Bandelier National Monument
Resource Management Division

1996 Ecological Restoration Report

Progress of the Watershed Restoration Demonstration Project & Results from Small Scale Studies

3/19/98

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1

Watershed Restoration Project

Introduction

A primary management concern at Bandelier National Monument, is the loss of cultural and natural resources to accelerated soil erosion in Piñon-Juniper Woodlands. We believe that inadequate herbaceous cover is the primary cause for this; soils are exposed to raindrop impact, reduced infiltration and increased runoff. Thus the restoration or enhancement of herbaceous cover on these sites would be the most desirable solution to this problem. The purpose of this project is to evaluate a management action that would achieve these objectives: soil surface protection, decreased runoff and erosion and increased infiltration. This is a report on the status of this project. This report will discuss the progress of installing and implementing each monitoring parameter, the implementation of the treatment, and proposed studies looking a various ecological processes associated with this treatment.

A review of the literature suggested that overstory reduction has the greatest potential for re-establishing herbaceous cover in PJ woodlands. This treatment involves restructuring the Piñon-Juniper woodland by mechanically cutting down a significant portion (minimally 75%) of the overstory and broadcasting the slash across the site. We hypothesize that this will do four things:

1. Cutting down trees will reduce competition for moisture.

2. Broadcasting slash across the site provides mulch that will protect the surface from raindrop impact and slow water movement across the site resulting in increased infiltration.

3. Broadcasting slash redistributes nutrients that were concentrated within the canopy of trees.

4. Broadcasting slash into the inter-canopy areas ameliorates soil temperature extremes and evaporation loss, enhancing site conditions for germinating and establishment of herbaceous plants.

Small-scale studies (>0.5 –ha) began in the fall of 1994 demonstrated that overstory reduction could restore herbaceous cover in degraded Piñon-Juniper woodlands. In light of these results, funding was secured to test the functionality of this treatment at a landscape scale by treating one of two 40-ha. paired watersheds.

Beginning in the fall of 1996, we began the installation of sampling points and baseline data collection for the various response parameters we hypothesize would be affected. This included quantifying vegetative cover, soil erosion, soil moisture, ground dwelling arthropod populations, and affects on vegetative cover of cultural sites.

METHODS

Experimental Design

This is study is a paired plot design without replication. Comparisons will be made between the treatment and control watersheds using appropriate procedures to test for significance. Because there is no replication of the treatment (only one watershed treated), statistical inferences are restricted to the paired watersheds (Wester 1992,). Inferences made to the general landscape will be made deductively from the weight of evidence from the small scale studies and the large scale study and other supporting studies.

Vegetative Cover

Vegetative cover is being estimated using line-intercept methodology. Transects were placed systematically with a randomized start. The purpose of placing transects systematically was to insure that entire watershed would be represented. Since there was no prior knowledge of what plants would occur along the transects, it is reasonable to assume that transect placement was unbiased. Cultural sites were avoided since they were to be sampled explicitly. The following describe in detail how the transects were established and data collected.

Transects are distributed evenly in both watershed with ten transects on both the west and east sides of each watershed (Fig 1). Transects are coded in the following format: V[C or T][N] with V for vegetation transect; C designates Control watershed, T the treatment watershed; N is a number from 1 to 20. Transects are numbered consecutively from 1-20 in each watershed. Numbering begins on the west side of each watershed. Transect one is on the south end and ten on the north end (Fig.1). The east side is numbered in opposite fashion, with transect eleven on the north end and 20 on the south end (Fig.1).

The transects are 103-m in overall length, beginning at the crest of the ridge and extending down slope perpendicular to the contour (Fig. 2). A transect consists of two 51.5 m segments, the last 1.5 meters accommodates a device that maintains tension on the 60-m nylon coated steel tape. Five 24 in. stakes are used to delineate each transect; two stamped aluminum, and three 3/8^{ths} rebar stakes. The two aluminum stakes are stamped with the transect's id and placed at the 0-m mark of the upper segment, and at the 51.5-m mark of the lower segment. The stamped side of the stakes face each other. A 3/8^{ths} rebar stake is placed at the 51.5-m mark of the up slope segment serving as an attachment point for the tape tension device for reading the upper segment of the transect. It also serves as the 0-m mark for the lower segment of the transect. The tape tension device needed for reading this segment attaches to the aluminum stake at the end of this segment. For both the upper and lower segments a 3/8^{ths} rebar stake is placed opposite the tick side of the tape at the 10-m mark. This helps to orient the direction the tape needs to be pulled for reading transects in subsequent years.

When collecting data, two cover strata, basal/ground cover and canopy cover, are recorded. Basal cover is recorded as soil, litter; rock, wood and the root crown of plants and the centimeter the substrate begins. This centimeter serves as the end centimeter for the previous substrate.

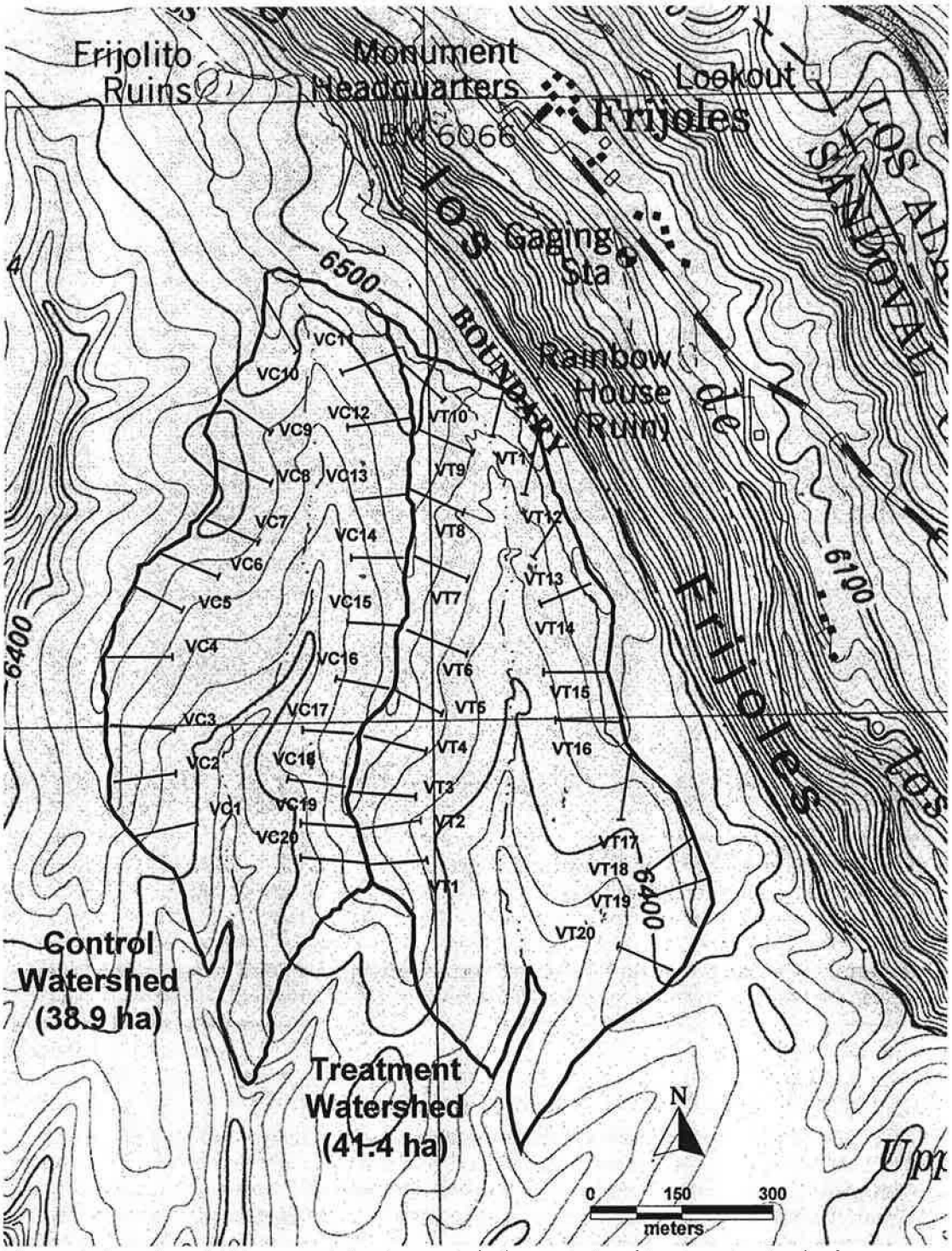


Figure 1. Location of 100-m vegetation transects in the control and treatment watersheds.

Using LTER methodology, each segment of the transect was read independently with the data recorded electronically on an HP LX 200 palmtop computer and a file created for each segment. The file name consists of the transect id recorded from the stake, the month, and day (mmdd) and either a

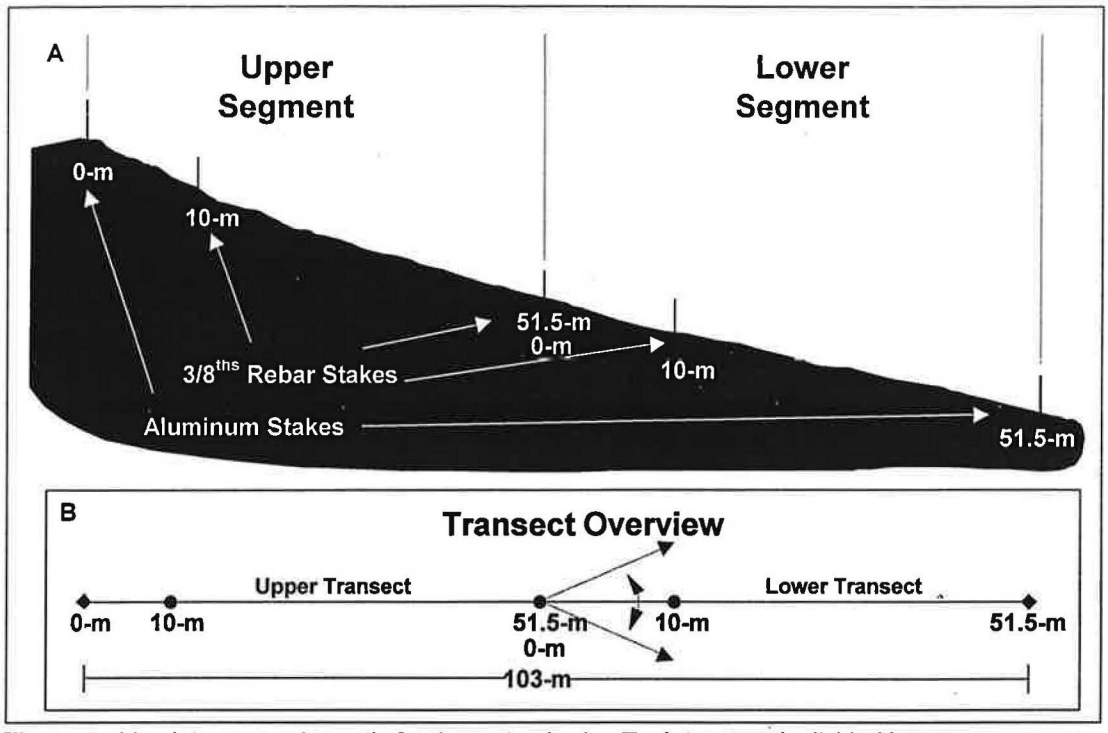


Figure 2. Line intercept schematic for the watersheds. Each transect is divided into two segments: upper and lower. The total length of each segment is 51.5 meters with data recorded only for the first 50 meters. A transect may geniculate at the mid-point (B).

"u" for the upper segment or an "d" for the lower segment (i.e. VT9U922). Each segment was read cm by cm along the ticked side of the tape beginning at the upper aluminum stake and ending at the 5-m mark of the tape. The lower transect was read similarly.

Status: Vegetative Cover was collected in the fall of 1996. Transects were read beginning on the 16 of October. On the 18 of October a major early snow fell delaying the transect reading until November 4, with the completion of the transect reading November, 26. It was then determined that transects VT10 & VT11 were to close on the lower end. Therefore, The transects were then shifted to the next higher transect number. That is 10 became 11; 11 became 12, until transect 16 which was relocated half way between its original location, which had become transect 15, and transect 17. Transects VT17 through VT20 were not reassigned. No analysis has been done to compare cover between the two watersheds.

Herbaceous Biomass

An additional vegetative parameter to be measured is that of grass standing biomass and subsequent production. Perennial grasses in general grow new growth every year from the basal crown. This allows the above ground biomass of perennial grasses to be harvested at the end of each growing season without inducing plant mortalisty or decreasing plant vigor. We propose to harvest at the end of each growing season biomass from perennial grass, as well as, annual forbs and grasses for that same year, by species. We will use 0.5 m^2 quadrats placed at 20 meter intervals parallel to and one meter from the vegetation cover transects (Fig. 3). The quadrats would be placed systematically beginning at

the 0-m stake and ending at the 100-m stake opposite the ticked side of the tape. The samples will be collected by species in number 12 paper bags, to be oven dried at 60°C (140°F) for 24 hours and weighed. This will allow us to estimate production by species in the two watersheds. The dry mass will be expressed as kg ha^{-1} dry weight.

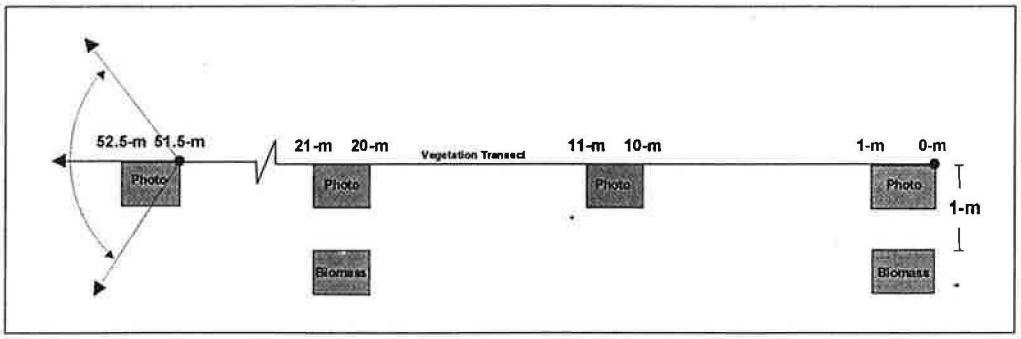


Figure 3. Sampling layout 0.5x1.0-m quadrats for collecting biomass and quadrat photos. Biomass wil be collected at 20-m intervals, including end points, one meter offset of transect. Photos taken at 10-m intervals including end points along transect opposite ticked side of the tape. A photo was also taken down the transect from the 0-m end of the tape.

Status: Biomass will be collected during the winter months prior to the treatment application.

Cultural Sites

In order to assess the impacts overstory reduction may have on vegetative cover associated with cultural sites, two twenty five meter transects were established on each of five sites within each watershed. Designated within each watershed were three structural sites and two lithic scatters.

An attempt was made to orient the transects perpendicular to the long axis of each site. Transects were placed ten meters apart on large sites and five meters on small sites. Data was recorded per the vegetative cover portion of this report. Transects were labeled with **C** if they were in the control watershed and a **T** if located in the treatment watershed. The letter **A** was used for all transects to distinguish them from the other vegetation transects in the watersheds and **V** was used to distinguish them as vegetative cover transects. The numbers one to five were used to designate each site individually within each watershed. The two transects on each site are designated as one or two; one is the most northerly or westerly transect and two the most southerly or easterly. Thus, **CAV41** would be in the most northerly or westerly vegetation cover transects in the control watershed, on archeological site **four**.

Plot photos were also taken to visually document changes that may occur as a result of the treatment. Using a 50-cm x 100-cm frame, photos were taken at five meter intervals along the transect beginning at the 0 meter stake and ending at the 25 meter stake. The frame was oriented with the long dimension (100-cm side) parallel to the transect and on the opposite side that the tape was read, and extending to the next meter (i.e. 0 to1-m; 5 to 6-m, etc).

Status: Baseline cover data from the cultural sites was not collected until late May 1997, after the treatment had been implemented and before a treatment affect was noticeable.

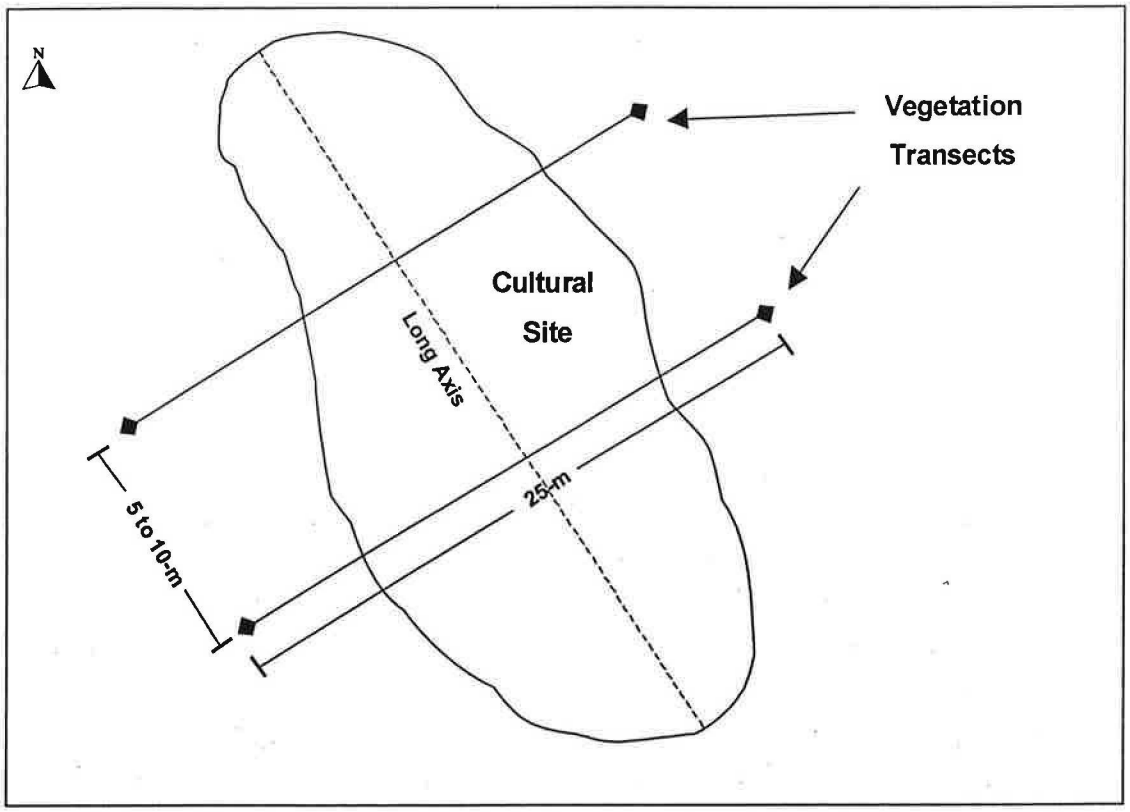


Figure 4. General layout of transects on cultural sites. Transects are 25-m in length and parallel to each other. The transects are placed 5 to 10-m apart, with eact transect 2.5 to 5-m on either side of the mid-point of and perpendicular to the long axis.

Soil Erosion

The primary object of the overstory reduction, as stated earlier, is to arrest soil erosion threatening cultural resources in this landscape. In order to test the efficacy of this treatment it is necessary to estimate rates of erosion within each watersheds. Additionally, we wanted to test hypotheses pertaining to the nature of soil erosion processes. We hypothesize that two differing unvegetated soil surfaces are experiencing differing rates of soil erosion depending upon nature of the material at the air-soil interface. These soil surfaces are characterized as either having a mantle of El Cajate Pumice or a loam-sandy soil surface. Additionally, we wanted to test hypothesis that channel slope effects sediment flux. A major limitation to testing this hypothesis is the lack of pre-treatment data. In non-replicated paired watershed studies, two years of baseline measurements are made prior to treatment. However, funding and time constraints did not allow for these measurements. Thus, our ability to use inferential statistics to attribute differences to a treatment effect is limited. Non-the-less, to get some measure what those differences may be, we established 90 soil erosion bridges (seb) within each watershed. Within these watersheds we stratified the sampling where 18 sebs are explicitly located on inter-channel surfaces covered with primary El Cajate pumice and 18 placed on

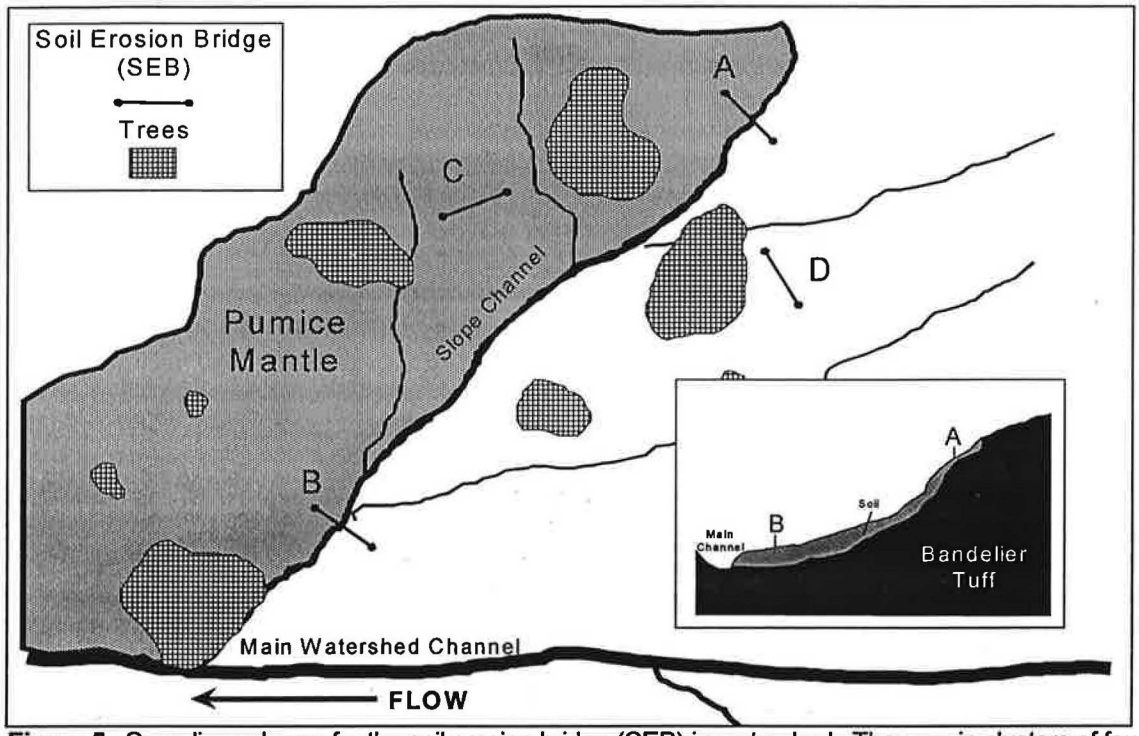


Figure 5. Sampling scheme for the soil erosion bridge (SEB) in watershed. They are in clusters of four between the vegetation transects (90 SEB per watershed). One is located at the upper portion, above the inflection point, of channel (A), the second (B) is below the inflection point. A third (C) is located on an inter-channel site on the pumice mantle. The fourth (D) is located on an inter-channel site were the mantel has been eroded away.

surfaces where pumice was absent (Figure 5A). Additionally, we stratified the seb to partition channel slope differences. These sebs are paired into 18 channels per watershed. One seb of the pair is placed in a channel in the upper part of the channel, the second is placed below the inflection point of the channel (Figure 5).

When taking measurements sebs are approached from downslope to avoid disturbing soil upslope from the SEBs. Generally walking upslope or between the seb stakes is avoided. The bridges are installed parallel to the contour. Two 2' x ¾" . rebar stakes are driven into the ground such that when the bridge is set on them they will fit into the holes drilled in each end of the bridge as far as they will go. The bridge is leveled in two dimensions using the round bubble level on the end of the bridge. Once leveled, wooden shims are inserted into each end of the bridge to keep it level while measurements are being taken. Pins are inserted into the holes on the bridge and carefully lowered (not dropped) until the point is just touching the surface substrate. The pin in suspended from the bridge using a clothes pin to hold it in place; the pin does not rest on the soil surface. The substrate may be soil, rock, pumice, litter, pine cones, wood , plant or artifact.. For each point the substrate is recorded.. This is repeated for all thirty one pins. Once the pins have been positioned a metric tape graduated in mm is used to take readings by measuring from the top of the bridge to the top of the pin. Readings are made in millimeters. The readings are subtracted from the previous set of readings to determine if the site is degrading, agrading or is static. A mean is taken for each seb (n=30), with this value used in the analysis. The null hypothesis will be that the control watershed is equal to or not greater than the treatment watershed. If the null hypothesis is rejected we will intuitively assume that this difference is attributable to the treatment. A decision that management must answer is to what level of confidence (70, 80, 90) is necessary to make management action decisions.

Status: The SEBs were installed in the fall of 1996. However, before the first set of data points could be collected to establish the data baseline, a mid-October snowfall fell covering the soil surface. The melting soil saturated the soil and subsequent freeze-thaw cycles result in the soil surface to be frost-heaved elevating the soil surface 5 to 15 mm in many places. Thus the fall sampling was made on freeze-thaw modified surfaces, missing the baseline established by that summer's rainfall. Thus we propose that a set of measurements be taken in May or June 1997, prior to the onset of the '97 rainy season in early July. This will provide an opportunity for the freeze-thaw effect to subside and the establishment of a baseline that will reflect the effect of the 1997 summer rainy season on sediment flux. It is during this time of the year that precipitation is most erosive, resulting in the highest seasonal rates of soil erosion.

Soil Moisture & Temperature

An additional process we hypothesize to be affected is the horizontal distribution of water within the Piñon-Juniper woodland. Breashears (1993) found that in Piñon Juniper woodlands on the Pajarito Plateau soil moisture is distributed heterogeneously between the canopy and inter-canopy and this distribution changes seasonally. We hypothesize that the amount and distribution of soil moisture will be altered by the treatment. That is, this treatment will result in a greater and more homogenous distribution of soil moisture, than the untreated site, particularly following intense thunderstorms,. Also, initially since transportation loss through the woody vegetation has been reduced in the treatment watershed, soil moisture depletion should lag behind that of the control watershed. To test this hypothesis we will monitor soil moisture using Time Domain Reflectometry (TDR) technology. This technology will allow us to monitor, at high resolution (1 hr.), soil moisture in the upper 10 cm at one location, with complimentary measurements made at other locations periodically within the two watersheds.

We will be measuring soil moisture every hour on one cluster in the treatment watershed except when measurements are made at the other sites. Measurements will be made minimally on a monthly basis except when events occur that may change soil moisture dramatically. This would be during snow melt and after rainfall events. In addition, rainfall intensity measurements will be made at the continually monitored site. Soil moisture measurements will consists of 24 measurements from each watershed. The measurements are made in clusters of eight probes; three clusters per watershed. The probes in each cluster are placed into two perpendicular 28-m transects of four evenly spaced probes (Figure. 6).One transect is oriented perpendicular to the contour and the other parallel to the contour with each transect intersecting about the transects mid-point. In order to avoid spatial auto-correlation, spacing between probes was kept at a minimum distance of 4-m (Breshears, personnel comm.). In order to reduce spatial heterogeneity due to soil differences, sampling is focus on the shallow soils, with minimal amounts of pumice. The probes are 30-cm in length, however soil depth is frequently less than 15-cm. Therefore, the probes were inserted at an angle so that only the top 10-cm is measured.

Status: Began obtaining measurements in April 1997. A program must be written to process the data for analysis. Late May (then every 2 weeks then Oct.)

Another parameter affecting herbaceous plant establishment both indirectly and directly is soil temperature. Directly, in that without shading from other plants or litter, young seedlings are exposed to direct solar radiation. This potentially elevates plant tissue temperatures above lethal limits. Indirectly in that the solar radiation striking the exposed soil surface rapidly dries it out, decreasing moisture availability. In addition, soil temperature increases inversely to the amount of soil moisture. Thus as soil moisture is depleted soil temperature increases becoming more intolerable for plant seedlings. Broadcasting slash into the interstitial areas will provide shading for the soil surface and young plants

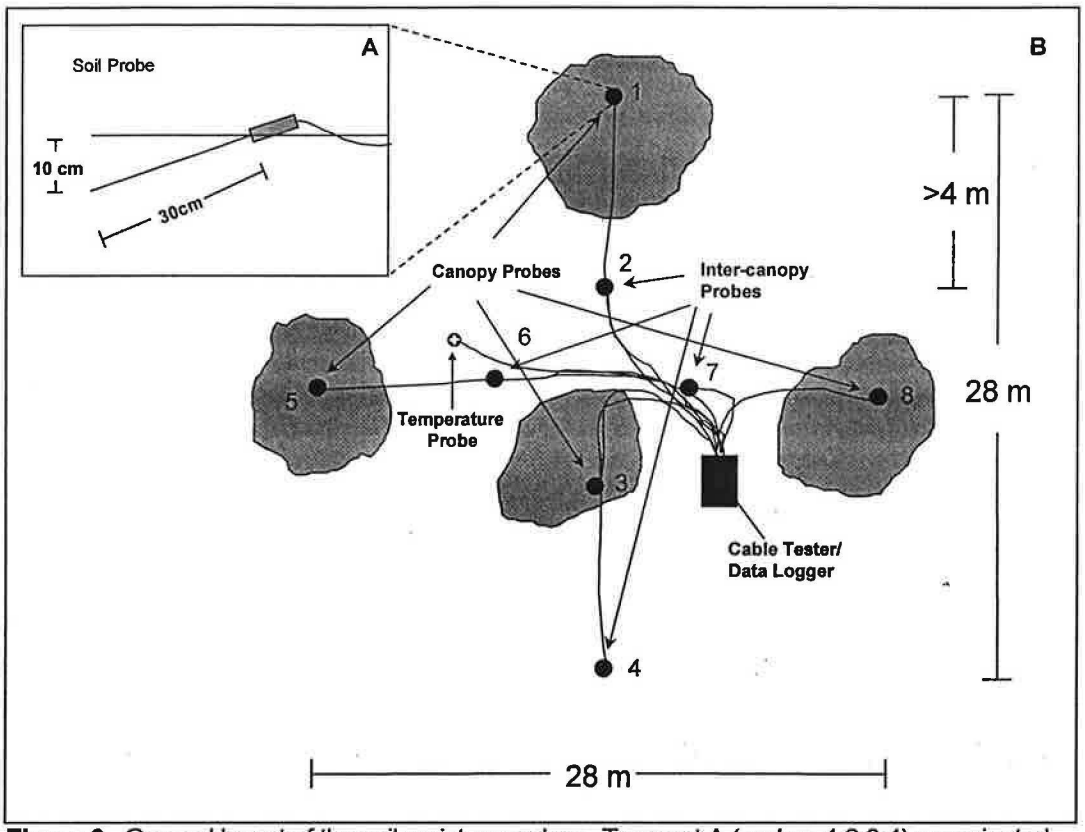


Figure 6. General layout of the soil moisture probes. Transect A (probes 1,2,3,4) are oriented perpendicular with the contour and transect B (probes 5,6,7,8) are oriented parallel with the contour (B). The probes are placed minimally 4 m apart and oriented so that they are only measuring the upper 10-cm of soil profile (A).

resulting in lower temperature maximums, dampening diurnal temperature fluxes and lowering the rate of soil moisture evaporation. To see if there is some evidence of this we are measuring soil temperature in the top two centimeters of the soil surface at the six TDR sites (see above). These measurements are made when soil moisture measurements are made and monitored continually at one-hour intervals at the continuously monitored TDR site.

Status: Begin obtaining measurements in April 1997. A program must be written to process the data for analysis.

Arthropod Populations

The effect will also have beneficial effects for ground dwelling arthropods. We hypothesize that the habitat will be enhanced to support larger populations of individual species as well as greater species diversity. This could possible benefit those species that depend upon those species as part of their prey base.In order to estimate species diversity and relative population abundance we will install 40 arthropod pitfalls in the control and treatment watersheds. Two pitfalls were installed per vegetation transect fortotal of forty in each watershed. Using the thirty pitfalls of the PJ woodlands for environmental monitoring as a reference, we felt this would be an adequate sample size for the watersheds. The location of the pitfalls will follow a randomized stratified sampling scheme. The pitfalls will be located 10 m north of the vegetation cover transects (Figure 1) at a randomly selected meter mark that is a multiple of 10, beginning with zero. One pitfall will be assigned to the upper transect segment (0 to 50 m) and one to the lower (60 to 100) in order to obtain equal representation of these

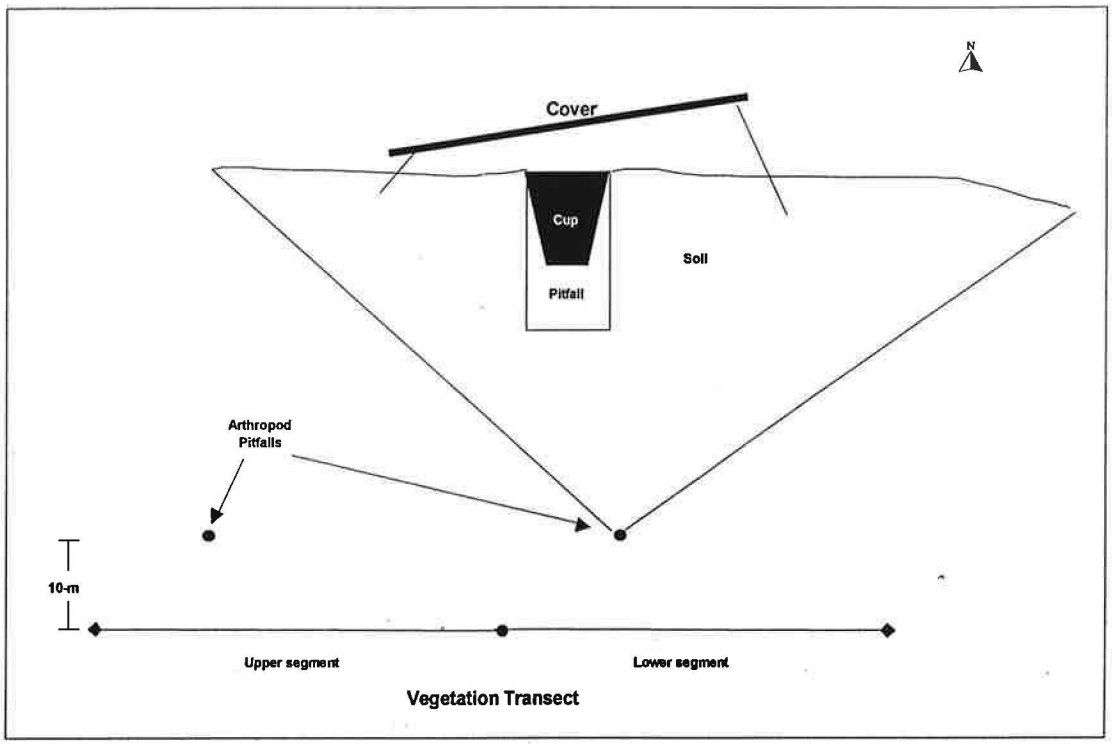


Figure 7. Schematic of the arthropods sampling scheme for the two watersheds. Pitfalls are offset from the vegetation transect 10-m, in a location that would accomadate their installation.

slope positions. On the central ridge were the treatment may overlap into the control, the pitfall will be moved in 5 m increments down the transect into the control watershed until it is out of the slash.

The pitfalls will consist of three inch O.D. PVC (poly-vinyl-chloride) pipe in six inch lengths inserted in the ground, flush with the soil surface. The PVC pipe will accommodate 10 oz. Solo plastic cups. The cups will contain four to five ounces Propylene glycol with the trade name Sierra Antifreeze. The pitfalls will e collected at six-week intervals as per the SOP established by Dr. David Lightfoot. The samples will be archived the samples can be identified and quantified.

Status: To be installed in the early summer of 1997.

Ungulate Exclosure

A potential problem identified by Bandelier's Vegetation Management Specialist and the wildlife Biologist is potential negative impacts from elk herbivory. Treated areas may possibly concentrate elk and deer because of a more desirable habitat relative to the surrounding landscape. This could possibly negate the benefits of the treatment and thus potentially limit the park's ability to restore these degraded woodlands. In order to obtain some measure of what those effects may be a two-hectare exclosure is to be constructed in each watershed (Fig. 1). Each exclosure site is to be located on similar soils, tree and herbaceous cover, and landscape position. The exclosures will be enclosed by an eight stranded eight-foot tall electric fence. Solar charged 12-volt marine batteries will power the fence energizers. Vegetative cover, grass biomass and soil erosion will be measured in the exclosures. The vegetative cover transects will be 60-m in length with 5 transects in each exclosure. Four SEBs will be located between each transect following the same stratification as the watershed.

Status: Pretreatment data was completed in November of 1996. Construction of the exclosure is to completed by mid Summer 1997.

Photo Documentation

Along with general random color photographs of the watershed, an intensive effort is being made to photo document the watershed in a systematic fashion over time. Photo points were established along the vegetation transect at ten meter intervals beginning at 0 –m stake and ending at 103-m stake (Fig. 2). A 50x100cm quadrat was used to delineate the photo plot. It was placed on the ground on the left side of the transect as one looks down the transect from the 0-m stake. The long dimension of the quad was placed parallel to the transect with one corner ot the spot that was a multiple of ten and ending at the next higher number (Fig.2). A reference photo was also taken from both ends of the transect beginning with the second set of photos taken. The first only had the photo at the beginning (0-m) stake taken. The reference photo was photo of the entire length of the transect looking back towards the other end.

Data Management

Data for this project is to be processed and stored on the Dell Dimensions XPS H266 located in the Jail Annex. The data will be located in a folder entitled Watershed in the Projects folder on the Desktop. MS Office applications and Statistical Package for the Social Sciences (SPSS) will be used to process these data. The data will be archived on 100 MB Zip disks. Backups will be made at sufficient enough intervals to ensure minimal data loss.

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Chapter

2

Small Scale Studies at Frijoles Mesa, Alamo Mesa, and Garcia Mesa

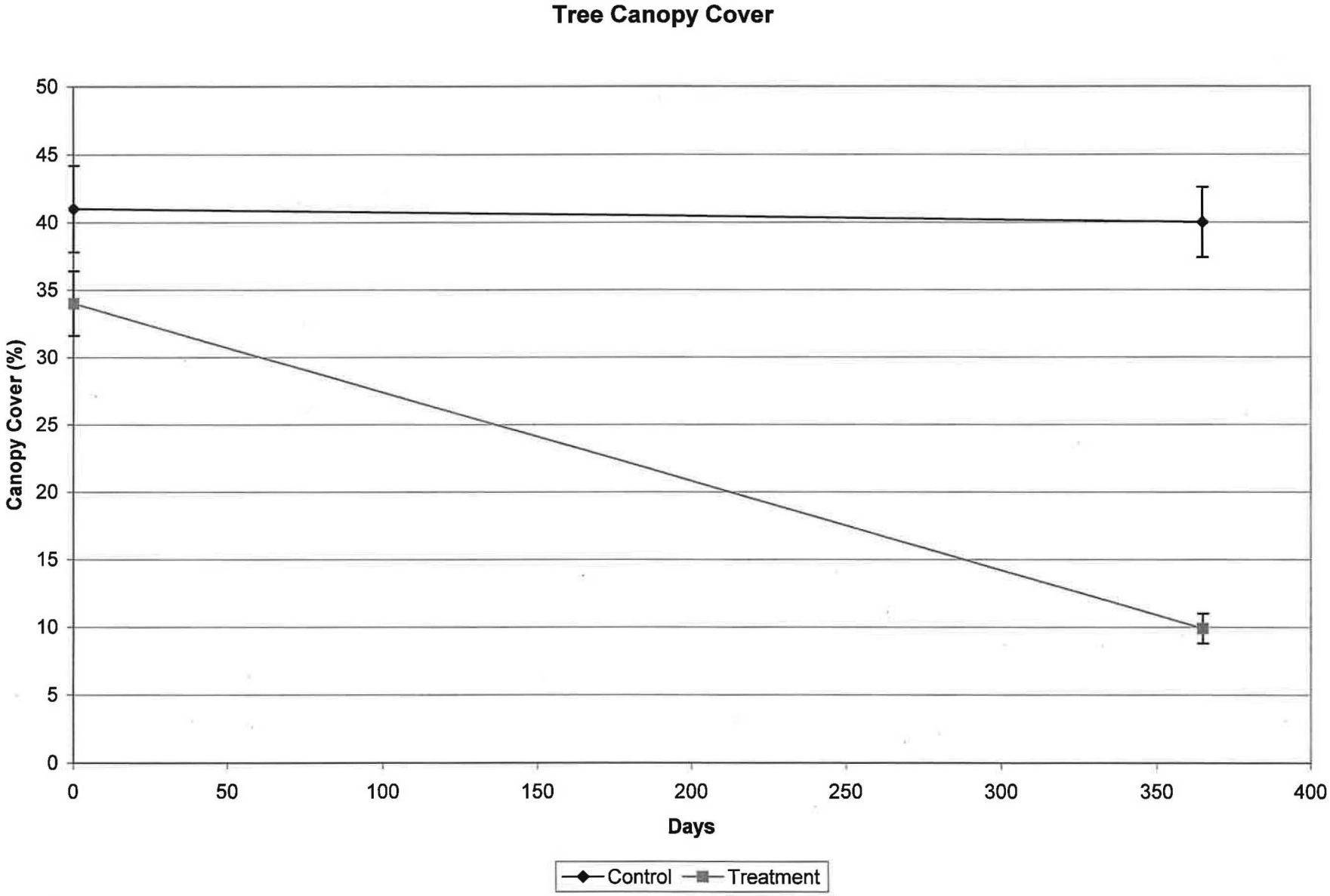
Introduction

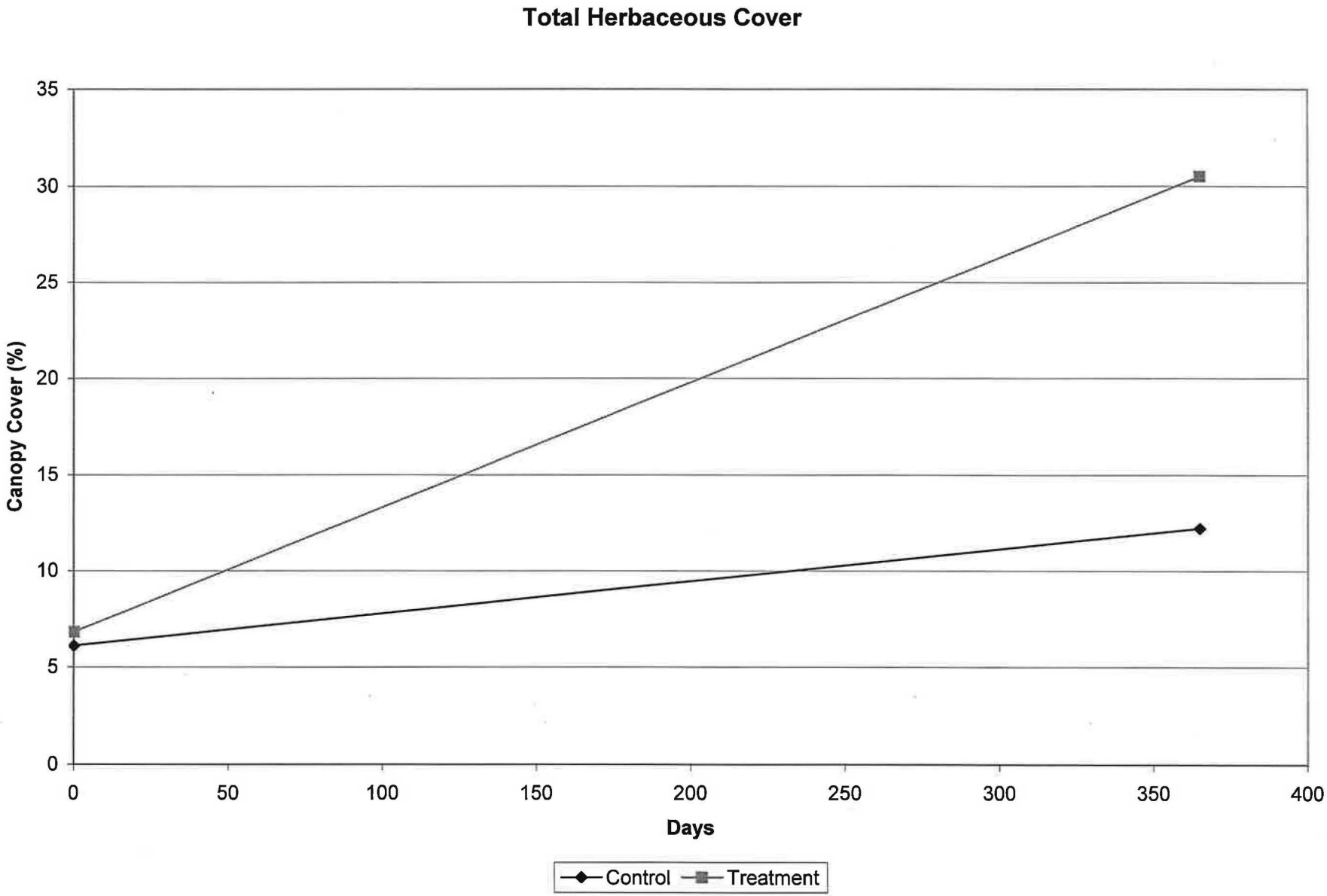
The small-scale plot studies conducted at Frijoles, Alamo, and Garcia Mesa are integral to the development of appropriate management strategies for Bandelier's degraded Piñon-Juniper Woodlands. Overstory reduction treatments involving the cutting and redistribution of slash was conducted to assess it's efficacy in re-establish some assemblages of an herbaceous understory. The overall objective of this project was to arrest the accelerated soil erosion occurring within the PJ landscape. These studies were implemented beginning in the fall of 1994. Three sites were selected varying in elevation from 1800 meters (Alamo Mesa), 1900 meters (Frijoles Mesa) and 2000 meters (Garcia Mesa). The Frijoles and Garcia Mesas sites received seeding in combination with various seedbed preparation treatments: raking/seeding; imprinting/seeding; imprinting/no seeding; no raking or imprinting/seeding. All the treatments had received a cutting and broadcast slash treatment

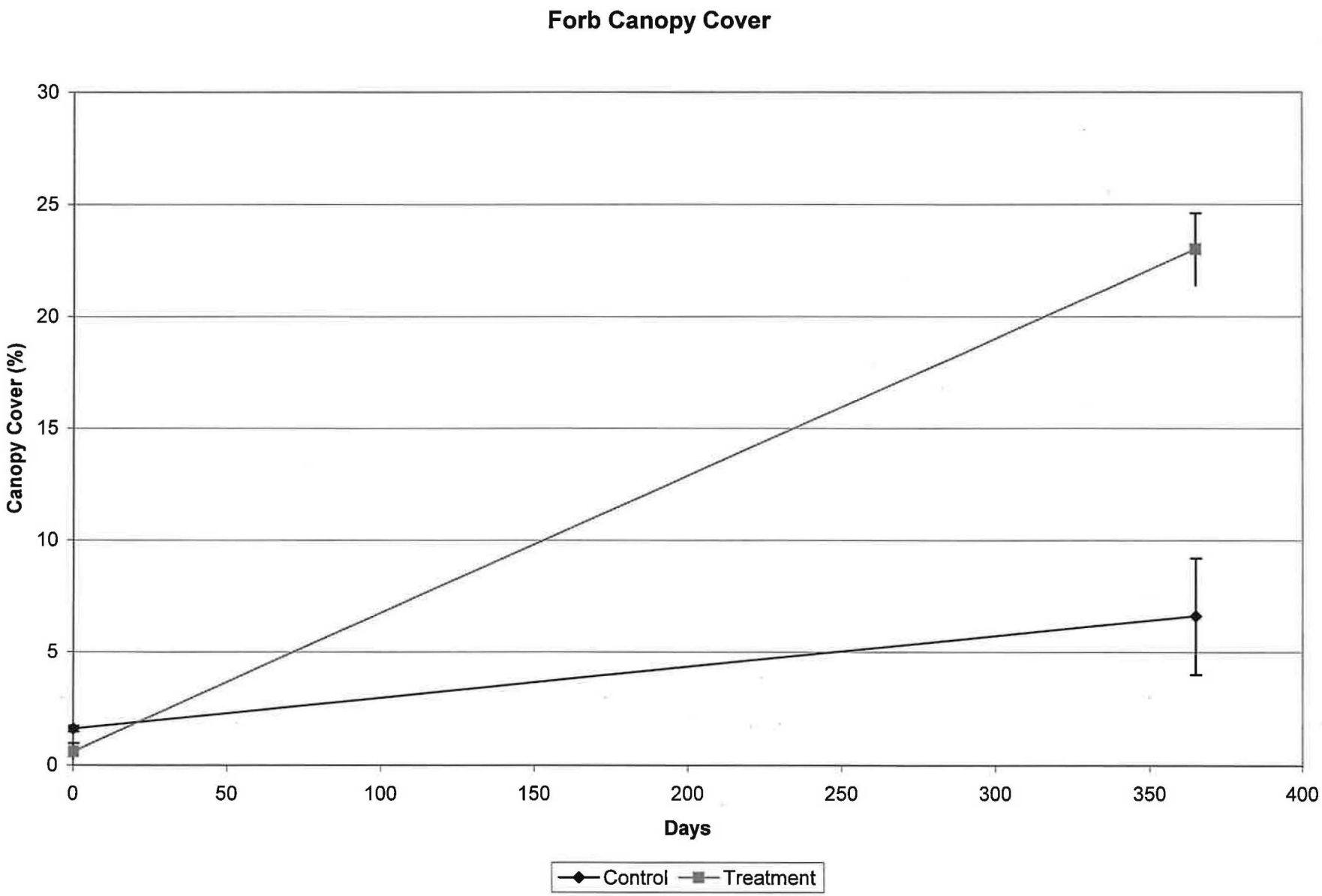
This data collection season is the second growing season post treatment. Herbaceous cover increases dramatically as you move out of the untreated woodlands into the clearing created by the treatment, with a clear and distinct boundary. Plants such as *Hymenoxys richardsonii* are larger and more robust than their counter-part in the adjacent woodlands. Quantitatively the data from the LTER transects bare out what is visually obvious (Fig 2-1). Total cover estimates are around 75% with perennial grasses contributing around 45% of total cover and forbs the balance. Evidence of soil erosion, so prevalent prior to treatment (Fig. 2-2), is non-existent (Fig 2-3). In addition to measuring vegetative cover, we measured soil moisture using Time-Domain Reflectometry for a period prior to and after a rainfall event of high volume (2.54 cm) and low intensity in September. The soil moisture data correlate our hypothesis that slash broadcast into the interstitial areas result in greater soil water verses the interstitial areas of untreated sites.

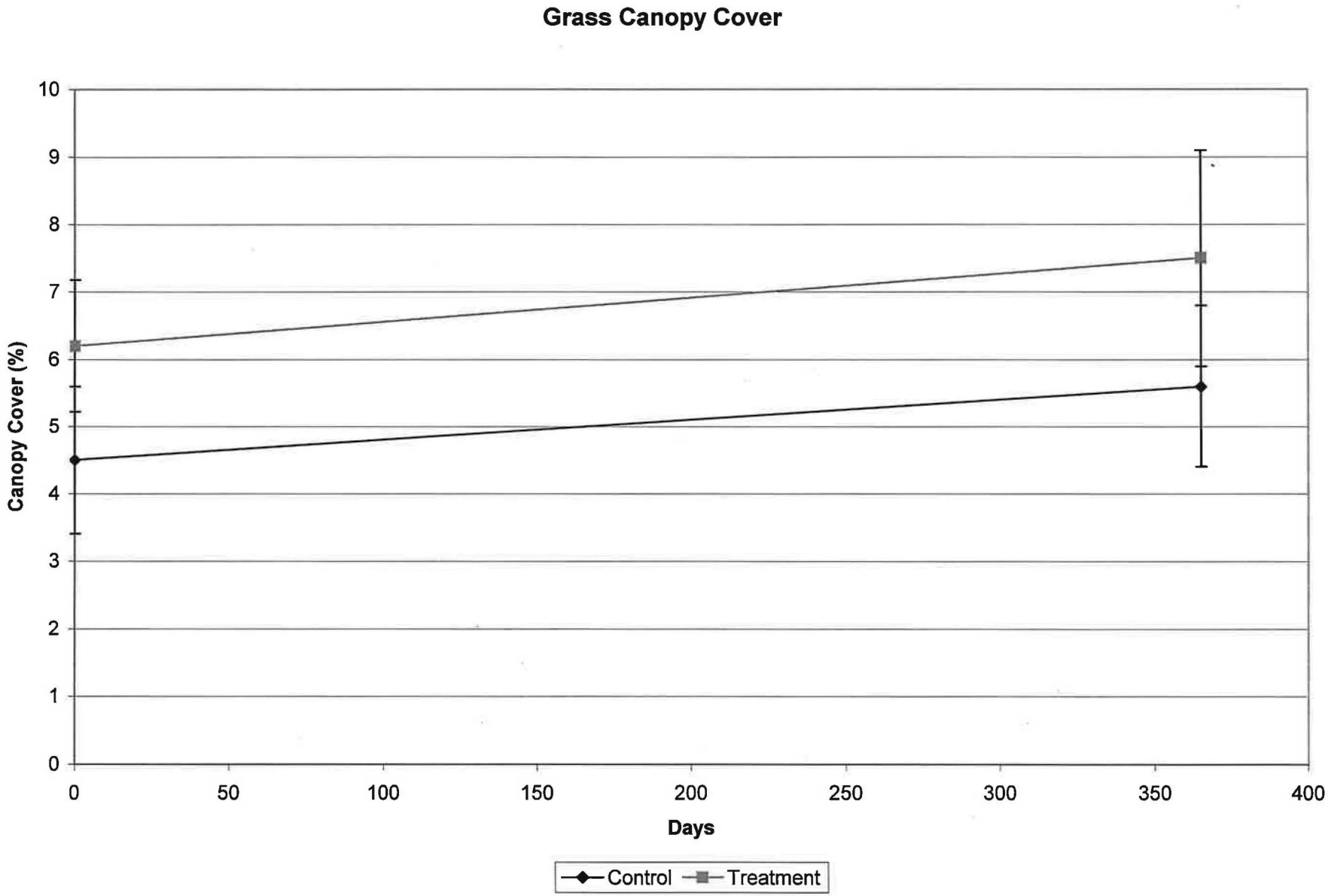
The following graphs summarizes change data of canopy cover across all grasses and forbes and total herbaceous cover in terms of canopy cover from 1994/95 and '96 as a result of the primary treatment; the tree cutting and broadcasting of slash into the interstitial areas. Also are presented are graphs showing the basal cover for the three measurement periods as result of in basal cover for the tree seeded species of grasses: *Bouteloua gracilis*; *Schizacyrium scoparium*; *Sporobolus cryptandrus.* channges that are a result of the basal cover reflects that changes in

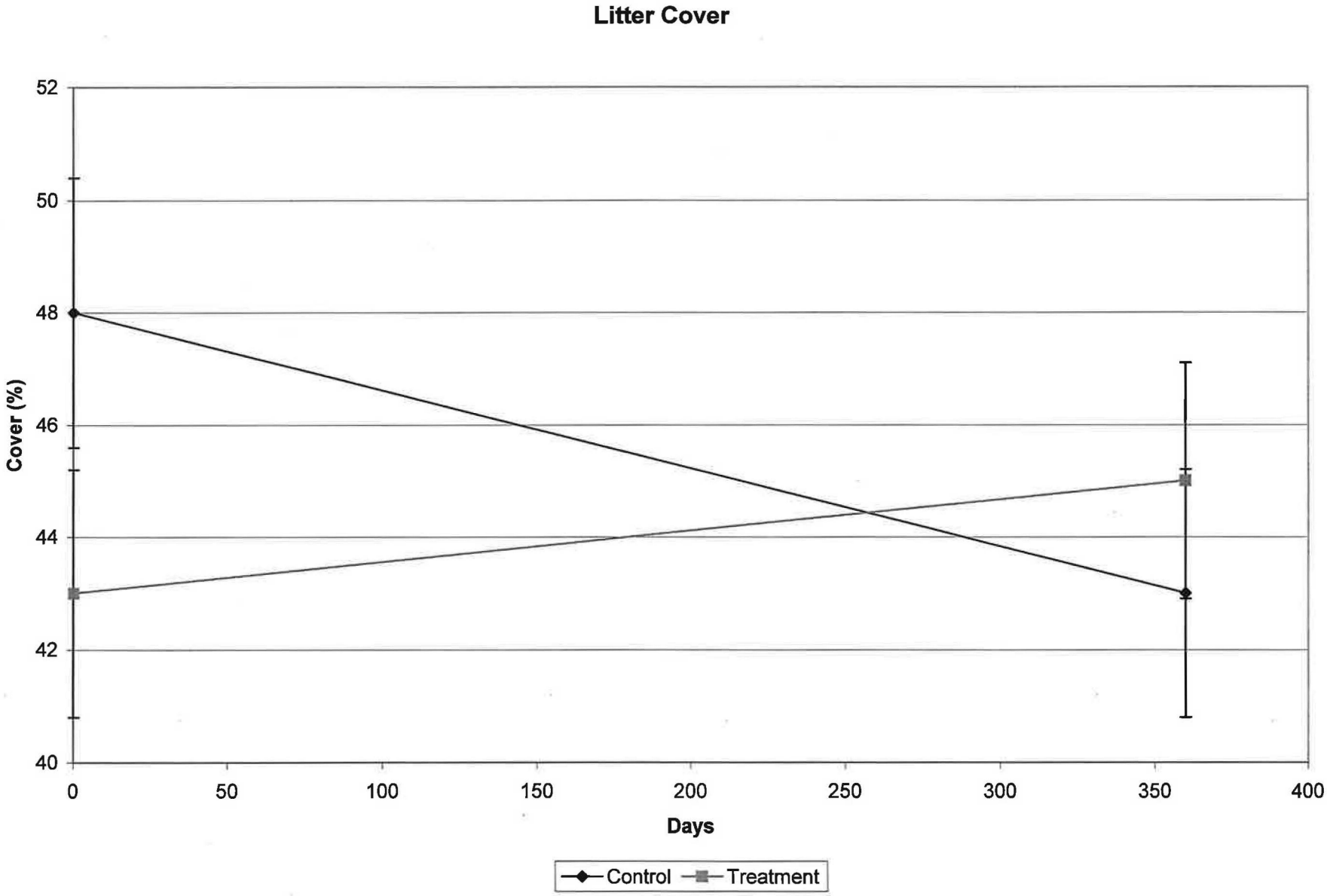
The promising results from these studies have lead to the implementation of the large scale Watershed project. They will also continue to be valuable in that they will yield data on changes in herbaceous species composition over time (successional trajactories). Particularly as we move from the restoration phase to the fire maintenance phase of this study and for generating hypothesis as to what mechanisms are involved in the restoration process.


Tree Canopy Cover
Canopy Cover (%)
50
45
40
35
30
25
20
15
10
5
0
0
50
100
150
200
250
300
350
400
Days
Control
Treatment

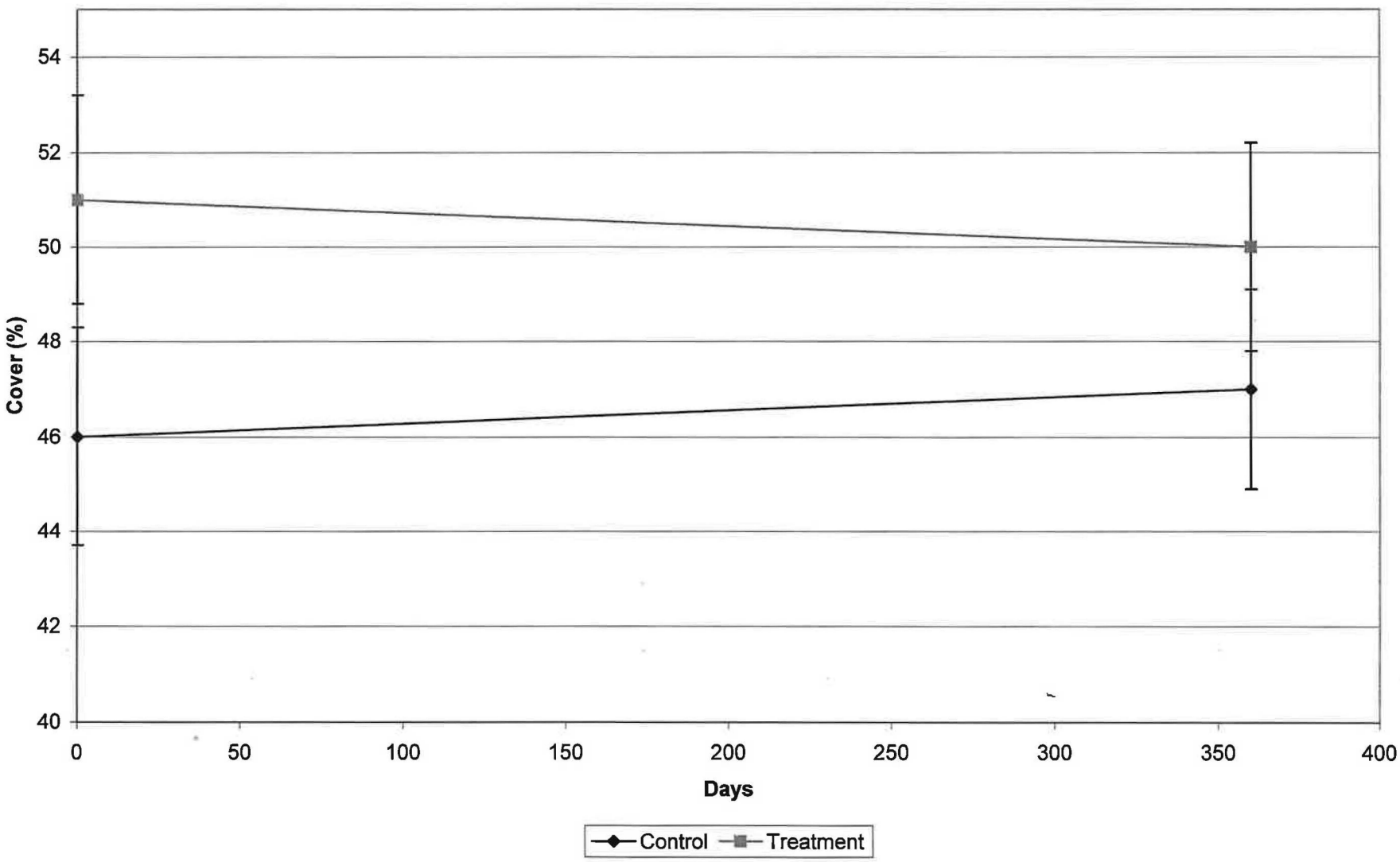

Total Herbaceous Cover
Canopy Cover (%)
35
30
25
20
15
10
5
0
0
50
100
150
200
250
300
350
400
Days
Control
Treatment


Forb Canopy Cover
Canopy Cover (%)
30
25
20
15
10
5
0
0
50
100
150
200
250
300
350
400
Days
Control
Treatment


Grass Canopy Cover
Canopy Cover (%)
10
9
8
7
6
5
4
3
2
1
0
0
50
100
150
200
250
300
350
400
Days
Control
Treatment


Litter Cover
52
50
48
46
44
42
40
Cover (%)
0
50
100
150
200
250
300
350
400
Days
Control
Treatment

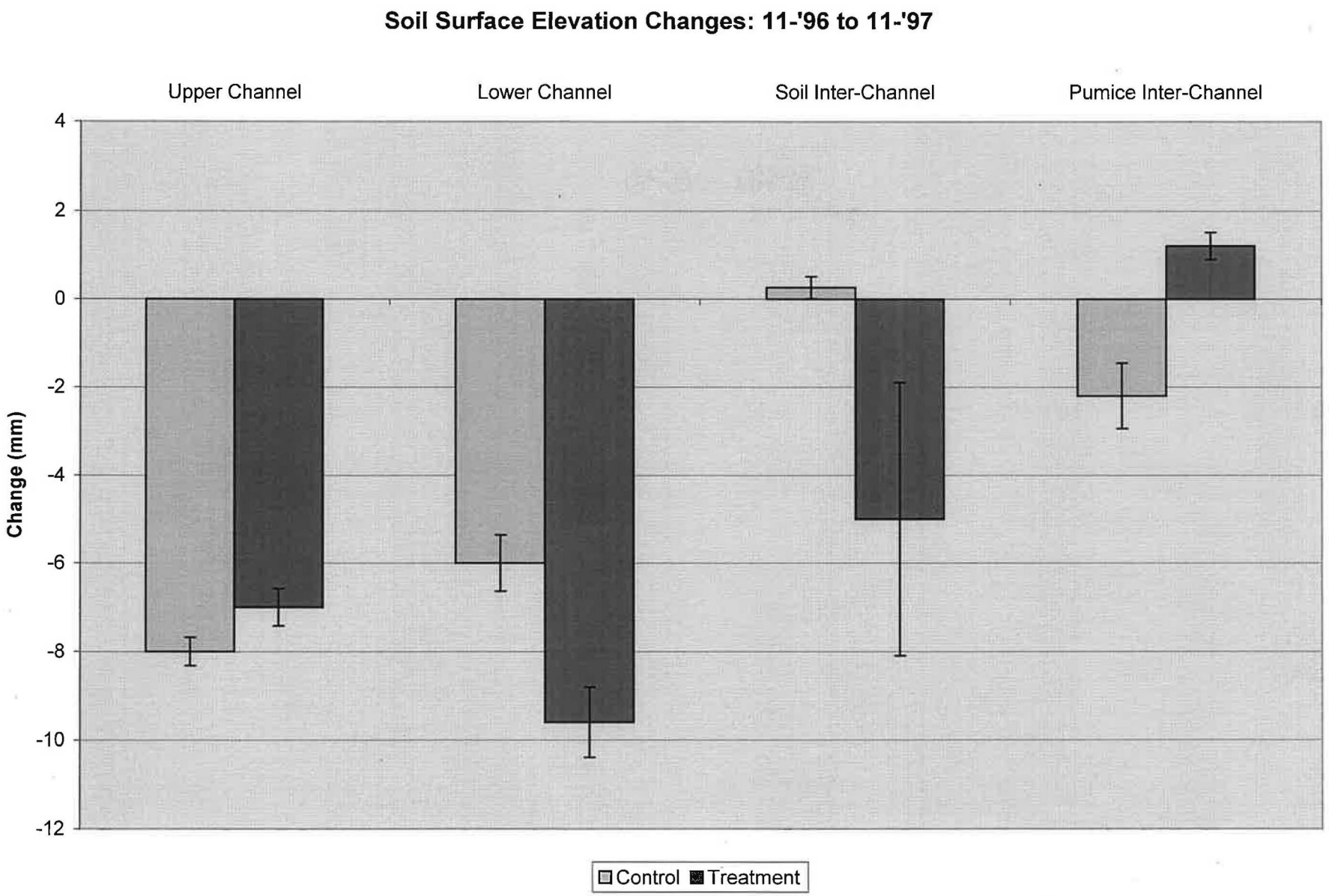
Exposed Soil

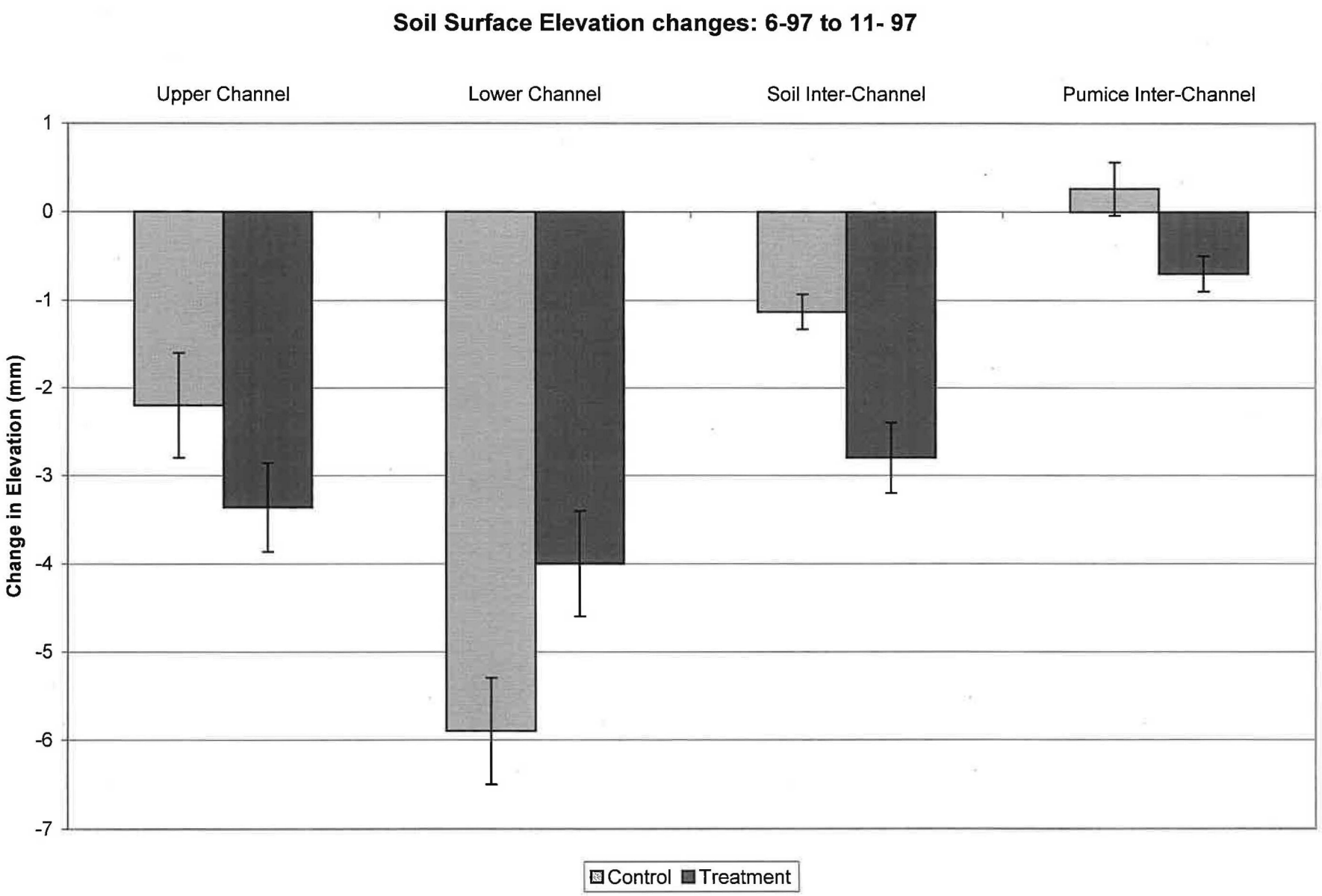


Soil Erosion Data

WTSHD	Location		Mean	N	Std. Deviation	Std. Error of Mean	Minimum	Maximum
Control	Soil Inter-Channel	S'97 to F'97	-.3728	558	6.0201	.2549	-30.00	19.00
		CHNG_YR	-8.0466	558	7.7708	.3290	-40.00	20.00
	Soil Inter-Channel	S'97 to F'97	-1.9014	558	6.0852	.2576	-31.00	21.00
		CHNG_YR	328.1290	558	64.4580	2.7287	195.00	492.00
	Lower Channel	S'97 to F'97	-5.9068	558	15.5557	.6585	-220.00	54.00
		CHNG_YR	-11.3961	558	15.2336	.6449	-131.00	46.00
	Pumice Inter-Channel	S'97 to F'97	.2634	558	6.2822	.2659	-100.00	26.00
		CHNG_YR	-4.4391	558	5.8247	.2466	-27.00	19.00
	Upper Channel	S'97 to F'97	-2.2366	558	14.6920	.6220	-58.00	88.00
		CHNG_YR	-8.0753	558	17.4820	.7401	-61.00	97.00
	Total	S'97 to F'97	-2.0308	2790	10.8890	.2062	-220.00	88.00
		CHNG_YR	59.2344	2790	137.9978	2.6126	-131.00	492.00
Treatment	Soil Inter-Channel	S'97 to F'97	-1.2975	558	10.4809	.4437	-67.00	80.00
		CHNG_YR	-7.3638	558	10.1204	.4284	-35.00	77.00
	Soil Inter-Channel	S'97 to F'97	-4.3082	558	15.9414	.6749	-287.00	64.00
		CHNG_YR	349.0376	558	47.5584	2.0133	-5.00	459.00
	Lower Channel	S'97 to F'97	-3.9892	558	15.1473	.6412	-53.00	60.00
		CHNG_YR	-7.2366	558	73.0132	3.0909	-144.00	406.00
	Pumice Inter-Channel	S'97 to F'97	17.8728	558	76.8900	3.2550	-18.00	358.00
		CHNG_YR	-5.1022	558	7.2165	.3055	-28.00	30.00
	Upper Channel	S'97 to F'97	-3.3674	558	10.6730	.4518	-59.00	75.00
		CHNG_YR	1.2993	558	44.4862	1.8833	-107.00	293.00
	Total	S'97 to F'97	.9821	2790	37.3421	.7070	-287.00	358.00
		CHNG_YR	69.0215	2790	146.8940	2.7810	-144.00	459.00
Total	Soil Inter-Channel	S'97 to F'97	-.8351	1116	8.5554	.2561	-67.00	80.00
		CHNG_YR	-7.7052	1116	9.0248	.2702	-40.00	77.00
	Soil Inter-Channel	S'97 to F'97	-3.1048	1116	12.1201	.3628	-287.00	64.00
		CHNG_YR	338.5833	1116	57.5746	1.7235	-5.00	492.00
	Lower Channel	S'97 to F'97	-4.9480	1116	15.3759	.4603	-220.00	60.00
		CHNG_YR	-2.0797	1116	53.5339	1.6025	-144.00	406.00
	Pumice Inter-Channel	S'97 to F'97	9.0681	1116	55.2330	1.6534	-100.00	358.00
		CHNG_YR	-4.7706	1116	6.5631	.1965	-28.00	30.00
	Upper Channel	S'97 to F'97	-2.8020	1116	12.8474	.3846	-59.00	88.00
		CHNG_YR	-3.3880	1116	34.1070	1.0210	-107.00	293.00
	Total	S'97 to F'97	-.5244	5580	27.5433	.3687	-287.00	358.00
		CHNG_YR	64.1280	5580	142.5866	1.9088	-144.00	492.00

-7.2 SE.78


Soil Surface Elevation Changes: 11-'96 to 11-'97
Upper Channel
Lower Channel
Soil Inter-Channel
Pumice Inter-Channel
Change (mm)
4
2
0
-2
-4
-6
-8
-10
-12
Control
Treatment


Soil Surface Elevation changes: 6-97 to 11- 97
Upper Channel
Lower Channel
Soil Inter-Channel
Pumice Inter-Channel
Change in Elevation (mm)
1
0
-1
-2
-3
-4
-5
-6
-7
Control
Treatment

Basal and Canopy Cover

				BSL_PCT						CNPY_PCT					
FORM	STATE	WTRSHD	YR	Mean	N	Std. Deviation	Std. Error of Mean	Minimum	Maximum	Mean	N	Std. Deviation	Std. Error of Mean	Minimum	Maximum
Soil	live	c	96.00	46.1575	20	10.6584	2.3833	20.82	65.54	.0000	20	.0000	.0000	.00	.00
			97.00	46.9000	20	9.5688	2.1396	25.43	60.87	3.050E-02	20	9.763E-02	2.183E-02	.00	.42
			Total	46.5287	40	10.0047	1.5819	20.82	65.54	1.525E-02	40	6.987E-02	1.105E-02	.00	.42
		t	96.00	51.1140	20	9.7297	2.1756	34.36	74.60	.0000	20	.0000	.0000	.00	.00
			97.00	49.8750	20	9.8128	2.1942	37.14	72.03	1.526E-02	19	6.186E-02	1.419E-02	.00	.27
			Total	50.4945	40	9.6657	1.5283	34.36	74.60	7.436E-03	39	4.327E-02	6.929E-03	.00	.27
		Total	96.00	48.6358	40	10.3809	1.6414	20.82	74.60	.0000	40	.0000	.0000	.00	.00
			97.00	48.3875	40	9.6844	1.5312	25.43	72.03	2.308E-02	39	8.147E-02	1.305E-02	.00	.42
			Total	48.5116	80	9.9758	1.1153	20.82	74.60	1.139E-02	79	5.804E-02	6.530E-03	.00	.42
	Total	c	96.00	46.1575	20	10.6584	2.3833	20.82	65.54	.0000	20	.0000	.0000	.00	.00
			97.00	46.9000	20	9.5688	2.1396	25.43	60.87	3.050E-02	20	9.763E-02	2.183E-02	.00	.42
			Total	46.5287	40	10.0047	1.5819	20.82	65.54	1.525E-02	40	6.987E-02	1.105E-02	.00	.42
		t	96.00	51.1140	20	9.7297	2.1756	34.36	74.60	.0000	20	.0000	.0000	.00	.00
			97.00	49.8750	20	9.8128	2.1942	37.14	72.03	1.526E-02	19	6.186E-02	1.419E-02	.00	.27
			Total	50.4945	40	9.6657	1.5283	34.36	74.60	7.436E-03	39	4.327E-02	6.929E-03	.00	.27
		Total	96.00	48.6358	40	10.3809	1.6414	20.82	74.60	.0000	40	.0000	.0000	.00	.00
			97.00	48.3875	40	9.6844	1.5312	25.43	72.03	2.308E-02	39	8.147E-02	1.305E-02	.00	.42
			Total	48.5116	80	9.9758	1.1153	20.82	74.60	1.139E-02	79	5.804E-02	6.530E-03	.00	.42
cacti	dead	c	96.00	3.500E-03	20	1.089E-02	2.436E-03	.00	.04	4.000E-03	20	1.789E-02	4.000E-03	.00	.08
			97.00	1.000E-03	20	4.472E-03	1.000E-03	.00	.02	3.500E-02	20	6.755E-02	1.510E-02	.00	.22
			Total	2.250E-03	40	8.317E-03	1.315E-03	.00	.04	1.950E-02	40	5.124E-02	8.102E-03	.00	.22
		t	97.00	.1885	20	3.631E-02	8.120E-03	.06	.20	.0000	20	.0000	.0000	.00	.00
			Total	.1885	20	3.631E-02	8.120E-03	.06	.20	.0000	20	.0000	.0000	.00	.00
		Total	96.00	3.500E-03	20	1.089E-02	2.436E-03	.00	.04	4.000E-03	20	1.789E-02	4.000E-03	.00	.08
			97.00	9.475E-02	40	9.832E-02	1.555E-02	.00	.20	1.750E-02	40	5.037E-02	7.964E-03	.00	.22
			Total	6.433E-02	60	9.116E-02	1.177E-02	.00	.20	1.300E-02	60	4.268E-02	5.510E-03	.00	.22
	live	c	96.00	9.200E-02	20	.1289	2.882E-02	.00	.52	9.650E-02	20	.1360	3.040E-02	.00	.56
			97.00	2.150E-02	20	4.344E-02	9.714E-03	.00	.17	.2245	20	.2107	4.713E-02	.00	.76
			Total	5.675E-02	40	.1014	1.604E-02	.00	.52	.1605	40	.1867	2.952E-02	.00	.76
		t	96.00	.1400	20	.1811	4.050E-02	.00	.49	2.400E-02	20	4.570E-02	1.022E-02	.00	.15
			97.00	8.000E-03	20	2.067E-02	4.623E-03	.00	.07	.1345	20	.1978	4.424E-02	.00	.70
			Total	7.400E-02	40	.1437	2.273E-02	.00	.49	7.925E-02	40	.1524	2.409E-02	.00	.70
		Total	96.00	.1160	40	.1571	2.483E-02	.00	.52	6.025E-02	40	.1066	1.686E-02	.00	.56
			97.00	1.475E-02	40	3.427E-02	5.418E-03	.00	.17	.1795	40	.2068	3.270E-02	.00	.76
			Total	6.538E-02	80	.1239	1.385E-02	.00	.52	.1199	80	.1742	1.947E-02	.00	.76
	Total	c	96.00	4.775E-02	40	.1008	1.594E-02	.00	.52	5.025E-02	40	.1066	1.685E-02	.00	.56
			97.00	1.125E-02	40	3.220E-02	5.091E-03	.00	.17	.1298	40	.1818	2.875E-02	.00	.76
			Total	2.950E-02	80	7.659E-02	8.563E-03	.00	.52	9.000E-02	80	.1534	1.715E-02	.00	.76
		t	96.00	.1400	20	.1811	4.050E-02	.00	.49	2.400E-02	20	4.570E-02	1.022E-02	.00	.15
			97.00	9.825E-02	40	9.594E-02	1.517E-02	.00	.20	6.725E-02	40	.1540	2.435E-02	.00	.70
			Total	.1122	60	.1306	1.685E-02	.00	.49	5.283E-02	60	.1295	1.672E-02	.00	.70
		Total	96.00	7.850E-02	60	.1386	1.789E-02	.00	.52	4.150E-02	60	9.130E-02	1.179E-02	.00	.56
			97.00	5.475E-02	80	8.350E-02	9.335E-03	.00	.20	9.850E-02	80	.1703	1.905E-02	.00	.76
			Total	6.493E-02	140	.1107	9.356E-03	.00	.52	7.407E-02	140	.1443	1.220E-02	.00	.76

Basal and Canopy Cover

				BSL_PCT						CNPY_PCT					
FORM	STATE	WTRSHD	YR	Mean	N	Std. Deviation	Std. Error of Mean	Minimum	Maximum	Mean	N	Std. Deviation	Std. Error of Mean	Minimum	Maximum
forbs	dead	c	96.00	2.000E-03	20	8.944E-03	2.000E-03	.00	.04	3.100E-02	20	4.191E-02	9.372E-03	.00	.16
			97.00	.0000	20	.0000	.0000	.00	.00	.2765	20	.3447	7.707E-02	.00	1.07
			Total	1.000E-03	40	6.325E-03	1.000E-03	.00	.04	.1538	40	.2724	4.307E-02	.00	1.07
		t	96.00	5.500E-03	20	1.504E-02	3.362E-03	.00	.06	.1965	20	.3394	7.588E-02	.00	1.30
			97.00	.0000	20	.0000	.0000	.00	.00	.6055	20	.7771	.1738	.00	2.14
			Total	2.750E-03	40	1.086E-02	1.717E-03	.00	.06	.4010	40	.6271	9.915E-02	.00	2.14
		Total	96.00	3.750E-03	40	1.234E-02	1.951E-03	.00	.06	.1138	40	.2529	3.999E-02	.00	1.30
			97.00	.0000	40	.0000	.0000	.00	.00	.4410	40	.6163	9.745E-02	.00	2.14
			Total	1.875E-03	80	8.872E-03	9.920E-04	.00	.06	.2774	80	.4962	5.548E-02	.00	2.14
	live	c	96.00	9.800E-02	20	.1330	2.974E-02	.00	.47	1.7115	20	1.6511	.3692	.20	6.36
			97.00	.2890	20	.8448	.1889	.00	3.77	6.6450	20	7.2137	1.6130	1.60	36.11
			Total	.1935	40	.6047	9.561E-02	.00	3.77	4.1783	40	5.7377	.9072	.20	36.11
		t	96.00	.1035	20	.1178	2.633E-02	.00	.31	.6865	20	.6074	.1358	.03	2.59
			97.00	8.300E-02	20	.1720	3.846E-02	.00	.71	23.0750	20	11.7173	2.6201	5.04	44.14
			Total	9.325E-02	40	.1459	2.306E-02	.00	.71	11.8808	40	13.9854	2.2113	.03	44.14
		Total	96.00	.1007	40	.1240	1.961E-02	.00	.47	1.1990	40	1.3331	.2108	.03	6.36
			97.00	.1860	40	.6107	9.656E-02	.00	3.77	14.8600	40	12.7065	2.0091	1.60	44.14
			Total	.1434	80	.4400	4.919E-02	.00	3.77	8.0295	80	11.3062	1.2641	.03	44.14
	Total	c	96.00	5.000E-02	40	.1050	1.660E-02	.00	.47	.8713	40	1.4329	.2266	.00	6.36
			97.00	.1445	40	.6075	9.606E-02	.00	3.77	3.4608	40	5.9841	.9462	.00	36.11
			Total	9.725E-02	80	.4358	4.872E-02	.00	3.77	2.1660	80	4.5154	.5048	.00	36.11
		t	96.00	5.450E-02	40	9.658E-02	1.527E-02	.00	.31	.4415	40	.5453	8.622E-02	.00	2.59
			97.00	4.150E-02	40	.1272	2.011E-02	.00	.71	11.8403	40	14.0228	2.2172	.00	44.14
			Total	4.800E-02	80	.1124	1.257E-02	.00	.71	6.1409	80	11.4068	1.2753	.00	44.14
		Total	96.00	5.225E-02	80	.1003	1.121E-02	.00	.47	.6564	80	1.0987	.1228	.00	6.36
			97.00	9.300E-02	80	.4392	4.910E-02	.00	3.77	7.6505	80	11.5121	1.2871	.00	44.14
			Total	7.262E-02	160	.3182	2.516E-02	.00	3.77	4.1534	160	8.8743	.7016	.00	44.14
grasses	dead	c	96.00	1.100E-02	20	4.919E-02	1.100E-02	.00	.22	2.950E-02	20	.1077	2.408E-02	.00	.48
			97.00	.0000	20	.0000	.0000	.00	.00	1.250E-02	20	3.611E-02	8.074E-03	.00	.14
			Total	5.500E-03	40	3.479E-02	5.500E-03	.00	.22	2.100E-02	40	7.974E-02	1.261E-02	.00	.48
		t	96.00	3.000E-03	20	1.342E-02	3.000E-03	.00	.06	1.400E-02	20	5.030E-02	1.125E-02	.00	.22
			97.00	7.000E-03	20	1.780E-02	3.980E-03	.00	.06	2.000E-03	20	6.156E-03	1.376E-03	.00	.02
			Total	5.000E-03	40	1.569E-02	2.481E-03	.00	.06	8.000E-03	40	3.589E-02	5.675E-03	.00	.22
		Total	96.00	7.000E-03	40	3.582E-02	5.664E-03	.00	.22	2.175E-02	40	8.332E-02	1.317E-02	.00	.48
			97.00	3.500E-03	40	1.292E-02	2.043E-03	.00	.06	7.250E-03	40	2.611E-02	4.129E-03	.00	.14
			Total	5.250E-03	80	2.681E-02	2.998E-03	.00	.22	1.450E-02	80	6.179E-02	6.908E-03	.00	.48
	live	c	96.00	.5680	20	.7454	.1667	.01	3.32	4.6705	20	4.5215	1.0110	.18	17.33
			97.00	.4875	20	.7551	.1688	.00	3.04	5.5730	20	7.1633	1.6018	.26	31.42
			Total	.5278	40	.7417	.1173	.00	3.32	5.1217	40	5.9302	.9376	.18	31.42
		t	96.00	.8835	20	.7763	.1736	.07	3.07	6.2005	20	4.9566	1.1083	.69	18.41
			97.00	.6285	20	.6124	.1369	.02	2.23	7.5135	20	5.5244	1.2353	.97	21.19
			Total	.7560	40	.7021	.1110	.02	3.07	6.8570	40	5.2230	.8258	.69	21.19
		Total	96.00	.7258	40	.7680	.1214	.01	3.32	5.4355	40	4.7464	.7505	.18	18.41
			97.00	.5580	40	.6823	.1079	.00	3.04	6.5433	40	6.3900	1.0104	.26	31.42
			Total	.6419	80	.7267	8.125E-02	.00	3.32	5.9894	80	5.6205	.6284	.18	31.42

Basal and Canopy Cover

				BSL_PCT						CNPY_PCT					
FORM	STATE	WTRSHD	YR	Mean	N	Std. Deviation	Std. Error of Mean	Minimum	Maximum	Mean	N	Std. Deviation	Std. Error of Mean	Minimum	Maximum
grasses	Total	c	96.00	.2895	40	.5928	9.374E-02	.00	3.32	2.3500	40	3.9355	.6223	.00	17.33
			97.00	.2438	40	.5820	9.202E-02	.00	3.04	2.7928	40	5.7382	.9073	.00	31.42
			Total	.2666	80	.5842	6.531E-02	.00	3.32	2.5714	80	4.8940	.5472	.00	31.42
		t	96.00	.4433	40	.7017	.1110	.00	3.07	3.1073	40	4.6673	.7380	.00	18.41
			97.00	.3177	40	.5309	8.395E-02	.00	2.23	3.7578	40	5.4163	.8564	.00	21.19
			Total	.3805	80	.6215	6.948E-02	.00	3.07	3.4325	80	5.0342	.5628	.00	21.19
		Total	96.00	.3664	80	.6501	7.268E-02	.00	3.32	2.7286	80	4.3064	.4815	.00	18.41
			97.00	.2808	80	.5548	6.202E-02	.00	3.04	3.2753	80	5.5654	.6222	.00	31.42
			Total	.3236	160	.6039	4.774E-02	.00	3.32	3.0019	160	4.9678	.3927	.00	31.42
litter	live	c	96.00	47.7440	20	10.7417	2.4019	35.03	75.13	.4315	20	.7321	.1637	.00	2.50
			97.00	42.9165	20	9.7025	2.1696	18.91	65.51	.4365	20	.4536	.1014	.00	1.67
			Total	45.3302	40	10.3948	1.6436	18.91	75.13	.4340	40	.6011	9.505E-02	.00	2.50
		t	96.00	42.6200	20	9.9643	2.2281	18.30	62.46	.3985	20	.3414	7.635E-02	.01	1.52
			97.00	44.5660	20	9.3505	2.0908	23.99	57.00	20.6070	20	6.8621	1.5344	7.12	33.76
			Total	43.5930	40	9.5884	1.5161	18.30	62.46	10.5027	40	11.3009	1.7868	.01	33.76
		Total	96.00	45.1820	40	10.5506	1.6682	18.30	75.13	.4150	40	.5641	8.919E-02	.00	2.50
			97.00	43.7413	40	9.4422	1.4929	18.91	65.51	10.5218	40	11.2854	1.7844	.00	33.76
			Total	44.4616	80	9.9746	1.1152	18.30	75.13	5.4684	80	9.4282	1.0541	.00	33.76
	Total	c	96.00	47.7440	20	10.7417	2.4019	35.03	75.13	.4315	20	.7321	.1637	.00	2.50
			97.00	42.9165	20	9.7025	2.1696	18.91	65.51	.4365	20	.4536	.1014	.00	1.67
			Total	45.3302	40	10.3948	1.6436	18.91	75.13	.4340	40	.6011	9.505E-02	.00	2.50
		t	96.00	42.6200	20	9.9643	2.2281	18.30	62.46	.3985	20	.3414	7.635E-02	.01	1.52
			97.00	44.5660	20	9.3505	2.0908	23.99	57.00	20.6070	20	6.8621	1.5344	7.12	33.76
			Total	43.5930	40	9.5884	1.5161	18.30	62.46	10.5027	40	11.3009	1.7868	.01	33.76
		Total	96.00	45.1820	40	10.5506	1.6682	18.30	75.13	.4150	40	.5641	8.919E-02	.00	2.50
			97.00	43.7413	40	9.4422	1.4929	18.91	65.51	10.5218	40	11.2854	1.7844	.00	33.76
			Total	44.4616	80	9.9746	1.1152	18.30	75.13	5.4684	80	9.4282	1.0541	.00	33.76
rock	live	c	96.00	5.2620	20	3.4416	.7696	.00	14.32	2.000E-03	20	8.944E-03	2.000E-03	.00	.04
			97.00	5.7235	20	3.9992	.8943	.00	15.34	1.400E-02	20	5.595E-02	1.251E-02	.00	.25
			Total	5.4928	40	3.6901	.5835	.00	15.34	8.000E-03	40	4.001E-02	6.327E-03	.00	.25
		t	96.00	3.2200	20	2.4260	.5425	.07	7.90	.0000	20	.0000	.0000	.00	.00
			97.00	3.3610	20	2.8833	.6447	.00	10.17	5.500E-03	20	1.356E-02	3.033E-03	.00	.04
			Total	3.2905	40	2.6310	.4160	.00	10.17	2.750E-03	40	9.868E-03	1.560E-03	.00	.04
		Total	96.00	4.2410	40	3.1156	.4926	.00	14.32	1.000E-03	40	6.325E-03	1.000E-03	.00	.04
			97.00	4.5422	40	3.6432	.5760	.00	15.34	9.750E-03	40	4.041E-02	6.390E-03	.00	.25
			Total	4.3916	80	3.3716	.3770	.00	15.34	5.375E-03	80	2.908E-02	3.251E-03	.00	.25
	Total	c	96.00	5.2620	20	3.4416	.7696	.00	14.32	2.000E-03	20	8.944E-03	2.000E-03	.00	.04
			97.00	5.7235	20	3.9992	.8943	.00	15.34	1.400E-02	20	5.595E-02	1.251E-02	.00	.25
			Total	5.4928	40	3.6901	.5835	.00	15.34	8.000E-03	40	4.001E-02	6.327E-03	.00	.25
		t	96.00	3.2200	20	2.4260	.5425	.07	7.90	.0000	20	.0000	.0000	.00	.00
			97.00	3.3610	20	2.8833	.6447	.00	10.17	5.500E-03	20	1.356E-02	3.033E-03	.00	.04
			Total	3.2905	40	2.6310	.4160	.00	10.17	2.750E-03	40	9.868E-03	1.560E-03	.00	.04
		Total	96.00	4.2410	40	3.1156	.4926	.00	14.32	1.000E-03	40	6.325E-03	1.000E-03	.00	.04
			97.00	4.5422	40	3.6432	.5760	.00	15.34	9.750E-03	40	4.041E-02	6.390E-03	.00	.25
			Total	4.3916	80	3.3716	.3770	.00	15.34	5.375E-03	80	2.908E-02	3.251E-03	.00	.25

Basal and Canopy Cover

FORM	STATE	WTRSHD	YR	BSL_PCT Mean	N	Std. Deviation	Std. Error of Mean	Minimum	Maximum	CNPY_PCT Mean	N	Std. Deviation	Std. Error of Mean	Minimum	Maximum
shrubs	dead	c	96.00	.0000	20	.0000	.0000	.00	.00	1.850E-02	20	8.273E-02	1.850E-02	.00	.37
			97.00	.0000	20	.0000	.0000	.00	.00	2.050E-02	20	6.151E-02	1.375E-02	.00	.24
			Total	.0000	40	.0000	.0000	.00	.00	1.950E-02	40	7.197E-02	1.138E-02	.00	.37
		t	96.00	.1525	20	.6820	.1525	.00	3.05	5.000E-04	20	2.236E-03	5.000E-04	.00	.01
			97.00	4.500E-03	20	2.012E-02	4.500E-03	.00	.09	8.500E-03	20	3.801E-02	8.500E-03	.00	.17
			Total	7.850E-02	40	.4821	7.623E-02	.00	3.05	4.500E-03	40	2.689E-02	4.251E-03	.00	.17
		Total	96.00	7.625E-02	40	.4822	7.625E-02	.00	3.05	9.500E-03	40	5.848E-02	9.247E-03	.00	.37
			97.00	2.250E-03	40	1.423E-02	2.250E-03	.00	.09	1.450E-02	40	5.084E-02	8.038E-03	.00	.24
			Total	3.925E-02	80	.3410	3.813E-02	.00	3.05	1.200E-02	80	5.450E-02	6.094E-03	.00	.37
	live	c	96.00	.1840	20	.4387	9.810E-02	.00	1.53	4.0230	20	3.6981	.8269	.17	16.35
			97.00	.1475	20	.4118	9.208E-02	.00	1.60	3.2930	20	3.0212	.6756	.00	11.68
			Total	.1657	40	.4204	6.647E-02	.00	1.60	3.6580	40	3.3535	.5302	.00	16.35
		t	96.00	6.050E-02	20	.1723	3.852E-02	.00	.69	2.2025	20	1.8169	.4063	.00	6.73
			97.00	.0000	20	.0000	.0000	.00	.00	2.2250	20	1.7897	.4002	.00	6.12
			Total	3.025E-02	40	.1241	1.962E-02	.00	.69	2.2138	40	1.7801	.2815	.00	6.73
		Total	96.00	.1223	40	.3349	5.295E-02	.00	1.53	3.1128	40	3.0200	.4775	.00	16.35
			97.00	7.375E-02	40	.2970	4.696E-02	.00	1.60	2.7590	40	2.5099	.3968	.00	11.68
			Total	9.800E-02	80	.3154	3.527E-02	.00	1.60	2.9359	80	2.7648	.3091	.00	16.35
	Total	c	96.00	9.200E-02	40	.3201	5.061E-02	.00	1.53	2.0207	40	3.2829	.5191	.00	16.35
			97.00	7.375E-02	40	.2970	4.696E-02	.00	1.60	1.6567	40	2.6823	.4241	.00	11.68
			Total	8.288E-02	80	.3069	3.431E-02	.00	1.60	1.8388	80	2.9843	.3337	.00	16.35
		t	96.00	.1065	40	.4932	7.798E-02	.00	3.05	1.1015	40	1.6887	.2670	.00	6.73
			97.00	2.250E-03	40	1.423E-02	2.250E-03	.00	.09	1.1168	40	1.6795	.2656	.00	6.12
			Total	5.438E-02	80	.3506	3.920E-02	.00	3.05	1.1091	80	1.6734	.1871	.00	6.73
		Total	96.00	9.925E-02	80	.4132	4.619E-02	.00	3.05	1.5611	80	2.6348	.2946	.00	16.35
			97.00	3.800E-02	80	.2120	2.370E-02	.00	1.60	1.3868	80	2.2401	.2505	.00	11.68
			Total	6.862E-02	160	.3288	2.599E-02	.00	3.05	1.4739	160	2.4393	.1928	.00	16.35
trees	dead	c	96.00	.5255	20	.7220	.1614	.00	2.26	.6875	20	1.1295	.2526	.00	3.50
			97.00	.8050	20	.9269	.2073	.00	3.34	.3635	20	.4656	.1041	.00	1.88
			Total	.6653	40	.8322	.1316	.00	3.34	.5255	40	.8684	.1373	.00	3.50
		t	96.00	1.3095	20	1.3200	.2952	.00	4.22	.4165	20	.5131	.1147	.00	1.53
			97.00	1.1310	20	1.1034	.2467	.00	3.62	.5075	20	.5734	.1282	.00	1.93
			Total	1.2203	40	1.2042	.1904	.00	4.22	.4620	40	.5391	8.523E-02	.00	1.93
		Total	96.00	.9175	40	1.1227	.1775	.00	4.22	.5520	40	.8767	.1386	.00	3.50
			97.00	.9680	40	1.0193	.1612	.00	3.62	.4355	40	.5207	8.233E-02	.00	1.93
			Total	.9428	80	1.0657	.1191	.00	4.22	.4937	80	.7188	8.037E-02	.00	3.50
	live	c	96.00	.2725	20	.4455	9.961E-02	.00	1.82	43.0030	20	13.6362	3.0491	23.75	80.76
			97.00	.1905	20	.3669	8.203E-02	.00	1.34	40.5585	20	12.0472	2.6938	21.93	69.37
			Total	.2315	40	.4049	6.403E-02	.00	1.82	41.7808	40	12.7604	2.0176	21.93	80.76
		t	96.00	.3615	20	.6322	.1414	.00	2.10	34.1750	20	10.9229	2.4424	11.44	54.29
			97.00	.2890	20	.8699	.1945	.00	3.71	9.9395	20	5.0760	1.1350	3.57	23.97
			Total	.3252	40	.7515	.1188	.00	3.71	22.0572	40	14.8756	2.3520	3.57	54.29
		Total	96.00	.3170	40	.5417	8.565E-02	.00	2.10	38.5890	40	12.9883	2.0536	11.44	80.76
			97.00	.2398	40	.6608	.1045	.00	3.71	25.2490	40	17.9903	2.8445	3.57	69.37
			Total	.2784	80	.6016	6.726E-02	.00	3.71	31.9190	80	16.9738	1.8977	3.57	80.76

Basal and Canopy Cover

				BSL_PCT						CNPY_PCT					
FORM	STATE	WTRSHD	YR	Mean	N	Std. Deviation	Std. Error of Mean	Minimum	Maximum	Mean	N	Std. Deviation	Std. Error of Mean	Minimum	Maximum
trees	Total	c	96.00	.3990	40	.6059	9.579E-02	.00	2.26	21.8453	40	23.4593	3.7092	.00	80.76
			97.00	.4978	40	.7622	.1205	.00	3.34	20.4610	40	22.0245	3.4824	.00	69.37
			Total	.4484	80	.6859	7.669E-02	.00	3.34	21.1531	80	22.6195	2.5289	.00	80.76
		t	96.00	.8355	40	1.1287	.1785	.00	4.22	17.2958	40	18.7208	2.9600	.00	54.29
			97.00	.7100	40	1.0694	.1691	.00	3.71	5.2235	40	5.9602	.9424	.00	23.97
			Total	.7728	80	1.0943	.1223	.00	4.22	11.2596	80	15.0814	1.6862	.00	54.29
		Total	96.00	.6173	80	.9265	.1036	.00	4.22	19.5705	80	21.2118	2.3716	.00	80.76
			97.00	.6039	80	.9288	.1038	.00	3.71	12.8422	80	17.7704	1.9868	.00	69.37
			Total	.6106	160	.9248	7.311E-02	.00	4.22	16.2064	160	19.7951	1.5649	.00	80.76
sub-shrubs	dead	c	96.00	5.000E-03	20	1.573E-02	3.517E-03	.00	.06	3.050E-02	20	6.708E-02	1.500E-02	.00	.28
			97.00	.0000	20	.0000	.0000	.00	.00	2.500E-03	20	9.105E-03	2.036E-03	.00	.04
			Total	2.500E-03	40	1.127E-02	1.781E-03	.00	.06	1.650E-02	40	4.933E-02	7.800E-03	.00	.28
		t	96.00	3.000E-03	20	1.342E-02	3.000E-03	.00	.06	5.200E-02	20	9.232E-02	2.064E-02	.00	.28
			97.00	.0000	20	.0000	.0000	.00	.00	1.050E-02	20	4.696E-02	1.050E-02	.00	.21
			Total	1.500E-03	40	9.487E-03	1.500E-03	.00	.06	3.125E-02	40	7.528E-02	1.190E-02	.00	.28
		Total	96.00	4.000E-03	40	1.446E-02	2.287E-03	.00	.06	4.125E-02	40	8.039E-02	1.271E-02	.00	.28
			97.00	.0000	40	.0000	.0000	.00	.00	6.500E-03	40	3.363E-02	5.317E-03	.00	.21
			Total	2.000E-03	80	1.036E-02	1.158E-03	.00	.06	2.387E-02	80	6.367E-02	7.119E-03	.00	.28
	live	c	96.00	2.500E-02	20	5.587E-02	1.249E-02	.00	.20	.5110	20	.6921	.1547	.00	2.45
			97.00	1.400E-02	20	2.909E-02	6.505E-03	.00	.11	.5350	20	.6826	.1526	.00	2.56
			Total	1.950E-02	40	4.432E-02	7.007E-03	.00	.20	.5230	40	.6786	.1073	.00	2.56
		t	96.00	2.100E-02	20	3.523E-02	7.877E-03	.00	.13	.4330	20	.4165	9.313E-02	.00	1.56
			97.00	1.450E-02	20	3.137E-02	7.014E-03	.00	.13	1.6860	20	.9993	.2235	.21	3.97
			Total	1.775E-02	40	3.309E-02	5.232E-03	.00	.13	1.0595	40	.9867	.1560	.00	3.97
		Total	96.00	2.300E-02	40	4.614E-02	7.296E-03	.00	.20	.4720	40	.5651	8.936E-02	.00	2.45
			97.00	1.425E-02	40	2.986E-02	4.722E-03	.00	.13	1.1105	40	1.0263	.1623	.00	3.97
			Total	1.862E-02	80	3.887E-02	4.346E-03	.00	.20	.7913	80	.8837	9.880E-02	.00	3.97
	Total	c	96.00	1.500E-02	40	4.176E-02	6.602E-03	.00	.20	.2707	40	.5429	8.584E-02	.00	2.45
			97.00	7.000E-03	40	2.151E-02	3.401E-03	.00	.11	.2688	40	.5475	8.657E-02	.00	2.56
			Total	1.100E-02	80	3.325E-02	3.717E-03	.00	.20	.2698	80	.5417	6.057E-02	.00	2.56
		t	96.00	1.200E-02	40	2.785E-02	4.403E-03	.00	.13	.2425	40	.3548	5.610E-02	.00	1.56
			97.00	7.250E-03	40	2.309E-02	3.651E-03	.00	.13	.8483	40	1.0988	.1737	.00	3.97
			Total	9.625E-03	80	2.553E-02	2.854E-03	.00	.13	.5454	80	.8667	9.690E-02	.00	3.97
		Total	96.00	1.350E-02	80	3.530E-02	3.946E-03	.00	.20	.2566	80	.4559	5.097E-02	.00	2.45
			97.00	7.125E-03	80	2.217E-02	2.479E-03	.00	.13	.5585	80	.9105	.1018	.00	3.97
			Total	1.031E-02	160	2.955E-02	2.337E-03	.00	.20	.4076	160	.7336	5.799E-02	.00	3.97
Total	dead	c	96.00	9.117E-02	120	.3489	3.185E-02	.00	2.26	.1335	120	.5193	4.741E-02	.00	3.50
			97.00	.1343	120	.4774	4.358E-02	.00	3.34	.1184	120	.2763	2.522E-02	.00	1.88
			Total	.1128	240	.4178	2.697E-02	.00	3.34	.1260	240	.4152	2.680E-02	.00	3.50
		t	96.00	.2947	100	.8290	8.290E-02	.00	4.22	.1359	100	.3155	3.155E-02	.00	1.53
			97.00	.2218	120	.6050	5.523E-02	.00	3.62	.1890	120	.4674	4.266E-02	.00	2.14
			Total	.2550	220	.7147	4.819E-02	.00	4.22	.1649	220	.4054	2.734E-02	.00	2.14
		Total	96.00	.1837	220	.6222	4.195E-02	.00	4.22	.1346	220	.4377	2.951E-02	.00	3.50
			97.00	.1781	240	.5456	3.522E-02	.00	3.62	.1537	240	.3847	2.483E-02	.00	2.14
			Total	.1808	460	.5828	2.717E-02	.00	4.22	.1446	460	.4106	1.914E-02	.00	3.50

Basal and Canopy Cover

				BSL_PCT						CNPY_PCT					
FORM	STATE	WTRSHD	YR	Mean	N	Std. Deviation	Std. Error of Mean	Minimum	Maximum	Mean	N	Std. Deviation	Std. Error of Mean	Minimum	Maximum
Total	live	c	96.00	11.1559	180	19.9098	1.4840	.00	75.13	6.0499	180	14.0783	1.0493	.00	80.76
			97.00	10.7433	180	18.9940	1.4157	.00	65.51	6.3678	180	13.4208	1.0003	.00	69.37
			Total	10.9496	360	19.4313	1.0241	.00	75.13	6.2088	360	13.7352	.7239	.00	80.76
		t	96.00	10.9471	180	19.9237	1.4850	.00	74.60	4.9022	180	11.2672	.8398	.00	54.29
			97.00	10.9806	180	20.0106	1.4915	.00	72.03	7.2850	179	9.9315	.7423	.00	44.14
			Total	10.9638	360	19.9394	1.0509	.00	74.60	6.0903	359	10.6743	.5634	.00	54.29
		Total	96.00	11.0515	360	19.8893	1.0483	.00	75.13	5.4761	360	12.7456	.6718	.00	80.76
			97.00	10.8619	360	19.4821	1.0268	.00	72.03	6.8251	359	11.8031	.6229	.00	69.37
			Total	10.9567	720	19.6733	.7332	.00	75.13	6.1496	719	12.2940	.4585	.00	80.76
	Total	c	96.00	6.7300	300	16.3352	.9431	.00	75.13	3.6833	300	11.2778	.6511	.00	80.76
			97.00	6.4997	300	15.5941	.9003	.00	65.51	3.8680	300	10.8289	.6252	.00	69.37
			Total	6.6149	600	15.9560	.6514	.00	75.13	3.7757	600	11.0468	.4510	.00	80.76
		t	96.00	7.1427	280	16.7650	1.0019	.00	74.60	3.2000	280	9.3123	.5565	.00	54.29
			97.00	6.6771	300	16.3627	.9447	.00	72.03	4.4371	299	8.4346	.4878	.00	44.14
			Total	6.9018	580	16.5455	.6870	.00	74.60	3.8388	579	8.8837	.3692	.00	54.29
		Total	96.00	6.9292	580	16.5311	.6864	.00	75.13	3.4500	580	10.3695	.4306	.00	80.76
			97.00	6.5884	600	15.9699	.6520	.00	72.03	4.1521	599	9.7039	.3965	.00	69.37
			Total	6.7559	1180	16.2422	.4728	.00	75.13	3.8067	1179	10.0387	.2924	.00	80.76

Report

Biomass Fall 1997

FORM	Watershed	Mean	N	Std. Deviation	Std. Error of Mean	Minimum	Maximum
Forb	control	66.1583	20	35.1168	7.8523	7.17	126.13
	treatment	305.1100	20	253.7452	56.7392	13.07	1024.90
	Total	185.6342	40	215.8915	34.1354	7.17	1024.90
Grass	control	43.4517	20	48.9610	10.9480	1.03	173.10
	treatment	78.4467	20	96.9835	21.6862	.53	350.90
	Total	60.9492	40	77.8728	12.3128	.53	350.90
Total	control	54.8050	40	43.5987	6.8936	1.03	173.10
	treatment	191.7783	40	221.6384	35.0441	.53	1024.90
	Total	123.2917	80	173.0291	19.3452	.53	1024.90

Report

TRRMEAN

SPECIES	LOCATION	Mean	N	Std. Deviation	Std. Error of Mean	Minimum	Maximum
arlo	c	.3450	20	.9729	.2176	.00	4.20
	t	.8917	20	3.9877	.8917	.00	17.83
	Total	.6183	40	2.8783	.4551	.00	17.83
arsp	c	3.333E-02	20	.1491	3.333E-02	.00	.67
	Total	3.333E-02	20	.1491	3.333E-02	.00	.67
asmu	c	9.167E-02	20	.4099	9.167E-02	.00	1.83
	t	.7850	20	1.9759	.4418	.00	6.93
	Total	.4383	40	1.4516	.2295	.00	6.93
badi	c	24.5983	20	28.0036	6.2618	.00	117.87
	t	115.0400	20	147.4919	32.9802	.00	498.17
	Total	69.8192	40	114.3566	18.0814	.00	498.17
boer	c	4.000E-02	20	.1789	4.000E-02	.00	.80
	Total	4.000E-02	20	.1789	4.000E-02	.00	.80
bogr	c	20.7617	20	43.2945	9.6809	.00	172.80
	t	24.7000	20	23.5453	5.2649	.00	68.90
	Total	22.7308	40	34.4563	5.4480	.00	172.80
brte	c	.1350	20	.6037	.1350	.00	2.70
	Total	.1350	20	.6037	.1350	.00	2.70
chal	c	7.333E-02	20	.1795	4.015E-02	.00	.77
	t	4.9967	20	14.3776	3.2149	.00	61.60
	Total	2.5350	40	10.3411	1.6351	.00	61.60
doug	c	7.833E-02	20	.3503	7.833E-02	.00	1.57
	Total	7.833E-02	20	.3503	7.833E-02	.00	1.57
erdi	t	1.9217	20	8.5940	1.9217	.00	38.43
	Total	1.9217	20	8.5940	1.9217	.00	38.43
eufe	c	.2200	20	.6487	.1450	.00	2.67
	t	1.4617	20	4.4725	1.0001	.00	19.97
	Total	.8408	40	3.2164	.5086	.00	19.97
eusp	c	.1200	20	.4622	.1033	.00	2.07
	t	9.167E-02	20	.1876	4.195E-02	.00	.73
	Total	.1058	40	.3485	5.509E-02	.00	2.07
forb1	c	.2300	20	1.0130	.2265	.00	4.53
	Total	.2300	20	1.0130	.2265	.00	4.53
greg	c	.5850	20	2.6162	.5850	.00	11.70
	t	.3800	20	1.1768	.2631	.00	4.20
	Total	.4825	40	2.0050	.3170	.00	11.70
ipag	t	.7717	20	3.4510	.7717	.00	15.43
	Total	.7717	20	3.4510	.7717	.00	15.43
iplo	c	1.6817	20	3.6543	.8171	.00	14.50
	t	.6750	20	2.5997	.5813	.00	11.57
	Total	1.1783	40	3.1715	.5015	.00	14.50
kocr	c	.8733	20	2.3251	.5199	.00	9.10
	t	4.500E-02	20	.1468	3.283E-02	.00	.60
	Total	.4592	40	1.6793	.2655	.00	9.10
liri	c	4.333E-02	20	.1590	3.555E-02	.00	.70
	Total	4.333E-02	20	.1590	3.555E-02	.00	.70
lowr	c	25.9750	20	24.6789	5.5184	.00	94.43
	t	104.4717	20	112.9114	25.2478	.23	442.87
	Total	65.2233	40	89.9316	14.2194	.00	442.87

Report

TRRMEAN

SPECIES	LOCATION	Mean	N	Std. Deviation	Std. Error of Mean	Minimum	Maximum
luki	c	8.0683	20	10.8860	2.4342	.00	34.80
	t	33.8067	20	41.0278	9.1741	.00	107.17
	Total	20.9375	40	32.3675	5.1178	.00	107.17
lyph	t	1.2267	20	5.4858	1.2267	.00	24.53
	Total	1.2267	20	5.4858	1.2267	.00	24.53
mesp	t	2.833E-02	20	.1267	2.833E-02	.00	.57
	Total	2.833E-02	20	.1267	2.833E-02	.00	.57
mumi	c	1.667E-03	20	7.454E-03	1.667E-03	.00	.03
	Total	1.667E-03	20	7.454E-03	1.667E-03	.00	.03
mumo	c	5.2883	20	11.4440	2.5590	.00	45.90
	t	7.2683	20	23.6310	5.2841	.00	99.00
	Total	6.2783	40	18.3538	2.9020	.00	99.00
ormi	c	1.000E-02	20	3.078E-02	6.882E-03	.00	.13
	t	.4083	20	1.4813	.3312	.00	6.50
	Total	.2092	40	1.0537	.1666	.00	6.50
pofe	c	2.7033	20	5.0177	1.1220	.00	18.47
	t	6.2700	20	22.4667	5.0237	.00	100.63
	Total	4.4867	40	16.1689	2.5565	.00	100.63
scsc	c	22.1000	10	38.8287	12.2787	.17	127.87
	t	33.5783	20	74.3289	16.6204	.00	257.80
	Total	29.7522	30	64.1706	11.7159	.00	257.80
sesp	t	.2217	20	.9913	.2217	.00	4.43
	Total	.2217	20	.9913	.2217	.00	4.43
sihy	c	.2067	20	.6999	.1565	.00	2.97
	t	2.7083	20	5.8987	1.3190	.00	19.50
	Total	1.4575	40	4.3353	.6855	.00	19.50
sili	c	1.4183	20	5.6012	1.2525	.00	25.00
	t	9.0900	20	38.0019	8.4975	.00	170.43
	Total	5.2542	40	27.0912	4.2835	.00	170.43
spcr	c	1.9867	20	7.5861	1.6963	.00	34.13
	t	2.5767	20	5.5091	1.2319	.00	18.87
	Total	2.2817	40	6.5508	1.0358	.00	34.13
stco	c	1.667E-02	20	7.454E-02	1.667E-02	.00	.33
	Total	1.667E-02	20	7.454E-02	1.667E-02	.00	.33
tina	t	1.5233	20	5.8405	1.3060	.00	25.97
	Total	1.5233	20	5.8405	1.3060	.00	25.97
veth	c	2.9750	20	10.8722	2.4311	.00	48.67
	t	28.6183	20	109.2528	24.4297	.00	488.97
	Total	15.7967	40	77.7255	12.2895	.00	488.97
Total	c	3.9858	550	14.6682	.6255	.00	172.80
	t	14.7522	520	54.3799	2.3847	.00	498.17
	Total	9.2181	1070	39.6886	1.2133	.00	498.17