY washed cobbley drainage at 3.3km from river. Notable spp: BAIMUL, LARTRU, DATMET. ENCFAR, ACAGRE, LEPLAS,

Site access: Site is easy to access from river. Walking in this site is extremely easy, as there are very few plants, no water, and the grade in the Bright Angel shale is very gradual.

Tamarisk: None

Tamarisk numbers: Seedlings: 0 Saplings: 0 Mature: 0

Tamarisk control: No TAMRAM

Canyon/Park	**Trail Canyon**	River mile:	219 R
Location	Trail 6	Date:	5/18/2005
Start point:		End point:	
Easting	288324	Easting	287960
Northing	3970012	Northing	3970782
GPS Accuracy (m)	4	GPS Accuracy (m)	9
Elevation (m)	557	Elevation (m)	604

Site description: From 3.3-4.4km from the river, this 1.1km stretch of hot dry creek bed has no TAMRAM and no water, but plenty of ACAGRE and ENCFAR. Site ends in BA shale, but canyon drainage is getting slightly more narrow and filling with bigger boulders from above. Assoc spp: LARTRI, BRILON, DATMET, Penstemon spp.

Site access: Easy walk from river, but starting to be a longer day hike (9km round trip) with less water availability.

Tamarisk: None

Tamarisk numbers: Seedlings: 0 Saplings: 0 Mature: 0

Tamarisk control: No TAMRAM

Canyon/Park	**Trail Canyon**	River mile:	219 R
Location	Trail 7	Date:	5/18/2005
Start point:		End point:	
Easting	287960	Easting	287733
Northing	3970782	Northing	3971578
GPS Accuracy (m)	9	GPS Accuracy (m)	12
Elevation (m)	604	Elevation (m)	686
Site description:	Site is 1.1km starting 4.4km from river. Canyon is still dry but getting more narrow and more full of boulders. Plants are consistent with Trail 4, 5, and 6. An Asclepias spp? is appearing - very viney, milky sap. FOUSPL also.		
Site access:	Bring lots of water if it is a warm sunny day.		
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	No TAMRAM		

Canyon/Park	**Trail Canyon**	River mile:	219 R
Location	Trail 8	Date:	5/18/2005
Start point:		End point:	
Easting	287733	Easting	0
Northing	3971578	Northing	0
GPS Accuracy (m)	12	GPS Accuracy (m)	
Elevation (m)	686	Elevation (m)	
Site description:	Site ends approximately 700-1000m upstream from beginning pt (photopoint 8): Site cliffs out low in the Muav, the left fork (5km from river is fork) was scouted out and also cliffed out in the Muav. Neither had any TAMRAM. The alcove in the right fork had mostly acacia as the dominant plant.		
Site access:	Easy 6km walk from river.		
Tamarisk	None		
Tamarisk numbers:	Seedlings: 0	Saplings: 0	Mature: 0
Tamarisk control:	No TAMRAM		

Canyon/Park	**Trib Btwn Boulder and**	River mile:	82.3 L
Location	Trib Bt. Boulder and Grapevine 1	Date:	6/10/2005
Start point:		End point:	
Easting	408362	Easting	408362
Northing	3990648	Northing	3990648
GPS Accuracy (m)	8	GPS Accuracy (m)	8
Elevation (m)	0	Elevation (m)	0
Site description:	Dry wash on Tonto Trail between Boulder and Grapevine.		
Site access:	Easy		
Tamarisk	Sapling next to trail.		
Tamarisk numbers:	Seedlings: 0	Saplings: 1	Mature: 0
Tamarisk control:	Small crew		

Appendix D - Habitat Assessment Data

Canyon/Park	**Badger**	River mile:	8 R
Location	Badger 1	Date	5/4/2005
Start point:		End point:	
Easting	441358	Easting	441110
Northing	4069828	Northing	4069973
GPS accuracy (m)	13	GPS accuracy (m)	7
Surface water within		Surface water type:	
Soil	dry	Surface rocks:	sandstone
Associated species:	Fallugia paradoxa (D. Don) Endl. ex Torr., Stanleya pinnata (Pursh) Britt., Ephedra spp., Chrysothamnus spp., Phacelia spp., Sphaeralcea spp., Bromus rubens L.		
Dominant species:	Brickellia longifolia S. Wats., Atriplex spp.		
Habitat type:	Great Basin desert scrub		
Vegetation	Sparse	Average height of vegetation	1
Tamarisk estimate:	None		
Other info:			
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Badger**	River mile:	8 R
Location	Badger 2	Date	5/4/2005
Start point:		End point:	
Easting	441110	Easting	440829
Northing	4069973	Northing	4069989
GPS accuracy (m)	7	GPS accuracy (m)	7
Surface water within		Surface water type:	pothole
Soil	dry	Surface rocks:	sandstone
Associated species:	Tamarix ramosissima Ledeb., Stanleya pinnata (Pursh) Britt.		
Dominant species:	Chrysothamnus spp., Brickellia longifolia S. Wats.		
Habitat type:	Great Basin desert scrub		
Vegetation	sparse	Average height of vegetation	1.5
Tamarisk estimate:	Low, scattered		
Other info:			
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Badger**	River mile:	8 R
Location	Badger 3	Date	5/4/2005
Start point:		End point:	
Easting	440829	Easting	440570
Northing	4069989	Northing	4070039
GPS accuracy (m)	7	GPS accuracy (m)	7
Surface water within		Surface water type:	pothole
Soil	dry	Surface rocks:	shale
Associated species:	Bromus rubens L., Stanleya pinnata (Pursh) Britt., Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird		
Dominant species:	Brickellia longifolia S. Wats.		
Habitat type:	Great Basin desert scrub		
Vegetation	Sparse	Average height of vegetation	1
Tamarisk estimate:	Low		
Other info:			
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Badger**	River mile:	8 R
Location	Badger 4	Date	5/4/2005
Start point:		End point:	
Easting	440570	Easting	440354
Northing	4070039	Northing	4070141
GPS accuracy (m)	7	GPS accuracy (m)	14
Surface water within		Surface water type:	pothole
Soil	dry	Surface rocks:	shale
Associated species:	Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird, Stanleya pinnata (Pursh) Britt., Nicotiana obtusifolia Mertens & Galeotti, Bromus rubens L., Ephedra spp.		
Dominant species:	Brickellia longifolia S. Wats.		
Habitat type:	Great Basin desert scrub		
Vegetation	Sparse	Average height of vegetation	1
Tamarisk estimate:	Low		
Other info:			
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Badger**	River mile:	8 R
Location	Badger 5	Date	5/4/2005
Start point:		End point:	
Easting	440354	Easting	440268
Northing	4070141	Northing	4070219
GPS accuracy (m)	14	GPS accuracy (m)	20
Surface water within		Surface water type:	pothole
Soil	dry	Surface rocks:	shale
Associated species:	Stanleya pinnata (Pursh) Britt., Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird, Bromus rubens L., Ephedra spp., Nicotiana obtusifolia Mertens & Galeotti		
Dominant species:	Brickellia longifolia S. Wats.		
Habitat type:	Great Basin desert scrub		
Vegetation	Sparse	Average height of vegetation	0
Tamarisk estimate:	None		
Other info:			
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**South Canyon**	River mile:	31.5 R
Location	South Canyon 1	Date	5/6/2005
Start point:		End point:	
Easting	417413	Easting	418244
Northing	4036685	Northing	4037211
GPS accuracy (m)	7	GPS accuracy (m)	8
Surface water within		Surface water type:	pothole
Soil	dry	Surface rocks:	shale
Associated species:	Bromus tectorum L., Robinia neomexicana Gray, Tamarix ramosissima Ledeb., Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird, Stanleya pinnata (Pursh) Britt.		
Dominant species:	Brickellia longifolia S. Wats., Fallugia paradoxa (D. Don) Endl. ex Torr.		
Habitat type:	Mojave desert scrub		
Vegetation	Low to moderate	Average height of vegetation	1
Tamarisk estimate:	Sparse - primarily at point for transect		
Other info:	Started mapping from top of canyon. No tamarisk up canyon to large dryfall - just down canyon from where trail heads out to rim.		
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**South Canyon**	River mile:	31.5 R
Location	South Canyon 2	Date	5/6/2005
Start point:		End point:	
Easting	418244	Easting	418423
Northing	4037211	Northing	4037380
GPS accuracy (m)	8	GPS accuracy (m)	4
Surface water within		Surface water type:	pothole
Soil	dry	Surface rocks:	shale
Associated species:	Sphaeralcea spp., Tamarix ramosissima Ledeb., Stanleya pinnata (Pursh) Britt., Bromus tectorum L., Opuntia basilaris Engelm. & Bigelow		
Dominant species:	Fallugia paradoxa (D. Don) Endl. ex Torr., Brickellia longifolia S. Wats.		
Habitat type:	Mojave desert scrub		
Vegetation	sparse	Average height of vegetation	1
Tamarisk estimate:	Sparse		
Other info:			
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**South Canyon**	River mile:	31.5 R
Location	South Canyon 3	Date	5/6/2005
Start point:		End point:	
Easting	418423	Easting	419769
Northing	4037380	Northing	4038116
GPS accuracy (m)	4	GPS accuracy (m)	8
Surface water within		Surface water type:	pothole
Soil	dry	Surface rocks:	sandstone
Associated species:	Stanleya pinnata (Pursh) Britt., Opuntia basilaris Engelm. & Bigelow, Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth, Bromus rubens L., Bromus tectorum L., Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird, Fallugia paradoxa (D. Don) Endl. ex Torr.		
Dominant species:	Brickellia longifolia S. Wats.		
Habitat type:	Mojave desert scrub		
Vegetation	Sparse	Average height of vegetation	1
Tamarisk estimate:	Sparse		
Other info:	From South 3 to Transect 2 area.		
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**South Canyon**	River mile:	31.5 R
Location	South Canyon 4	Date	5/6/2005
Start point:		End point:	
Easting	419769	Easting	420713
Northing	4038116	Northing	4039253
GPS accuracy (m)	8	GPS accuracy (m)	12
Surface water within		Surface water type:	pothole
Soil	dry	Surface rocks:	shale
Associated species:	Tamarix ramosissima Ledeb., Atriplex spp., Ephedra spp., Bromus rubens L., Fallugia paradoxa (D. Don) Endl. ex Torr., Bromus tectorum L., Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird		
Dominant species:	Brickellia longifolia S. Wats.		
Habitat type:	Mojave desert scrub		
Vegetation	Sparse	Average height of vegetation	0.75
Tamarisk estimate:	Sparse		
Other info:	From transect 2 down canyon to where trail drops in. Very rocky within sparse vegetation. No potential habitat from this spot and no tamarisk to the river.		
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Saddle Canyon**	River mile:	47 L
Location	Saddle Bottom 1	Date	5/7/2005
Start point:		End point:	
Easting	420096	Easting	419771
Northing	4024913	Northing	4024759
GPS accuracy (m)	7	GPS accuracy (m)	7
Surface water within		Surface water type:	pothole
Soil	moist	Surface rocks:	limestone
Associated species:	Acer negundo L. var. californicum (Torr. & Gray) Sarg., Atriplex spp.		
Dominant species:	Acacia greggii Gray, Celtis laevigata Willd. var. reticulata (Torr.) L. Benson, Yucca spp., Prosopis glandulosa Torr., Brickellia longifolia S. Wats.		
Habitat type:	Great Basin desert scrub Riparian		
Vegetation	Moderate	Average height of vegetation	3
Tamarisk estimate:	None		
Other info:	Riparian but too thin for SWIFL.		
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Saddle Canyon**	River mile:	47 L
Location	Saddle Bottom 2	Date	5/7/2005
Start point:		End point:	
Easting	419771	Easting	419317
Northing	4024759	Northing	4024441
GPS accuracy (m)	7	GPS accuracy (m)	9
Surface water within		Surface water type:	stream
Soil	moist	Surface rocks:	limestone
Associated species:	Mahonia spp., Fallugia paradoxa (D. Don) Endl. ex Torr., Rhus trilobata Nutt. var. simplicifolia (Greene) Barkl.		
Dominant species:	Acer negundo L. var. californicum (Torr. & Gray) Sarg., Cercis orbiculata Greene, Celtis laevigata Willd. var. reticulata (Torr.) L. Benson		
Habitat type:	Riparian		
Vegetation	High	Average height of vegetation	3
Tamarisk estimate:	Low (1 mature)		
Other info:	Removal of TAMRAM will have no effect on species.		
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Saddle Canyon**	River mile:	47 L
Location	Saddle Upper 1 - 2	Date	5/7/2005
Start point:		End point:	
Easting	0	Easting	419336
Northing	0	Northing	4024456
GPS accuracy (m)		GPS accuracy (m)	12
Surface water within		Surface water type:	stream
Soil	saturated	Surface rocks:	sandstone
Associated species:	Bromus rubens L., Populus fremontii S. Wats., Mimulus spp., Adiantum capillus-veneris L., Cercis orbiculata Greene, Aquilegia spp.		
Dominant species:	Mahonia fremontii (Torr.) Fedde, Brickellia longifolia S. Wats., Acer negundo L. var. californicum (Torr. & Gray) Sarg.		
Habitat type:	Riparian		
Vegetation	Moderate to low	Average height of vegetation	2.5
Tamarisk estimate:	None		
Other info:	Transect from waterfall to open spot in canyon - some dense patches of box elder and cottonwood but very small and scattered.		
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Saddle Canyon**	River mile:	47 L
Location	Saddle Upper 2 - 3	Date	5/7/2005
Start point:		End point:	
Easting	419336	Easting	419317
Northing	4024456	Northing	4024441
GPS accuracy (m)	12	GPS accuracy (m)	9
Surface water within		Surface water type:	stream
Soil	saturated	Surface rocks:	sandstone
Associated species:	Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird, Acer negundo L. var. californicum (Torr. & Gray) Sarg., Apocynum androsaemifolium L., Bromus rubens L.		
Dominant species:	Brickellia longifolia S. Wats.		
Habitat type:	Riparian		
Vegetation	Low-moderate	Average height of vegetation	2
Tamarisk estimate:	None		
Other info:	Only ~40m from photopoint 2 to 3; we met up with the second transect group.		
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Little Nankoweap**	River mile:	52 R
Location	Little Nankoweap 1	Date	5/8/2005
Start point:		End point:	
Easting	0	Easting	421317
Northing	0	Northing	4018310
GPS accuracy (m)		GPS accuracy (m)	10
Surface water within		Surface water type:	
Soil	dry	Surface rocks:	shale
Associated species:	Bromus rubens L., Sphaeralcea spp., Atriplex canescens (Pursh) Nutt., Ephedra spp., Opuntia spp.		
Dominant species:	Acacia spp., Brickellia longifolia S. Wats.		
Habitat type:	Great Basin desert scrub		
Vegetation	Sparse	Average height of vegetation	1
Tamarisk estimate:	None		
Other info:			
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Little Nankoweap**	River mile:	52 R
Location	Little Nankoweap 2 & 3	Date	5/8/2005
Start point:		End point:	
Easting	421317	Easting	422813
Northing	4018310	Northing	4018325
GPS accuracy (m)	10	GPS accuracy (m)	
Surface water within		Surface water type:	
Soil	dry	Surface rocks:	limestone
Associated species:	Atriplex canescens (Pursh) Nutt., Ephedra spp., Bromus rubens L., Sphaeralcea spp., Opuntia spp.		
Dominant species:	Brickellia longifolia S. Wats., Acacia spp.		
Habitat type:	Great Basin desert scrub		
Vegetation	Sparse	Average height of vegetation	1
Tamarisk estimate:	None		
Other info:			
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**60 Mile**	River mile:	59.8 R
Location	60 Mile 1	Date	5/8/2005
Start point:		End point:	
Easting	427237	Easting	426877
Northing	4007776	Northing	4007617
GPS accuracy (m)	12	GPS accuracy (m)	10
Surface water within		Surface water type:	
Soil	dry	Surface rocks:	shale
Associated species:	Atriplex spp., Opuntia spp., Ephedra spp., Acacia spp., Sphaeralcea spp., Bromus rubens L., Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird, Prosopis glandulosa Torr., Brickellia spp.		
Dominant species:	Prosopis glandulosa Torr., Encelia spp.		
Habitat type:	Mojave desert scrub		
Vegetation	Sparse	Average height of vegetation	1
Tamarisk estimate:	Sparse (2 downstream from pt 1 at beginning of canyon)		
Other info:	Few trees, mainly rocky and some grasses, shrubs & cacti.		
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**60 Mile**	River mile:	59.8 R
Location	60 Mile 2	Date	5/8/2005
Start point:		End point:	
Easting	426877	Easting	426420
Northing	4007617	Northing	4007505
GPS accuracy (m)	10	GPS accuracy (m)	7
Surface water within		Surface water type:	
Soil	dry	Surface rocks:	shale
Associated species:	Stanleya pinnata (Pursh) Britt., Prosopis glandulosa Torr., Bromus tectorum L., Atriplex spp., Bromus rubens L., Sphaeralcea spp., Brickellia longifolia S. Wats., Acacia spp., Ephedra spp.		
Dominant species:	Atriplex spp., Encelia spp.		
Habitat type:	Mojave desert scrub		
Vegetation	Sparse	Average height of vegetation	1
Tamarisk estimate:	None		
Other info:	Very open, hot, rocky drainage.		
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**60 Mile**	River mile:	59.8 R
Location	60 Mile 3	Date	5/8/2005
Start point:		End point:	
Easting	426460	Easting	426453
Northing	4007505	Northing	4007419
GPS accuracy (m)	7	GPS accuracy (m)	7
Surface water within		Surface water type:	
Soil	dry	Surface rocks:	shale
Associated species:	Artemisia dracunculus L., Sphaeralcea spp., Atriplex spp., Brickellia spp., Bromus tectorum L., Bromus rubens L., Encelia spp., Acacia spp., Prosopis glandulosa Torr., Artemisia spp.		
Dominant species:	Brickellia longifolia S. Wats., Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird		
Habitat type:	Mojave desert scrub		
Vegetation	Sparse	Average height of vegetation	1
Tamarisk estimate:	None		
Other info:	Very sparse; dryfall after 135m route up to river right at 115m. Dan went up drainage past dryfall & no TAMRAM.		
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Carbon Canyon**	River mile:	64.7 R
Location	Carbon 15, 16, 17	Date	5/9/2005
Start point:		End point:	
Easting	425047	Easting	424754
Northing	4001271	Northing	4002003
GPS accuracy (m)	7	GPS accuracy (m)	4
Surface water within		Surface water type:	stream
Soil	moist	Surface rocks:	other
Associated species:			
Dominant species:	Prosopis glandulosa Torr., Tamarix ramosissima Ledeb.		
Habitat type:	Great Basin desert scrub		
Vegetation	Low	Average height of vegetation	3
Tamarisk estimate:	Low		
Other info:			
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Carbon Canyon**	River mile:	64.7 R
Location	Carbon East Fork 1, 2, 3, 4, 5	Date	5/9/2005
Start point:		End point:	
Easting	424754	Easting	424673
Northing	4002003	Northing	4003644
GPS accuracy (m)	7	GPS accuracy (m)	4
Surface water within		Surface water type:	stream
Soil	dry	Surface rocks:	other
Associated species:	Stanleya pinnata (Pursh) Britt., Fallugia paradoxa (D. Don) Endl. ex Torr.		
Dominant species:	Tamarix ramosissima Ledeb., Yucca spp., Prosopis glandulosa Torr.		
Habitat type:	Great Basin desert scrub		
Vegetation	Sparse	Average height of vegetation	2.5
Tamarisk estimate:	Low		
Other info:			
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Carbon Canyon**	River mile:	64.7 R
Location	Carbon Photopoint WF4 - WF6	Date	5/9/2005
Start point:		End point:	
Easting	423720	Easting	424578
Northing	4002483	Northing	4001994
GPS accuracy (m)	6	GPS accuracy (m)	3
Surface water within		Surface water type:	
Soil	dry	Surface rocks:	shale
Associated species:	Yucca spp., Opuntia spp., Atriplex spp., Encelia spp., Prosopis glandulosa Torr., Sphaeralcea spp., Gutierrezia spp., Bromus tectorum L., Bromus rubens L.		
Dominant species:	Ephedra spp., Coleogyne ramosissima Torr.		
Habitat type:	Mojave desert scrub		
Vegetation	Sparse	Average height of vegetation	0.5
Tamarisk estimate:	None		
Other info:	Dry, rocky, sparse vegetation until fork; transect to main fork of carbon east/west split.		
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Carbon Canyon**	River mile:	64.7 R
Location	Carbon ppt. WF1 to WF4	Date	5/9/2005
Start point:		End point:	
Easting	422889	Easting	423720
Northing	4004825	Northing	4002483
GPS accuracy (m)	4	GPS accuracy (m)	6
Surface water within		Surface water type:	
Soil	dry	Surface rocks:	shale
Associated species:	Echinocactus spp., Ephedra spp., Sphaeralcea spp., Juniperus spp., Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird, Yucca spp., Coleogyne ramosissima Torr., Bromus rubens L., Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth, Opuntia spp., Brickellia longifolia S. Wats., Atriplex spp.		
Dominant species:	Coleogyne ramosissima Torr., Ephedra spp., Gutierrezia spp.		
Habitat type:	Mojave desert scrub		
Vegetation	Very sparse	Average height of vegetation	0.5
Tamarisk estimate:	None		
Other info:	Start from top of west fork of carbon (just below Galeros Butte); very dry and rocky with little vegetation. Start is 5.7km from main east/west split in Carbon.		
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**70.2 Cardenas Hillside**	River mile:	70.2 L
Location	Cardenas hillside spring 1,2	Date	5/10/2005
Start point:		End point:	
Easting	423223	Easting	423158
Northing	3993478	Northing	3993503
GPS accuracy (m)	7	GPS accuracy (m)	4
Surface water within		Surface water type:	seep
Soil	dry	Surface rocks:	sandstone
Associated species:	Tamarix ramosissima Ledeb., Acacia spp., Stanleya pinnata (Pursh) Britt., Ephedra spp., Atriplex spp.		
Dominant species:	Cladium californicum (S. Wats.) O'Neill, Phragmites australis (Cav.) Trin. ex Steud., Prosopis glandulosa Torr.		
Habitat type:	Riparian		
Vegetation	Moderate to dense	Average height of vegetation	2.5
Tamarisk estimate:	Low (6-8 large mature in 2 clumps)		
Other info:	Very small seep area on hillside. Treed area is 2 acres. Seep area w/ riparian grasses is <5 acres. No surface water found. Area around seep is very sparse. ~600m from Cardenas beach on Escalante trail.		
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**70.8 mile drainage**	River mile:	70.8 L
Location	70.8 mile drainage photopoint 1 - 2	Date	5/10/2005
Start point:		End point:	
Easting	423076	Easting	422964
Northing	3992849	Northing	3993123
GPS accuracy (m)	4	GPS accuracy (m)	4
Surface water within		Surface water type:	seep
Soil	dry	Surface rocks:	sandstone
Associated species:	Tamarix ramosissima Ledeb., Bromus rubens L., Ephedra spp., Encelia spp.		
Dominant species:	Acacia spp., Prosopis glandulosa Torr.		
Habitat type:	Mojave desert scrub		
Vegetation	Low	Average height of vegetation	3
Tamarisk estimate:	Low (1 clump of ~10 mature, 20 saplings and seedlings around seep)		
Other info:			
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Cardenas Creek**	River mile:	72 L	
Location	Cardenas 1	Date	5/10/2005	
Start point:		End point:		
Easting	422872	Easting	422318	
Northing	3990978	Northing	3991654	
GPS accuracy (m)	7	GPS accuracy (m)	5	
Surface water within		Surface water type:		
Soil	dry	Surface rocks:	sandstone	
Associated species:	Fallugia paradoxa (D. Don) Endl. ex Torr., Ephedra spp.			
Dominant species:	Acacia spp., Rhus spp., Cercis orbiculata Greene			
Habitat type:	Great Basin desert scrub			
Vegetation	Sparse	Average height of vegetation		2
Tamarisk estimate:	None			
Other info:				
SWIFL	Not Southwestern Willow Flycatcher Habitat			

Canyon/Park	**Cardenas Creek**	River mile:	72 L	
Location	Cardenas 2, 3, 4, 5	Date	5/10/2005	
Start point:		End point:		
Easting	422318	Easting	422257	
Northing	3991654	Northing	3993524	
GPS accuracy (m)	5	GPS accuracy (m)	14	
Surface water within		Surface water type:		
Soil	dry	Surface rocks:	sandstone	
Associated species:	Fallugia paradoxa (D. Don) Endl. ex Torr., Opuntia spp.			
Dominant species:	Cercis orbiculata Greene, Rhus spp., Acacia spp.			
Habitat type:	Great Basin desert scrub			
Vegetation	Sparse	Average height of vegetation		1.5
Tamarisk estimate:	None			
Other info:				
SWIFL	Not Southwestern Willow Flycatcher Habitat			

Canyon/Park	**Hance**	River mile:	76.6 L		
Location	Hance 1	Date	6/8/2005		
Start point:		End point:			
Easting	413577	Easting		413412	
Northing	3986230	Northing		3986374	
GPS accuracy (m)	10	GPS accuracy (m)		13	
Surface water within		Surface water type:		seep	spring
Soil	dry saturated	Surface rocks:		sandstone	
Associated species:	Tamarix ramosissima Ledeb., Salix gooddingii Ball, Cercis orbiculata Greene, Brickellia longifolia S. Wats., Fraxinus anomala Torr. ex S. Wats.				
Dominant species:	Fallugia paradoxa (D. Don) Endl. ex Torr., Baccharis salicifolia (Ruiz & Pavón) Pers.				
Habitat type:	Riparian				
Vegetation	Moderate, 25-	Average height of vegetation		2	
Tamarisk estimate:	Was not completed				
Other info:					
SWIFL	Not Southwestern Willow Flycatcher Habitat				

Canyon/Park	**Hance**	River mile:	76.6 L		
Location	Hance 2	Date	6/8/2005		
Start point:		End point:			
Easting	413412	Easting		413210	
Northing	3986374	Northing		3986580	
GPS accuracy (m)	13	GPS accuracy (m)		30	
Surface water within		Surface water type:		seep	stream
Soil	saturated	Surface rocks:		sandstone	
Associated species:	Isocoma acradenia (Greene) Greene, Andropogon glomeratus (Walt.) B.S.P., Tamarix ramosissima Ledeb., Purshia stansburiana (Torr.) Henrickson, Fallugia paradoxa (D. Don) Endl. ex Torr., Cladium californicum (S. Wats.) O'Neill, Brickellia longifolia S. Wats., Typha spp.				
Dominant species:	Baccharis salicifolia (Ruiz & Pavón) Pers., Populus fremontii S. Wats.				
Habitat type:	Riparian				
Vegetation	Moderate, 25-50	Average height of vegetation		3	
Tamarisk estimate:	Not specified				
Other info:					
SWIFL	Not Southwestern Willow Flycatcher Habitat				

Canyon/Park	**Hance**	River mile:	76.6 L
Location	Hance 3	Date	6/8/2005
Start point:		End point:	
Easting	413210	Easting	413090
Northing	3986580	Northing	3987060
GPS accuracy (m)	30	GPS accuracy (m)	30
Surface water within		Surface water type:	stream
Soil	saturated	Surface rocks:	sandstone
Associated species:	Rhus trilobata Nutt., Typha spp., Tamarix ramosissima Ledeb., Cercis orbiculata Greene		
Dominant species:	Baccharis salicifolia (Ruiz & Pavón) Pers., Salix exigua Nutt.		
Habitat type:	Riparian		
Vegetation	Moderate, 25-	Average height of vegetation	2.5
Tamarisk estimate:	See tamarisk mapping		
Other info:			
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Hance**	River mile:	76.6 L
Location	Hance 4	Date	6/8/2005
Start point:		End point:	
Easting	413090	Easting	413395
Northing	3987060	Northing	3987790
GPS accuracy (m)	20	GPS accuracy (m)	9
Surface water within		Surface water type:	stream
Soil	saturated	Surface rocks:	granite
Associated species:	Populus fremontii S. Wats., Andropogon glomeratus (Walt.) B.S.P., Brickellia longifolia S. Wats.		
Dominant species:	Salix exigua Nutt., Baccharis salicifolia (Ruiz & Pavón) Pers.		
Habitat type:	Riparian		
Vegetation	Moderate, 25-	Average height of vegetation	2.5
Tamarisk estimate:	See tamarisk mapping		
Other info:			
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Hance**	River mile:	76.6 L
Location	Hance 5	Date	6/8/2005
Start point:		End point:	
Easting	413395	Easting	413406
Northing	3987790	Northing	3988356
GPS accuracy (m)	9	GPS accuracy (m)	7
Surface water within		Surface water type:	stream
Soil	saturated	Surface rocks:	sandstone
Associated species:	Andropogon glomeratus (Walt.) B.S.P.		
Dominant species:	Baccharis salicifolia (Ruiz & Pavón) Pers., Salix exigua Nutt.		
Habitat type:	Riparian		
Vegetation	Low, 10-25%	Average height of vegetation	3
Tamarisk estimate:	See tamarisk mapping		
Other info:			
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Hance**	River mile:	76.6 L
Location	Hance 6	Date	6/8/2005
Start point:		End point:	
Easting	413406	Easting	413500
Northing	3988356	Northing	3988400
GPS accuracy (m)	7	GPS accuracy (m)	30
Surface water within		Surface water type:	stream
Soil	saturated	Surface rocks:	granite
Associated species:	Brickellia longifolia S. Wats.		
Dominant species:	Salix exigua Nutt., Tamarix ramosissima Ledeb., Baccharis salicifolia (Ruiz & Pavón) Pers.		
Habitat type:	Riparian		
Vegetation	Low, <10%	Average height of vegetation	3
Tamarisk estimate:	See tamarisk mapping		
Other info:			
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Cottonwood**	River mile:	80.6 L
Location	Cottonwood 1	Date	6/9/2005
Start point:		End point:	
Easting	410871	Easting	410725
Northing	3988030	Northing	3988674
GPS accuracy (m)	8	GPS accuracy (m)	15
Surface water within		Surface water type:	stream
Soil	saturated	Surface rocks:	sandstone
Associated species:	Polypogon monspeliensis (L.) Desf., Populus fremontii S. Wats., Cercis orbiculata Greene, Bromus rubens L., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Solidago spp., Apocynum cannabinum L., Agave utahensis Engelm., Isocoma acradenia (Greene) Greene, Bromus tectorum L., Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Artemisia ludoviciana Nutt., Ephedra spp.		
Dominant species:	Purshia stansburiana (Torr.) Henrickson, Tamarix ramosissima Ledeb., Rhus trilobata Nutt.		
Habitat type:	Riparian		
Vegetation	Sparse, <5%	Average height of vegetation	1.5
Tamarisk estimate:	See tamarisk mapping		
Other info:	Upper Tapeats		
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Cottonwood**	River mile:	80.6 L
Location	Cottonwood 2	Date	6/9/2005
Start point:		End point:	
Easting	410725	Easting	411001
Northing	3988674	Northing	3989020
GPS accuracy (m)	15	GPS accuracy (m)	14
Surface water within		Surface water type:	stream
Soil	moist	Surface rocks:	schist
Associated species:	Populus fremontii S. Wats.		
Dominant species:	Cercis orbiculata Greene, Isocoma acradenia (Greene) Greene, Brickellia longifolia S. Wats., Baccharis salicifolia (Ruiz & Pavón) Pers.		
Habitat type:	Riparian		
Vegetation	Low, 5-10%	Average height of vegetation	2.5
Tamarisk estimate:	See tamarisk mapping		
Other info:	Below Tapeats gorge		
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Grapevine**	River mile:	81.5 L
Location	Grapevine 1	Date	6/9/2005
Start point:		End point:	
Easting	409169	Easting	409385
Northing	3989560	Northing	3989485
GPS accuracy (m)	30	GPS accuracy (m)	6
Surface water within		Surface water type:	seep
Soil	moist	Surface rocks:	sandstone
Associated species:	Rhus trilobata Nutt., Tamarix ramosissima Ledeb., Agave spp., Fallugia paradoxa (D. Don) Endl. ex Torr., Bromus rubens L., Hesperodoria salicina (Blake) Nesom, Eriogonum heermannii Dur. & Hilg. var. subracemosum (S. Stokes) Reveal, Coleogyne ramosissima		
Dominant species:	Gutierrezia sarothrae (Pursh) Britt. & Rusby, Acacia greggii Gray		
Habitat type:	Riparian		
Vegetation	Sparse, <5%	Average height of vegetation	1
Tamarisk estimate:	See tamarisk mapping		
Other info:	East rim of Grapevine Canyon, salty seep		
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Grapevine**	River mile:	81.5 L
Location	Grapevine 2	Date	6/9/2005
Start point:		End point:	
Easting	408639	Easting	408707
Northing	3989174	Northing	3989046
GPS accuracy (m)	12	GPS accuracy (m)	12
Surface water within		Surface water type:	seep
Soil	saturated	Surface rocks:	sandstone
Associated species:	Bernardia incana Morton, Iva acerosa (Nutt.) R.C. Jackson, Cirsium neomexicanum Gray, Cercis orbiculata Greene, Acacia greggii Gray, Fallugia paradoxa (D. Don) Endl. ex Torr., Juniperus spp.		
Dominant species:	Gutierrezia sarothrae (Pursh) Britt. & Rusby, Polypogon monspeliensis (L.) Desf., Rhus trilobata Nutt., Fraxinus anomala Torr. ex S. Wats.		
Habitat type:	Riparian		
Vegetation	High, 50-75%	Average height of vegetation	3.5
Tamarisk estimate:	See tamarisk mapping		
Other info:	Spring on east rim		
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Grapevine**	River mile:	81.5 L
Location	Grapevine 3	Date	6/9/2005
Start point:		End point:	
Easting	408491	Easting	408491
Northing	3989044	Northing	3989044
GPS accuracy (m)	8	GPS accuracy (m)	8
Surface water within		Surface water type:	
Soil	moist	Surface rocks:	sandstone
Associated species:	Polypogon monspeliensis (L.) Desf., Isocoma acradenia (Greene) Greene		
Dominant species:	Tamarix ramosissima Ledeb.		
Habitat type:	Riparian		
Vegetation	Low, 5-10%	Average height of vegetation	1
Tamarisk estimate:	See tamarisk mapping		
Other info:	Seep on east rim		
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Grapevine**	River mile:	81.5 L
Location	Grapevine 4	Date	6/10/2005
Start point:		End point:	
Easting	407444	Easting	407825
Northing	3988615	Northing	3988682
GPS accuracy (m)	7	GPS accuracy (m)	16
Surface water within		Surface water type:	stream
Soil	moist	Surface rocks:	shale
Associated species:	Aristida arizonica Vasey, Bromus rubens L.		
Dominant species:	Gutierrezia sarothrae (Pursh) Britt. & Rusby, Tamarix ramosissima Ledeb., Brickellia longifolia S. Wats.		
Habitat type:	Riparian		
Vegetation	Sparse, <5%	Average height of vegetation	0.5
Tamarisk estimate:	See tamarisk mapping		
Other info:	West fork.		
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Grapevine**	River mile:	81.5 L
Location	Grapevine 5	Date	6/10/2005
Start point:		End point:	
Easting	407825	Easting	408616
Northing	3988682	Northing	3989381
GPS accuracy (m)	16	GPS accuracy (m)	27
Surface water within		Surface water type:	stream
Soil	moist	Surface rocks:	sandstone
Associated species:	Haplopappus spp., Heterotheca villosa (Pursh) Shinners, Cercis orbiculata Greene, Gutierrezia sarothrae (Pursh) Britt. & Rusby, Cladium californicum (S. Wats.) O'Neill,		
Dominant species:	Brickellia longifolia S. Wats., Acacia greggii Gray		
Habitat type:	Riparian		
Vegetation	Sparse, <5%	Average height of vegetation	1
Tamarisk estimate:	See tamarisk mapping		
Other info:			
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Grapevine**	River mile:	81.5 L
Location	Grapevine 6	Date	6/10/2005
Start point:		End point:	
Easting	408616	Easting	408973
Northing	3989381	Northing	3989691
GPS accuracy (m)	27	GPS accuracy (m)	12
Surface water within		Surface water type:	stream
Soil	moist saturated	Surface rocks:	sandstone
Associated species:	Cladium californicum (S. Wats.) O'Neill, Adiantum capillus-veneris L.		
Dominant species:	Brickellia longifolia S. Wats., Populus fremontii S. Wats., Baccharis salicifolia (Ruiz & Pavón) Pers., Solidago spp., Purshia spp.		
Habitat type:	Riparian		
Vegetation	Low, 5-10%	Average height of vegetation	2
Tamarisk estimate:	See tamarisk mapping		
Other info:			
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Grapevine**	River mile:	81.5 L
Location	Grapevine 7	Date	6/10/2005
Start point:		End point:	
Easting	408973	Easting	409206
Northing	3989691	Northing	3989750
GPS accuracy (m)	12	GPS accuracy (m)	10
Surface water within		Surface water type:	stream
Soil	moist saturated	Surface rocks:	schist
Associated species:			
Dominant species:	Tamarix ramosissima Ledeb., Baccharis salicifolia (Ruiz & Pavón) Pers., Solidago spp., Populus fremontii S. Wats.		
Habitat type:	Riparian		
Vegetation	Sparse, <5%	Average height of vegetation	2
Tamarisk estimate:	See tamarisk mapping		
Other info:	Mid-schist.		
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Grapevine**	River mile:	81.5 L
Location	Grapevine 8	Date	6/10/2005
Start point:		End point:	
Easting	409206	Easting	409780
Northing	3989691	Northing	3990320
GPS accuracy (m)	10	GPS accuracy (m)	10
Surface water within		Surface water type:	stream
Soil	saturated	Surface rocks:	sandstone
Associated species:	Salix gooddingii Ball, Baccharis salicifolia (Ruiz & Pavón) Pers., Oenothera elata Kunth		
Dominant species:	Populus fremontii S. Wats., Tamarix ramosissima Ledeb.		
Habitat type:	Riparian		
Vegetation	Low	Average height of vegetation	0
Tamarisk estimate:	See tamarisk mapping		
Other info:			
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Grapevine**	River mile:	81.5 L
Location	Grapevine 9	Date	6/11/2005
Start point:		End point:	
Easting	407899	Easting	407171
Northing	3988422	Northing	3987424
GPS accuracy (m)	7	GPS accuracy (m)	8
Surface water within		Surface water type:	stream
Soil	moist	Surface rocks:	sandstone
Associated species:	Baccharis salicifolia (Ruiz & Pavón) Pers., Cercis orbiculata Greene, Celtis spp., Fraxinus anomala Torr. ex S. Wats.		
Dominant species:	Tamarix ramosissima Ledeb., Salix gooddingii Ball		
Habitat type:	Riparian		
Vegetation	Sparse, <5%	Average height of vegetation	1
Tamarisk estimate:	See tamarisk mapping		
Other info:	East fork.		
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Trib Btwn Boulder and**	River mile:	82.3 L
Location	Trib Btwn Boulder and Grapvine 1	Date	6/10/2005
Start point:		End point:	
Easting	408362	Easting	408362
Northing	3990648	Northing	3990648
GPS accuracy (m)	8	GPS accuracy (m)	8
Surface water within		Surface water type:	
Soil	moist	Surface rocks:	sandstone
Associated species:	Fraxinus anomala Torr. ex S. Wats., Atriplex canescens (Pursh) Nutt., Gutierrezia sarothrae (Pursh) Britt. & Rusby		
Dominant species:	Bromus rubens L.		
Habitat type:	Dry wash adjacent to		
Vegetation	Sparse, <5%	Average height of vegetation	0.5
Tamarisk estimate:	See tamarisk mapping		
Other info:			
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Boulder**	River mile:	82.8 L	
Location	Boulder 1	Date	6/10/2005	
Start point:		End point:		
Easting	406800	Easting	406109	
Northing	3990793	Northing	3990674	
GPS accuracy (m)	8	GPS accuracy (m)	10	
Surface water within		Surface water type:	seep	spring
Soil	moist	Surface rocks:	shale	
Associated species:	Artemisia ludoviciana Nutt.			
Dominant species:	Fallugia paradoxa (D. Don) Endl. ex Torr., Brickellia longifolia S. Wats.			
Habitat type:	Riparian			
Vegetation	Medium, 25-50%	Average height of vegetation	1.5	
Tamarisk estimate:	See tamarisk mapping			
Other info:	From the confluence of east and west fork up the west fork.			
SWIFL	Not Southwestern Willow Flycatcher Habitat			

Canyon/Park	**Boulder**	River mile:	82.8 L	
Location	Boulder 2	Date	6/10/2005	
Start point:		End point:		
Easting	406664	Easting	406867	
Northing	3990358	Northing	3990840	
GPS accuracy (m)	8	GPS accuracy (m)	11	
Surface water within		Surface water type:	seep	
Soil	saturated	Surface rocks:	sandstone	
Associated species:	Coleogyne ramosissima Torr., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Purshia stansburiana (Torr.) Henrickson, Rhus trilobata Nutt., Fallugia paradoxa (D. Don) Endl. ex Torr.			
Dominant species:	Fraxinus anomala Torr. ex S. Wats.			
Habitat type:	Riparian			
Vegetation	High, 50-75%	Average height of vegetation	2.5	
Tamarisk estimate:	See tamarisk mapping			
Other info:	Middle fork.			
SWIFL	Not Southwestern Willow Flycatcher Habitat			

Canyon/Park	**Boulder**	River mile:	82.8 L
Location	Boulder 3	Date	6/10/2005
Start point:		End point:	
Easting	407139	Easting	406867
Northing	3991023	Northing	3990840
GPS accuracy (m)	7	GPS accuracy (m)	6
Surface water within		Surface water type:	spring
Soil	saturated	Surface rocks:	sandstone
Associated species:	Isocoma acradenia (Greene) Greene, Salix gooddingii Ball, Brickellia longifolia S. Wats., Populus fremontii S. Wats.		
Dominant species:	Cercis orbiculata Greene		
Habitat type:	Riparian		
Vegetation	Low-moderate,	Average height of vegetation	2.5
Tamarisk estimate:	See tamarisk mapping		
Other info:	Top of Tapeats Gorge.		
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Boulder**	River mile:	82.8 L
Location	Boulder 4	Date	6/10/2005
Start point:		End point:	
Easting	406867	Easting	407603
Northing	3990840	Northing	3991335
GPS accuracy (m)	6	GPS accuracy (m)	7
Surface water within		Surface water type:	stream
Soil	saturated	Surface rocks:	schist
Associated species:	Sonchus spp., Bromus rubens L., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Artemisia ludoviciana Nutt., Baccharis salicifolia (Ruiz & Pavón) Pers., Erodium cicutarium (L.) L'Hér. ex Ait., Acacia greggii Gray		
Dominant species:	Tamarix ramosissima Ledeb.		
Habitat type:	Riparian		
Vegetation	Low, 5-10%	Average height of vegetation	2
Tamarisk estimate:	See tamarisk mapping		
Other info:	Start point for Archean.		
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Bright Angel Creek**	River mile:	88 R		
Location	Bright Angel 1	Date	6/7/2005		
Start point:		End point:			
Easting	403709	Easting		404413	
Northing	3999427	Northing		4000348	
GPS accuracy (m)	11.7	GPS accuracy (m)		5	
Surface water within		Surface water type:		stream	
Soil	dry	Surface rocks:		cobbles	schist
Associated species:	Bromus diandrus Roth, Populus fremontii S. Wats., Stephanomeria pauciflora (Torr.) A. Nels., Acacia greggii Gray, Vulpia microstachys, Gutierrezia sarothrae (Pursh) Britt. & Rusby, Sporobolus cryptandrus (Torr.) Gray				
Dominant species:	Bromus rubens L., Salix exigua Nutt., Baccharis salicifolia (Ruiz & Pavón) Pers., Isocoma acradenia (Greene) Greene, Tamarix ramosissima Ledeb.				
Habitat type:	Riparian				
Vegetation	Medium	Average height of vegetation		3	
Tamarisk estimate:	35 mature, 150 saplings				
Other info:	Canyon opens up out of the box and creek. Riparian vegetation widens and becomes more dense at end point. First cottonwood trees were spotted.				
SWIFL	Not Southwestern Willow Flycatcher Habitat				

Canyon/Park	**Crystal Canyon**	River mile:	99 R		
Location	Crystal 1	Date	5/12/2005		
Start point:		End point:			
Easting	388153	Easting		388515	
Northing	3999517	Northing		3999786	
GPS accuracy (m)	5	GPS accuracy (m)		6	
Surface water within		Surface water type:		stream	
Soil	dry	Surface rocks:		schist	
Associated species:	Encelia spp., Ephedra spp., Mammillaria spp.				
Dominant species:	Baccharis salicifolia (Ruiz & Pavón) Pers., Salix exigua Nutt., Tamarix ramosissima Ledeb.				
Habitat type:	Riparian				
Vegetation	High	Average height of vegetation		4	
Tamarisk estimate:	High				
Other info:					
SWIFL	Not Southwestern Willow Flycatcher Habitat. Could be potential in 5 years, but recommend removing TAMRAM.				

Canyon/Park	**Crystal Canyon**	River mile:	99 R
Location	Crystal 2	Date	5/12/2005
Start point:		End point:	
Easting	388515	Easting	388741
Northing	3999517	Northing	4000169
GPS accuracy (m)	6	GPS accuracy (m)	6
Surface water within		Surface water type:	stream
Soil	dry	Surface rocks:	other
Associated species:			
Dominant species:	Encelia spp., Baccharis salicifolia (Ruiz & Pavón) Pers., Ephedra spp., Tamarix ramosissima Ledeb.		
Habitat type:	Riparian		
Vegetation	Low	Average height of vegetation	1
Tamarisk estimate:	Low		
Other info:			
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Crystal Canyon**	River mile:	99 R
Location	Crystal 3	Date	5/12/2005
Start point:		End point:	
Easting	388741	Easting	389002
Northing	4000169	Northing	4000259
GPS accuracy (m)	6	GPS accuracy (m)	8
Surface water within		Surface water type:	stream
Soil	dry	Surface rocks:	schist
Associated species:	Ephedra spp., Salix exigua Nutt.		
Dominant species:	Baccharis spp., Tamarix ramosissima Ledeb., Pluchea sericea (Nutt.) Coville		
Habitat type:	Riparian		
Vegetation	Low	Average height of vegetation	1.6
Tamarisk estimate:	Low		
Other info:			
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Crystal Canyon**	River mile:	99 R
Location	Crystal 4	Date	5/13/2005
Start point:		End point:	
Easting	389002	Easting	389202
Northing	4000259	Northing	4000583
GPS accuracy (m)	8	GPS accuracy (m)	13
Surface water within		Surface water type:	stream
Soil	dry	Surface rocks:	other
Associated species:	Encelia spp., Ephedra spp.		
Dominant species:	Tamarix ramosissima Ledeb., Pluchea sericea (Nutt.) Coville		
Habitat type:	Riparian		
Vegetation	Moderate	Average height of vegetation	3
Tamarisk estimate:	Low-moderate		
Other info:			
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Crystal Canyon**	River mile:	99 R
Location	Crystal 5	Date	5/13/2005
Start point:		End point:	
Easting	389202	Easting	389449
Northing	4000583	Northing	4000867
GPS accuracy (m)	13	GPS accuracy (m)	9
Surface water within		Surface water type:	stream
Soil	dry	Surface rocks:	other
Associated species:	Isocoma acradenia (Greene) Greene, Baccharis spp., Typha spp., Ephedra spp., Bromus rubens L., Encelia spp.		
Dominant species:	Tamarix ramosissima Ledeb., Pluchea sericea (Nutt.) Coville		
Habitat type:	Riparian		
Vegetation	Moderate	Average height of vegetation	2
Tamarisk estimate:	Moderate		
Other info:			
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Crystal Canyon**	River mile:	99 R
Location	Crystal 6	Date	5/13/2005
Start point:		End point:	
Easting	389449	Easting	389716
Northing	4000867	Northing	4000699
GPS accuracy (m)	9	GPS accuracy (m)	14
Surface water within		Surface water type:	stream
Soil	dry	Surface rocks:	other
Associated species:	Baccharis spp., Acacia spp., Ephedra spp., Bromus rubens L.		
Dominant species:	Pluchea sericea (Nutt.) Coville, Tamarix ramosissima Ledeb.		
Habitat type:	Riparian		
Vegetation	Low - moderate	Average height of vegetation	1.5
Tamarisk estimate:	Moderate		
Other info:			
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**112 Mile Canyon**	River mile:	112.2 L
Location	112 Mile 1	Date	5/14/2005
Start point:		End point:	
Easting	373814	Easting	0
Northing	4011093	Northing	0
GPS accuracy (m)	3	GPS accuracy (m)	
Surface water within		Surface water type:	seep
Soil	moist	Surface rocks:	schist
Associated species:	Encelia spp.		
Dominant species:	Ephedra fasciculata A. Nels., Acacia greggii Gray		
Habitat type:	Mojave desert scrub Riparian		
Vegetation	Low	Average height of vegetation	3
Tamarisk estimate:	Low, 1 tree		
Other info:			
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Trail Canyon**	River mile:	219 R
Location	Trail Canyon 1	Date	5/18/2005
Start point:		End point:	
Easting	289763	Easting	289273
Northing	3968388	Northing	3968741
GPS accuracy (m)	10	GPS accuracy (m)	12
Surface water within		Surface water type:	stream
Soil	moist	Surface rocks:	schist
Associated species:	Acacia greggii Gray, Polypogon monspeliensis (L.) Desf., Baccharis salicifolia (Ruiz & Pavón) Pers., Sonchus spp., Larrea tridentata (Sessé & Moc. ex DC.) Coville, Encelia farinosa Gray ex Torr., Bromus rubens L.		
Dominant species:	Tamarix ramosissima Ledeb.		
Habitat type:	Mojave desert scrub Riparian		
Vegetation	Sparse	Average height of vegetation	1.5
Tamarisk estimate:	Low (10 mature / 100m)		
Other info:	Mouth to 500m up canyon.		
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Trail Canyon**	River mile:	219 R
Location	Trail Canyon 3	Date	5/18/2005
Start point:		End point:	
Easting	289273	Easting	289069
Northing	3968714	Northing	3969017
GPS accuracy (m)	12	GPS accuracy (m)	9
Surface water within		Surface water type:	stream
Soil	moist	Surface rocks:	granite
Associated species:	Baccharis salicifolia (Ruiz & Pavón) Pers., Acacia greggii Gray, Typha spp., Bromus rubens L., Cryptantha spp., Baccharis sarothroides Gray		
Dominant species:	Tamarix ramosissima Ledeb.		
Habitat type:	Riparian		
Vegetation	Moderate	Average height of vegetation	2.5
Tamarisk estimate:	Moderate (30 mature, 1 sapling / meter)		
Other info:	From 500m to 1km. At ~850 meters from mouth density increases & BACSAL begins.		
SWIFL	Not Southwestern Willow Flycatcher Habitat		

Canyon/Park	**Trail Canyon**	River mile:	219 R	
Location	Trail Canyon 4, 5, 6, 7, 8, 9	Date	5/18/2005	
Start point:		End point:		
Easting	289069	Easting	0	
Northing	3969017	Northing	0	
GPS accuracy (m)	9	GPS accuracy (m)		
Surface water within		Surface water type:	seep	
Soil	moist	Surface rocks:	granite	
Associated species:	Baccharis sarothroides Gray, Encelia spp., Encelia farinosa Gray ex Torr., Bromus rubens L.			
Dominant species:	Acacia greggii Gray			
Habitat type:	Mojave desert scrub			
Vegetation	Sparse	Average height of vegetation	1	
Tamarisk estimate:	None visible			
Other info:	No satellites for ending GPS - ends at 20m cliff with waterfall atop tapeats. Water intermittent depending on width of canyon. Water ends at ~100m above start point.			
SWIFL	Not Southwestern Willow Flycatcher Habitat			

Canyon/Park	**220 Mile Canyon**	River mile:	220 R	
Location	220 Mile 1	Date	5/19/2005	
Start point:		End point:		
Easting	289747	Easting	286307	
Northing	3967507	Northing	3966218	
GPS accuracy (m)	8	GPS accuracy (m)	10	
Surface water within		Surface water type:		
Soil	dry	Surface rocks:	sandstone	shale
Associated species:	Fouquieria splendens Engelm., Porophyllum gracile Benth., Datura wrightii Regel			
Dominant species:	Acacia greggii Gray, Encelia farinosa Gray ex Torr., Larrea tridentata (Sessé & Moc. ex DC.) Coville			
Habitat type:	Riparian			
Vegetation	Sparse	Average height of vegetation	3	
Tamarisk estimate:	None			
Other info:	220 mile canyon is a dry tributary with sparse vegetation. Dominant species is ACAGRE (1 every 25 m). Creekbed is wide, cobbly and without much vegetation. Need to return again to see if TAMRAM begins to encroach.			
SWIFL	Not Southwestern Willow Flycatcher Habitat			

Canyon/Park	**225 1/2 Mile**	River mile:	225.4 R	
Location	225.5 Mile 1 Canyon mouth	Date	5/19/2005	
Start point:		End point:		
Easting	285951	Easting	0	
Northing	3960884	Northing	0	
GPS accuracy (m)	5	GPS accuracy (m)		
Surface water within		Surface water type:	seep	stream
Soil	moist	Surface rocks:	granite	
Associated species:	Bromus rubens L., Acacia greggii Gray, Aristida spp., Encelia farinosa Gray ex Torr., Sonchus asper (L.) Hill			
Dominant species:	Tamarix ramosissima Ledeb.			
Habitat type:	Mojave desert scrub	Riparian		
Vegetation	Sparse	Average height of vegetation	1	
Tamarisk estimate:	Low (10 mature)			
Other info:	Some tadpoles in standing water. Intermittent stream with many standing pools. Stretch mapped ended at 10m falls ~250m from mouth of canyon. Area above falls was also surveyed, no potential habitat, scattered TAMRAM.			
SWIFL	Not Southwestern Willow Flycatcher Habitat			

Canyon/Park	**225 1/2 Mile**	River mile:	225.4 R	
Location	225.5 Mile 2	Date	5/19/2005	
Start point:		End point:		
Easting	285178	Easting	285592	
Northing	3961766	Northing	3961013	
GPS accuracy (m)	3	GPS accuracy (m)	10	
Surface water within		Surface water type:	spring	
Soil	moist	Surface rocks:	granite	sandstone
Associated species:	Perityle emoryi, Larrea tridentata (Sessé & Moc. ex DC.) Coville, Ferocactus cylindraceus (Engelm.) Orcutt var. cylindraceus, Porophyllum gracile Benth., Eriogonum racemosum Nutt., Typha latifolia L., Viguiera dentata (Cav.) Spreng.			
Dominant species:	Acacia greggii Gray, Polypogon monspeliensis (L.) Desf., Prosopis glandulosa Torr., Encelia farinosa Gray ex Torr.			
Habitat type:	Riparian			
Vegetation	sparse in drainage	Average height of vegetation	1.5	
Tamarisk estimate:	High (38 mature, 433 sapling, 600 seedling)			
Other info:	Saw six juvenile owls in this area.			
SWIFL	Not Southwestern Willow Flycatcher Habitat			

Appendix E – Data Forms

GRAND CANYON NATIONAL PARK
Tamarisk Mapping Data

Data Collector: _____ Date: _____

Canyon Name: _____ Site Name: _____

River Mile: _____ R L Time Spent on Survey: _____

UTM Unit Used: NAD27 NAD 83

Begin Easting: ___ ___ ___ ___ ___ ___ End Easting: ___ ___ ___ ___ ___ ___
Begin Northing: ___ ___ ___ ___ ___ ___ ___ End Northing: ___ ___ ___ ___ ___ ___ ___
GPS Accuracy: _____ m GPS Accuracy: _____ m

Site Description: _____

Site Access / Safety: _____

Tamarisk Distribution Description: _____

Tamarisk Numbers: Seedlings: _____ Saplings: _____ Mature: _____

Tamarisk Control Information: _____

Habitat Assessment Form

CANYON NAME: River Mile _____

River Side? **R L**

LOCATION DESCRIPTION:

UTM START: __ __ __ __ __ __ E __ __ __ __ __ __ __N GPS Accuracy _____m

UTM END: __ __ __ __ __ __ E __ __ __ __ __ __ __N GPS Accuracy _____m

NAD27 or NAD83 HIKING TIME:

DATE:

WATER:

Surface water within 25m? **Y N** Circle one: seep spring stream pothole river

Soil moisture: dry moist saturated standing water Surface rocks:

DOMINANT PLANT SPECIES:

ASSOCIATED PLANT SPECIES:

HABITAT TYPE:

VEGETATION DENSITY:

AVERAGE HEIGHT OF VEGETATION:

TAMARISK ESTIMATE:

OTHER INFORMATION:

SOUTHWESTERN WILLOW FLYCATCHER DETERMINATION:

Grand Canyon National Park, Water Quality/Discharge Data for Tamarisk Project

Check after entered in database ☐
Date of Survey:_____ Arrival Time:_____ Departure Time:_____
Observer (s):_____
Canyon Name: _____ Location Description: _____ (e.g. Kwagunt 1)
Additional Location Details: _____
_____
_____
_____
UTM Easting: ___ ___ ___ ___ ___ ___ UTM Northing: ___ ___ ___ ___ ___ ___ ___ GPS Accuracy (m) _____
Circle one: seep spring stream pothole river Light exposure: open full-shade partial-shade
Elevation (m): _____ Slope (degrees): _____ ° Aspect (0-360): _____
Soil type: sand loamy sand sandy loam silt loam loam sandy clay loam silty clay loam clay loam sandy clay clay silty clay
Weather (descriptive):_____
Weather over previous 3 days:_____
Current Temperature: Air = _____C Water = _____C

Water Quality

Last Calibration ⟶ Date: _____ Time: _____

Measurement Time (hhmm): _____ **Use military time*

Meter Reading #	1	2	3	Average
Temperature (C)	_____	_____	_____	_____
pH:	_____	_____	_____	_____
EC (mS)	_____	_____	_____	_____
TDS (ppm)	_____	_____	_____	_____

Discharge

Type: _____ (C=Container, P=Pygmy, W=Weir, F=Flume) **Note – we'll be using containers*

Container Volume: _____

Measurement Time (hhmm): _____

	Fill time (mm:ss)	Sample Quality (1=good, 2=fair, 3=poor)
Sample 1		
Sample 2		
Sample 3		
Sample 4		
Sample 5		
Sample 6		
Sample 7		
Sample 8		
Sample 9		
Sample 10		
AVERAGE		

Comments:_____
_____
_____

GRCA Tamarisk Spring 2005 Vegetation Transect Data

Canyon Name: Transect # A=tamarisk area B=reference	Date:	Recorder: Reader:	Weather Notes:
Transect Start Point Information:	Easting	Northing	GPS Accuracy
Transect End Point Information:	Easting	Northing	GPS Accuracy
Transect General Description:			Bearing: _____°

Pre-tamarisk removal
Post-tamarisk removal

Geological Layer Information:

Daubenmire Scale Cover Data from 50m Transects

Species	5 m	Age	15 m	Age	25 m	Age	35 m	Age	45 m	Age	Species	5 m	Age	15 m	Age	25m	Age	35 m	Age	45m	Age

Cover Scale:
0 = <0 %
1 = <1%
2 = 1 – 5 %
3 = 5 – 10 %
4 = 10 – 25 %
5 = 25 – 50 %
6 = 50 – 75 %
7 = 75 – 100 %

Age: For the previous readings, note S=Seedling, P=Sapling, M=Mature or combination for all tree species

Vegetation Structure Data from 50m Transects

(For each section on pole, record 6 letter species code and number of times it touches that section)

Point / Height	< 1.0	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 m +
1 5m								
2 15m								
3 25m								
4 35m								
5 45m								

Location Description: _____ (e.g. Kwagunt 1)
Additional Location Details: _____
_____
_____

River Mile _____ River Side? **R L** Revisit? **Y N**

Dominant Plant Species: _____
_____
Associated Plant Species:_____
_____
**Include all species not hit on the transect here!*
Habitat type_____ Land form: _____
Surface water within 25m? **Y N** Circle one: seep spring stream pothole river Elevation (m): _____
Slope (degrees): _____ ° Aspect (0-360): _____ Light exposure: open full-shade partial-shade Soil moisture: dry moist saturated standing water Surface rocks: _____
Soil type: sand loamy sand sandy loam silt loam loam sandy clay loam silty clay loam clay loam sandy clay clay silty clay

COMPLETE PHOTODOCUMENTATION FORMS FOR EACH TRANSECT!

DRAW MAP AND ENTER ANY ADDITIONAL INFORMATION:

Soil Salinity Data for Transects			
	Reading #1	Reading #2	Reading #3
5 m			
15 m			
25 m			
35 m			
45 m			

Substrate Categories:

Ground cover substrate classes used along transects	
Category	Description
Bare soil	<0.1 mm (smaller than sand)
Sand	0.1 - 2mm
Gravel	2 mm – 6.4 cm
Cobble	6.4 cm – 19 cm
Stone	19 - 61 cm
Boulder	> 61cm
Bedrock	Solid rock surface, non-boulder
Litter (duff)	Dead plant material < 3cm diameter
Coarse woody debris	Dead wood 3-10 cm diameter
Woody debris structure	Woody material > 10 cm in depth and width

50 m Point Intercept Transect Data

Canyon Name and Transect Number A= Tamarisk Area B=Reference Area

Data Point														
0.5														
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DESCRIPTION KEYS

SURFACE ROCKS:

Basalt	**Conglomerate**
Limestone	**Shale**
Sandstone	**Granite**
Mudstone	**Other** _____

LANDFORM:

Rockpile: uplands composed primarily of jointed and efoliating granitic outcrops
Drainage channel: bottom not side slope of a drainage confined by banks or a canyon
Valley Bottom Fill: usually level places
Side Slope: side of drainage channel
Lower Slope: lower better watered portion of a slope
Mid Slope: central portion of a slope
Upper Slope: the upper driest portion of a slope
Interfluve: the area between small drainage channels
Ridge: high ground between two opposing slopes
Slick rock: large exposed expanses of bedrock
Terrace: level or gently sloping shelf perched on a slope, often caused by down-cutting rivers
Mesa: level or gently sloping ground surrounded on 3 or more sides by steep down slopes and capped
Butte: similar to a mesa, except with a top that does not have a flat configuration
Cliff: very steep rock slopes
Talus: unsorted material resulting from mass wasting of steep mountain slopes
Sand Dune/Sand Sheet: large accumulations of sand, may be stable or unstable (moving)
Plateau: flat area of great extent and elevation; specifically an extensive land region; considerably elevated (more than 100 meters) above adjacent lower-lying terrain

SOIL TAXONOMY:

1. Place soil in hand, remove pebbles, and add water very slowly, until it has the potential to have the consistency of putty. Add more soil or water as needed.
    a. If the soil does not remain in a ball, circle "**sand**"
2. If the soil remains in a ball, squeeze the ball between your thumb and forefinger, attempting to make a ribbon of uniform thickness and width pushing up and over your forefinger until it breaks from its own weight.
    a. If no ribbon is formed, record "**loamy sand**"
3. If ribbon forms but breaks before it is 2.5 cm, rub the soil between fingers.
    a. If very gritty, record "**sandy loam**"
    b. If very smooth, record "**silt loam**"
    c. If neither gritty or smooth, record "**loam**"
4. If ribbon breaks between 2.5 and 5 cm, rub the soil between fingers.
    a. If very gritty, record "**sandy clay loam**"
    b. If very smooth, record "**silty clay loam**"
    c. If neither gritty or smooth, record "**clay loam**"
5. If ribbon breaks when it is >5 cm, rub the soil between fingers.
    a. If very gritty, record "**sandy clay**"
    b. If very smooth, record "**clay**"
    c. If neither gritty or smooth, record "**silty clay**"

HABITAT TYPES: Adapted from Brown et al. (1998)

Habitat Type	Description
Subalpine conifer forest	Engelmann spruce-alpine fir, bristlecone pine-limber pine
Mixed conifer	Douglas and white fir, ponderosa pine, aspen
Ponderosa pine forest	ponderosa pine, Gambel oak, white fir
Great Basin montane scrub	oak-scrub, mountain mahogany, brittlebush, serviceberry
Great Basin conifer woodland	pinyon-juniper series
Great Basin desertscrub	sagebrush, blackbrush, rabbitbrush, winterfat, saltbrush
Mojave desertscrub	creosote, blackbrush, mesquite, saltbush
Alpine/subalpine grassland	bunchgrass (AZ fescue) and sedge-forb-grass association
Semi-desert grassland	grama grass-scrub (*Bouteloua/Pleuraphis*), mixed shrub
Interior wetlands	Cattail, rushes, sedges, willows
Riparian	cottonwood-willow, mixed deciduous broadleaf