Melynda K. May. PATTERN AND PROCESS OF HEADWARD EROSION IN SALT MARSH TIDAL CREEKS. (Under the direction of Mark M. Brinson) Department of Biology. December 2002.

Under conditions of rising sea level and low sedimentation rates, tidal creeks erode headward. I described the physical, soil, and vegetation characteristics from tidal creek channels to the upland boundary of marshes. Based on the variability in this pattern, I identified three tidal creek classes that were statistically verified using discriminant function analysis. Creek class appears to be determined by the presence and thickness of an organic rich layer in the marsh. Creeks eroding into thick organic rich deposits were classified as strong wasting terrace (ST) creeks. ST creeks were generally found in marshes with poor drainage due to the low slope of the marsh surface. The low slope may have allowed water to pond on the surface of the marsh creating the persistent anoxic conditions needed to accumulate organic matter. ST creeks probably erode headward at a relatively high rate. Creeks eroding into thin organic rich deposits were classified as weak wasting terrace (WT) creeks, and were generally found in marshes with an intermediate slope and likely an intermediate drainage regime. WT creeks probably erode headward at an intermediate rate. Creeks eroding into marshes with no organic rich deposits were classified as no wasting terrace (NT) creeks. NT creeks were generally found in marshes with relatively good drainage due to the high slope of the marsh surface. NT creeks probably erode headward at a relatively slow rate. Slope appears to be the master variable in control of the pattern and process of headwater erosion. I also suggest an explanation that resolves the dual observations of high

sedimentation rates near tidal creeks and the erosion (lengthening and widening) of tidal creeks.

PATTERN AND PROCESS OF
HEADWARD EROSION
IN SALT MARSH TIDAL CREEKS

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PATTERN AND PROCESS OF

HEADWARD EROSION

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1. Introduction

Tidal creeks play an important role in the hydrodynamics of tidal salt marshes by increasing drainage and flooding in their zone of hydrologic influence. Plant communities occur in distinct zones in salt marshes, and the location of these zones is determined by a variety of factors including distance from a tidal creek and frequency of flooding, salinity, redox, biotic interactions between plants, and physical disturbance (Adams 1963, Bertness and Ellison 1987, Bertness 1991, Pennings and Callaway 1992, Bertness and Hacker 1994, Hacker and Bertness 1995, Brewer et al. 1999). However, Sanderson et al. (2001) found that they could accurately predict the spatial distribution of 10 marsh species based on the distance from a tidal creek, and the stream order and length of that tidal creek. This suggests that tidal creeks play a primary role in determining the zonation of salt marsh plant communities.

Near tidal creeks, marshes are flooded more frequently, and this zone is vegetated by tall form *Spartina alterniflora* Liosel.in US Atlantic Coast salt marshes (Radford et al. 1968). Farther from the tidal creek, short form *S. alterniflora* vegetates the marsh surface, and at greater distances other halophytes such as *Spartina patens* (Aiton) Muhl. and *Distichlis spicata* Greene can also be found (Radford et al. 1968). As tidal creeks migrate headward in response to rising sea level, the vegetation that characterizes these zones migrates inland in a process known as ecosystem state change (Hayden et al. 1991, Hayden et al. 1995, Brinson et al. 1995, Scheffer et al. 2001).

Ecosystem state change occurs when one ecosystem is replaced by another due to changes in the physical environment such as those caused by climate change (Hayden 1991). This differs from succession, exemplified by old field succession, in which disturbance can cause changes in species composition of forests, but the climax community remains unchanged (Bonck and Penfound 1945, Odum 1960).

Changes in state of tidal marshes may be facilitated by disturbance events such as wrack deposition (Reidenbaugh and Banta 1980, Tolley and Christian 1999) and trampling (Keusenkothen 2002). Paleoecological studies indicate that state change has occurred over large scales in response to past climate changes such as north-south fluctuations of forests in response glacial and interglacial periods (Davis 1981, Woodward 1992, Kullman 2001, Walther et al. 2002) and landward-seaward fluctuations in coastal ecosystems due to oscillations in sea level (Redfield 1972, Orson et al. 1985, Orson et al. 1998, Gajewski et al. 2002). Accordingly, recent shifts along ecological boundaries have been attributed to modern climate change (Kullman 2001, Sturm 2001, Walther et al. 2002).

Rising sea level is considered to be a major cause of landward movement of salt marsh zones and headward movements of tidal creeks. Over the past 3000 years, sea level rise has averaged 0.1-0.2 mm/year, but in the 20th century the rate of sea level rise has increased to 1.0-2.0 mm/year (Antonioli 1996, Lambeck and Bard 2000). Titus (1987) studied the effect of sea level rise on coastal salt marshes and predicted that approximately 80 percent of coastal salt marshes would be lost by 2100 if sea level rose 0.50-2.00 m, and marsh accretion is constant at about 4.0-6.0 mm per year. More recently, Church et al. (2001) predict that sea level could rise between 0.11 and 0.77 m between 1990 and 2100, but the authors suggest a rise of 0.49 m as the best estimate.

The loss or gain of salt marsh under conditions of rising sea level is determined by a marsh's capability to migrate horizontally onto land surfaces at a higher elevation (transgression), and to increase its vertical position at a rate no less than the vertical rate of sea level rise (Delaune et al. 1983, Day et al. 2000). Areas with a gently sloping land surface between the coast and inland areas provide a better opportunity than steep coastlines for marshes to transgress inland in response to rising sea level (Brinson et al. 1995, Moorhead and Brinson 1995, Ricker 1999).

Mashes subside when the vertical position of the marsh is descending in relation to sea level, or accretion occurs if the vertical position is rising. The vertical position of a marsh is determined by the net accumulation or erosion of sediment, the net accumulation or loss of organic matter, and the vertical movements of the land itself (Howes et al. 1981). Vegetation on the marsh surface reduces local current velocities, thus trapping inorganic sediment supplied by rivers or by reworked marine deposits (Wood et al. 1989, Callaway et al. 1997, Roman et al. 1997, Orson et al 1998, Christiansen et al. 2000). Large accretion events may occur during storms when sediment is resuspended from the estuary bottom or eroded from the marsh-sea boundary by waves and deposited on the marsh surface (Reed 1988, Goodbred and Hine 1995, Leonard et al. 1995).

Inorganic sediment supply can also influence a marsh's ability to accrete organic material by providing nutrients to the marsh, which helps maintain high productivity of plant biomass (Nyman et al. 1993). However, both organic and inorganic accumulations eventually compress under their own weight, reducing some of the vertical gains brought by accretion (Kaye and Barghoorn 1964, Bradley and Morris 1990, Cahoon et al. 1995). The strata underlying salt marshes may also undergo vertical movements. Areas that were glaciated during the Pleistocene are now rebounding upwards, while river dominated coasts such as the Mississippi delta are subsiding (Cahoon and Turner 1989, Douglas 1997).

Transgression and the loss of salt marsh at the marsh-sea boundary has been extensively documented along the Gulf and Atlantic coasts of the US and Canada (Salinas et al. 1986, Reed 1988, Gardener et al. 1992, Kastler and Wiberg 1996, Robichaud and Begin 1997). Donnelly and Bertness (2001) found that the boundary between high and low marsh in a Rhode Island salt marsh had rapidly moved landward between 1995 and 1998 in response to increased inundation as a result of recent accelerated sea level rise in the area. Kastler and Wiberg (1996) found that mainland marshes on the Eastern Shore of Virginia increased in area by 8.2%, from 1938 to 1990, largely due to the encroachment of salt marsh vegetation into areas previously occupied by upland forests. The landward retreat of the marsh-ocean boundary was minor by comparison (Knowlton 1971).

The capacity for transgression on the Eastern Shore of Virginia is supported by measurements of long-term accretion rates ranging from 0.9-2.1 mm/year in a Virginia marsh (Kastler and Wiberg 1996). Average sea-level rise is 2.8 - 4.2 mm per year along the Eastern Shore of Virginia; thus, the current rate of accretion is insufficient for the marshes to maintain their current position in the landscape, and these marshes transgress inland in response to rising sea level (Oertel et al. 1989, Hayden et al. 1995). As sea level rises, the marsh-upland transition is more frequently inundated during extreme high tides. Eventually the transitional upland species occupying this space succumb to salt stress and the area once occupied by the transitional vegetation is overtaken by marsh halophytes.

Expansion of tidal creek networks occurs rapidly in developing marshes where sediment supplies are high and the marsh expands outward into the lagoon in a process known as progradation (Redfield 1972, Shi et al. 1995). Shi et al. (1995) found that storm surges, salt marsh vegetation, sea level fluctuations, slope, sediment composition of creek banks, sediment supply, and sediment transport influenced the formation of tidal creek networks. In developing marshes, tidal creeks rapidly form over intertidal surfaces on the newly deposited sediments (Zeff 1988). The channels are eventually stabilized as vegetation is established on banks of the creeks (Garofalo 1980). Headward erosion of tidal creeks also occurs in mature marshes in response to rising sea level.

Knighton et al. (1992) have studied the evolution of tidal creeks in the Mary River estuary, Australia. Since two creeks breached a chenier ridge in the 1930’s, headward erosion of tidal creeks has occurred at a rate of 0.5 km/year. This rapid development was attributed to the large tidal range in the area (5-6 m), extremely low slope, and the existence of paleochannels. The lower portions of the marsh experience flood tides much sooner than the upper portions of the marsh, but water continues too drain off of the upper portions of the marsh when the low marsh is experiencing the beginning of flood tide (Boon 1975). It was during the prolonged ebb tides in the upper portions of the marsh that channels began to develop (Knighton et al. 1992). Channels were created at the distal ends of existing channels when diffuse flow off the marsh surface became concentrated until small channels were formed and incised (Mulrennan and Woodroffe 1998). Although the development of this tidal creek drainage system is not driven by rising sea level, it may provide a good model of how tidal creeks erode headward.

Worldwide, salt marshes can be divided into three major ecological zones – low, mid, and high marsh – defined by frequency of tidal flooding (Packham and Willis 1997). Low marshes are flooded daily during high tide, and are generally vegetated by monospecific stands of *S. alterniflora* along the east coasts of temperate North America. High marshes are flooded less regularly and are vegetated by *S. patens* and *D. spicata*. The mid marsh is vegetated by a mixture of the high and low marsh vegetation. Tidal creeks may be present in the low, mid, or high marsh, and the local effects of their hydrologic influence support species found in more frequently flooded conditions than would normally be found in that area.

The objective of this study was to describe the pattern of transgression from the tidal creek channel to the upland boundary of marshes on the Eastern Shore of Virginia. I identified 5 distinct zones, and then used space as a surrogate for time (chronosequence) to describe the changes that occur in the marsh as one zone is replaced by another during transgression (Brinson et al. 1995). Based on the variations of this pattern I identified three tidal creek classes, and discussed the relative rate of headward erosion in each of the three creek classes. Finally, I discussed the sedimentation characteristics of tidal creeks and suggested an explanation that may resolve the dual observations of high sedimentation rates near tidal creeks and erosion (lengthening and widening) of tidal creeks.

2. Methods

2.1 Site Description

The VCR-LTER megasite is a coastal lagoon complex of temperate salt marsh and barrier islands on the Atlantic side of Virginia's Eastern Shore. The study area includes the mainland fringing marshes of the VCR-LTER from the southerly Cushman's Landing Marsh (37^{o} 10' N, 75^{o} 56' W) near Magotha, VA to Kegotank Marsh (37^{o} 47' N, 75^{o} 33' W) near Modest Town, VA in the north (Figure 2.1). The distance between these two marshes covers approximately 100 km of coastline, within Northampton and Accomac counties.

The mainland marshes exist on a base layer of clay and sand that was forested during the Pleistocene when sea level was much lower. In especially poorly drained areas, peat deposits have formed upon this base layer. Two soil series are found in the mainland marshes, Chincoteague and Magotha, which are very poorly drained and poorly drained, respectively (Edmonds et al. 1985, Edmonds et al. 1990).

The tidal amplitude within the VCR-LTER megasite is approximately 1.25 m, and varies little across the study area (Oertel et al. 1989). Highly sinuous tidal creeks allow seawater to enter and exit the salt marsh in response to tides. On the Atlantic Coast of the US, low marshes lie between open water and mean high water (MHW) and are vegetated by tall form (taller than 50 cm) *S. alterniflora*. Mid-marshes lie at an elevation between MHW and mean high water at spring tide (MHWS), and are vegetated by tall and short form (less than 50 cm) *S. alterniflora.* High marshes are primarily vegetated by a

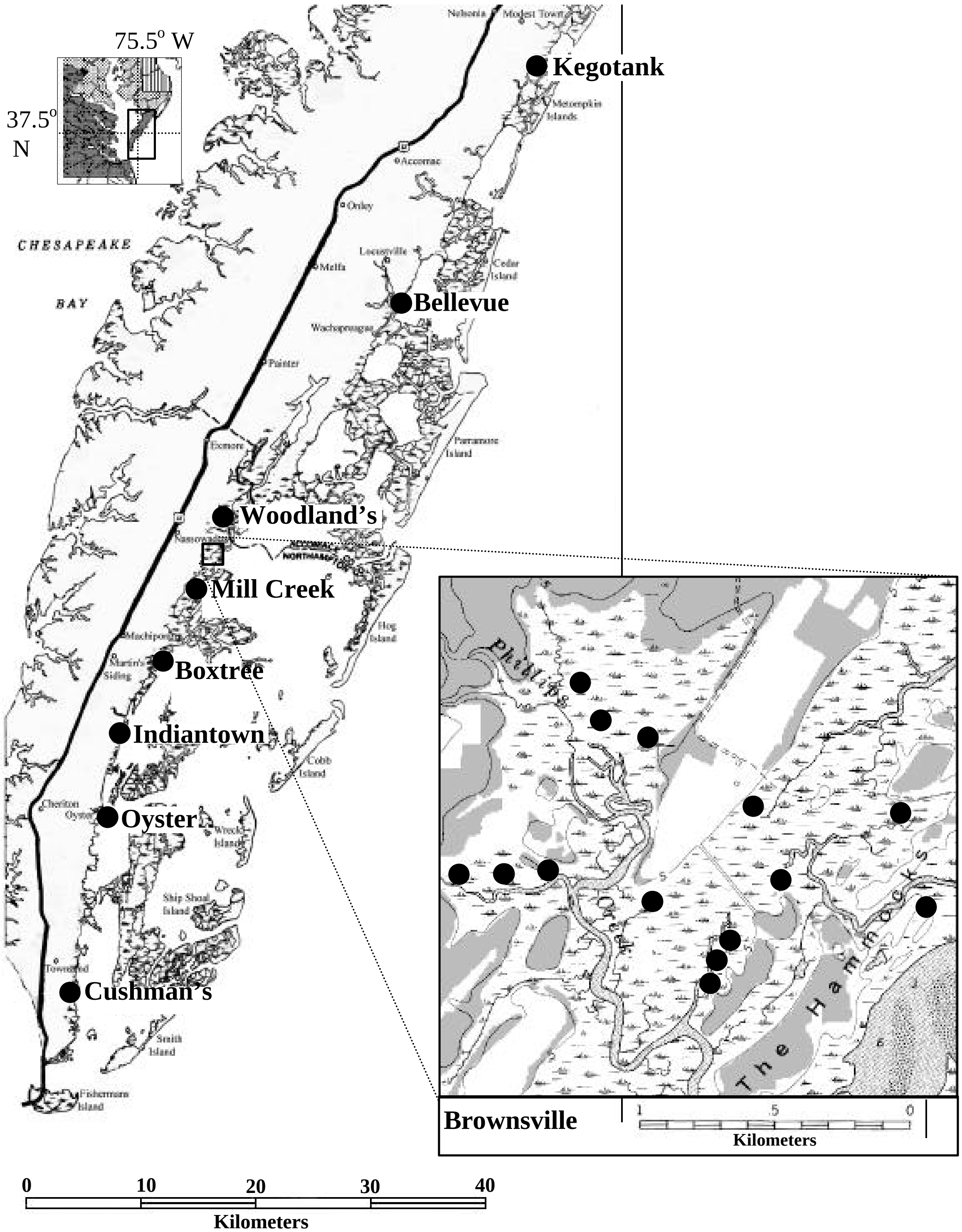


Figure 2.1. Study sites located in the VCR LTER, Eastern Shore, Virginia. Large map USGS Chincoteague, VA.; MD. 1984, inset is USGS Nassawodax Quad. VA, 1968.

mixture of *D. spicata*, *S. patens*, and in some areas *Juncus roemerianus*. High marshes occur at an elevation above MHWS, and are generally located above MHWS, is vegetated by salt marsh-forest transition species that can withstand occasional inundation by salt water during storms. *Iva frutescens*, *Baccharis halimifolia* L., *Borrichia frutescens* (L.) DC., *Myrica cerifera* L., a mixture of live trees and dead snags of *Juniperus virginiana* L., and *Pinus taeda* L. are common in the upper part of the high marsh and adjacent forest (Appolone 2000, Radford et al. 1968).

2.2 Creek Zones

I identified five zones around a tidal creek head extending from the creek channel to the upland boundary to describe the changes that occur around tidal creeks during ecosystem state change. The five creek zones extended from the edge of the creek channel to the edge of the salt marsh where salt marsh-forest transitional species such as *Iva frutescens* or *Phragmites australis* were found. These zones were named (1) basin, which was vegetated by tall from *S. alterniflora*, (2) transition, which was an erosional scarp thinly vegetated by tall and short form *S. alterniflora*, (3) front terrace, which was vegetated by short form *S. alterniflora*, (4) back terrace, which is vegetated by high marsh grasses *S. alterniflora* or a mixture of *S. alterniflora* and *Salicornia* spp., and (5) upland boundary, which was vegetated by transitional forest species such as *Iva frutescens* (L.) DC., *Scirpus robustus* Pursh, and *Phragmites australis* (Cav.) Trin (Radford et al. 1968) (Figure 2.2). The transition zone and upland boundary were

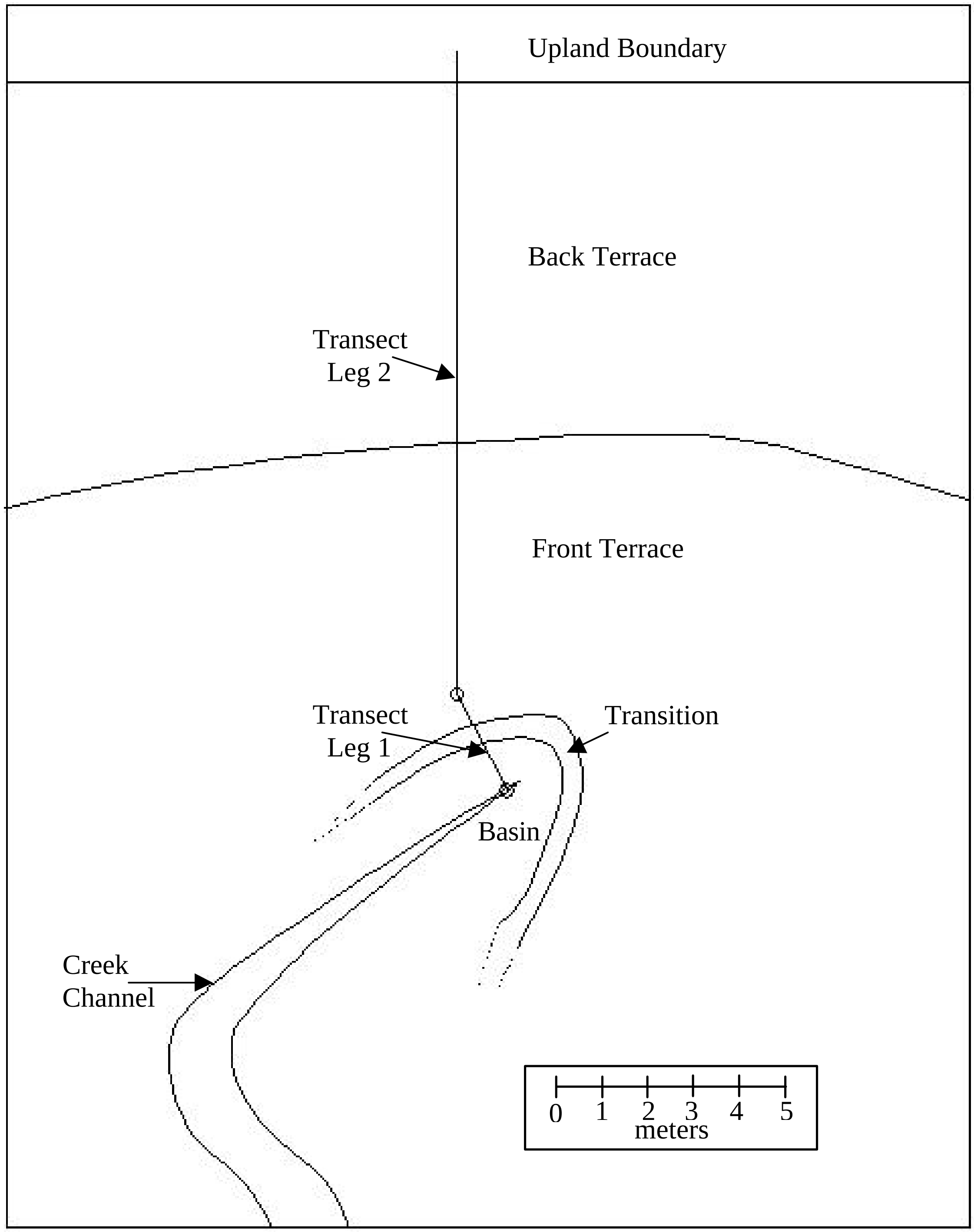


Figure 2.2. Aerial diagram of creek classes and placement of transect legs 1 and 2.

identified at all 23 sites, but some creeks did not have one or two of the following zones present: basin, front terrace, and back terrace.

The basin zone was located closest to the creek, had a gentle to steep slope, and was usually vegetated with tall form *S. alterniflora*, although vegetation was absent in some cases. Fiddler crabs and their burrows were often seen in the sediment.

The transition zone was an erosional feature located between the low elevation of the basin zone and the higher elevation of the front terrace (Figure 2.3). The morphology of the transition zone had a variety of forms ranging from creeks having little evidence of erosion to those with obvious erosional features such as erosional holes in the marsh surface and undercutting of sod. In all cases the transition zone was distinguished by its steep slope and low density of vegetation compared to the adjacent front terrace. Holes were present in the soil of the transition zone at all of the sites.

The front terrace had a very gentle slope and was vegetated by short form *S. alterniflora*. Fiddler crab burrows were commonly found in the soil surface. The slope of the back terrace was also generally low but species diversity was relatively high including *S. alterniflora*, *D. spicata*, and *S. patens*. Small fiddler crab burrows were commonly found in this zone. The upland boundary was generally vegetated by a mixture of high marsh grasses such as *D. spicata* and *S. patens* as well as transitional upland species such as *I. frutescens* and *P. australis.*

The basin-transition boundary was determined by the absence of large holes in the sediment surface and higher density of plants in the basin zone compared to transition zone itself, which had large holes in the sediment surface and a low density of plants.

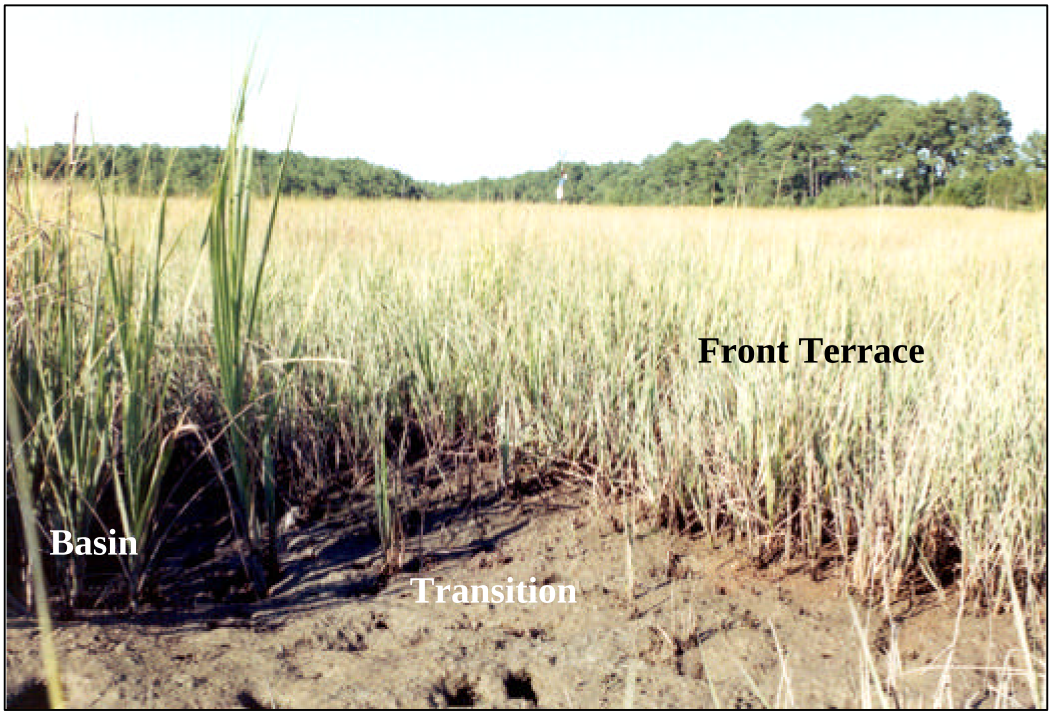


Figure 2.3. Photo of the basin, transition, and front terrace zones in an strong wasting terrace creek.

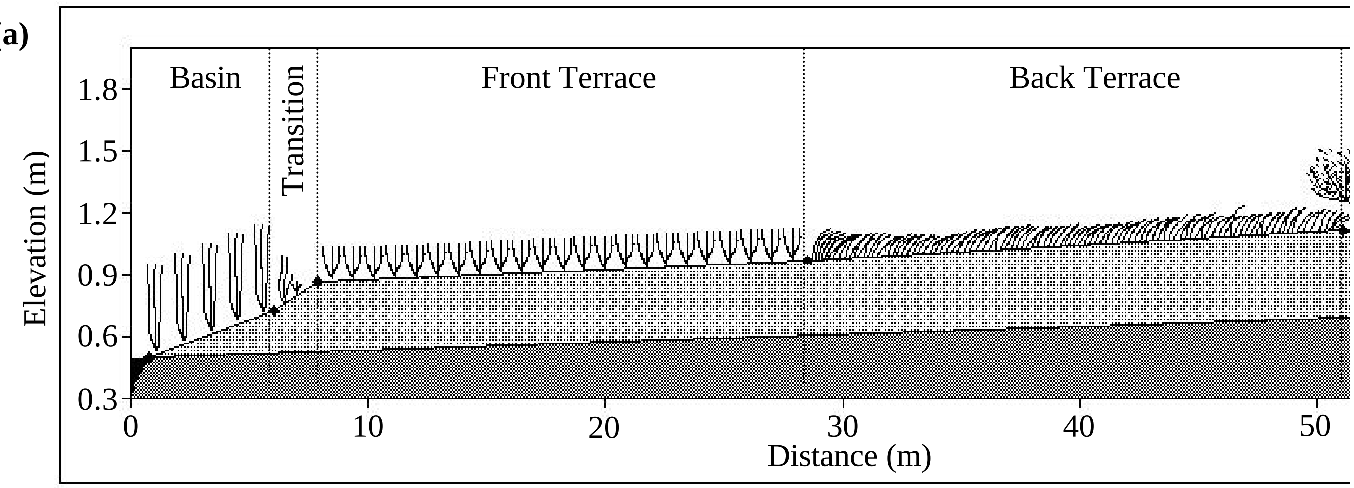
The transition-front terrace boundary was defined where the steep slope of the transition gives way to the more gently sloping front terrace. (Steep and gentle slopes were confirmed to differ in slope: 0.01 – 0.21 and 0.00 – 0.01, respectively.) The front terrace-back terrace boundary was defined by species composition or vegetation height. The front terrace was vegetated solely by *S. alterniflora*, while the back terrace was designated at the point where additional species were found, or where the average maximum *S. alterniflora* height decreased by 15cm or more over a distance of less than 5 m. The back terrace-upland boundary boundary was also defined by vegetation. The upland boundary was designated by the presence of transitional species such as *I. frutescens* and *P. australis.*

The five zones were then used to infer the chronological sequence of events involved in state change by using describing the changes in soil and vegetation that occur as tidal creeks erodes headward. In this chronosequence, the upland boundary becomes the back terrace, the back terrace becomes front terrace, the front terrace becomes transition, the transition becomes the basin, and the basin is finally converted to the creek channel.

2.3 Creek Classes

The headward erosion of tidal creeks takes place in the transition zone, but the erosional features present in the transition zone vary among creeks. I used these variations in the shape of the transition zone to visually identify three creek classes called strong wasting terrace, weak wasting terrace, and no wasting terrace (Figure 2.4). Creeks

(a)



(b)

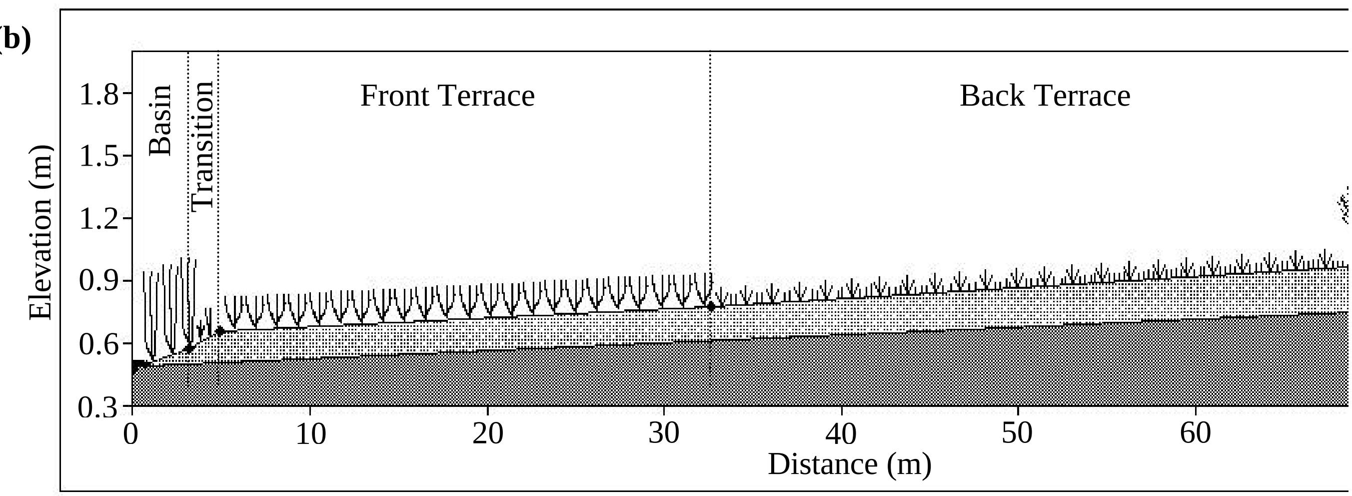


Figure 2.4. Diagram of vegetation and soil characteristics for each of the creek classes. (a) Strong wasting terrace creek, (b) Weak wasting terrace creek, (c) No wasting terrace creek.

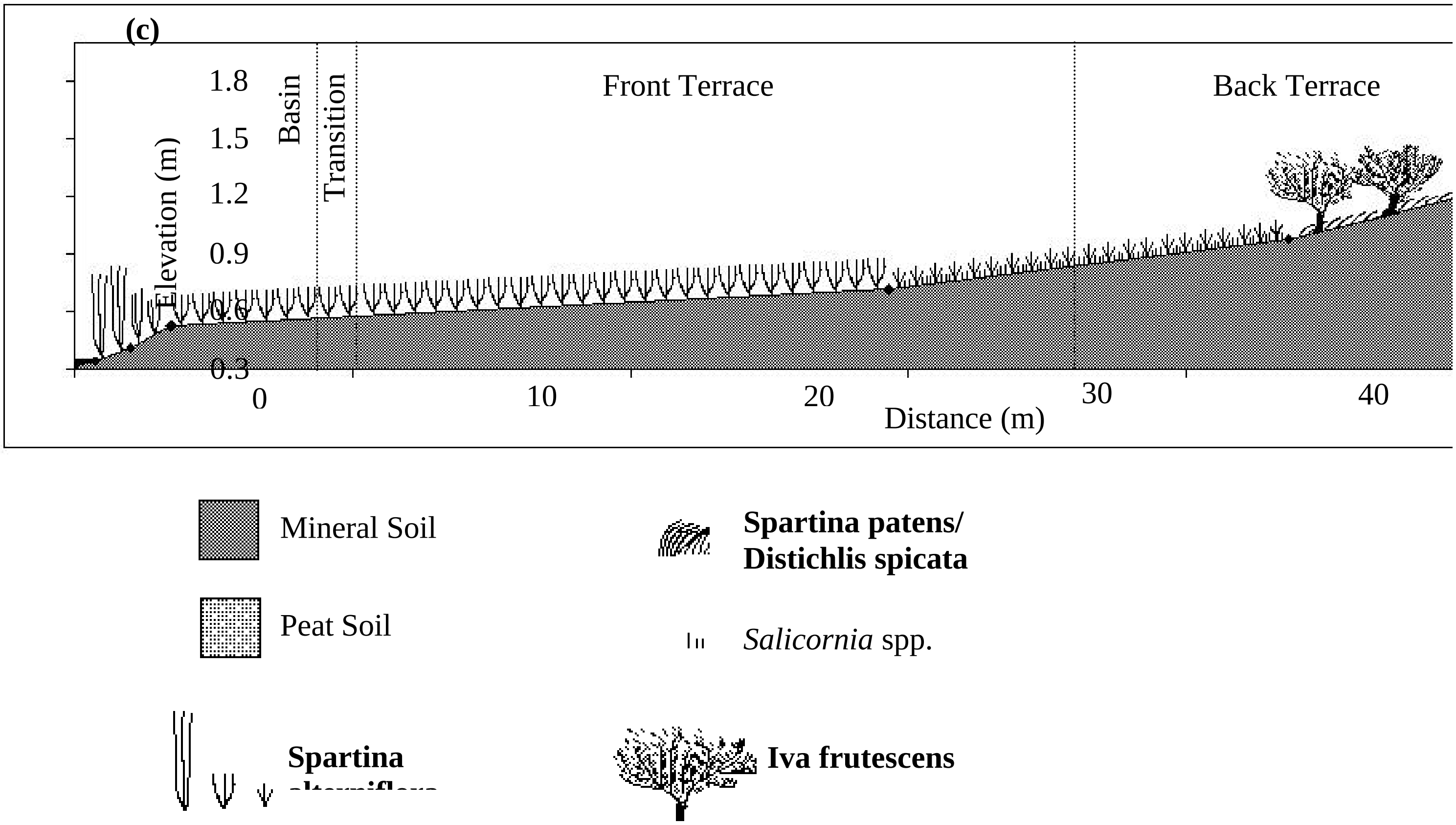


Figure 2.4. Completed.

with a strong wasting terrace (ST) had the most obvious erosional features of the three creek classes, and occurred in areas with relatively thick deposits of organic rich soil (at least 10 cm in depth). The transition zone of these creeks had a steep slope (at least 0.05) and a large drop in elevation of the marsh surface (at least 15 cm). Additionally, the transition zone of creeks in this class showed distinct erosional features including large holes (at least 5 cm in diameter) in the sediment surface that were coalescing, and in extreme cases there was undercutting and slumping of sod (Chapman 1960). The vegetation found in the transition zone was a low-density mixture of dead and dying plants that were left over from when the area was part of the front terrace, and tall form *S. alterniflora* that colonized the area from the basin zone.

Creeks with a weak wasting terrace (WT) had more subtle erosional features, and occurred in areas with a thin deposit of organic rich soil or overlying root mat (less than 10 cm deep). The transition zone of these creeks did not have a steep slope (0.01-0.11), and the drop in elevation of the marsh surface (less than 15 cm) was the lowest of the three creek classes. Instead, the transition zone appeared as an eroding fringe where the root mat that covered the terrace zones began to break apart. Large holes (at least 5 cm in diameter) were often seen in the sediment surface where the root mat was eroding and these holes began to coalesce at the fringe. The vegetation found in the transition zone was low in density or absent and was a mixture of dead and dying plants that were left over from when the area was part of the front terrace, and tall from *S. alterniflora* that colonized the area from the basin zone.

Creeks with no wasting terrace (NT) had no visible erosional features and occurred in areas with mineral soils. The transition zone of these creeks had a steep to gentle slope (0.01- 0.18) and the drop in elevation was also quite variable. Holes associated with fiddler crabs were often seen in the sediment surface, but the larger erosional holes seen in the ST and WT creeks were absent. The density of vegetation was often low compared to the adjacent front terrace and basin zones, and the height and apparent health of the plants was uniform throughout the transition zone.

2.4 Sampling Location and Methods

Twenty-three tidal creeks were surveyed within 9 marshes owned by The Nature Conservancy to investigate the changes in elevation, vegetation, and soil that occur when tidal creeks erode headward. Fifteen of the 23 creeks sampled were located in the Brownville Marsh area (Figure 2.1), and the remaining 8 creeks were located in marshes north (Woodlands, Bellevue, and Kegotank) and south (Mill Creek Marsh, Box Tree, Indiantown, Oyster, and Cushman's Landing) of Brownsville. A hinged transect was established for each creek by placing 3 PVC pipes into the marsh surface (Figure 2.2). The first pipe was placed in the center of the creek channel at the most headward point identifiable. The second pipe was placed in the front terrace zone, approximately 2-5 m from the transition-front terrace boundary, and this pipe was designated as the hinge of the transect. The third PVC pipe was placed in the upland boundary (defined by transitional brackish species such as *I. frutescens* and *P. australis*) at the point closest to second PVC pipe. Leg one of the transect was established between the first and second

PVC pipes, and leg two of the transect was established between the second and third PVC pipes (Figure 2.2).

The first leg of the transect was sampled at a greater frequency than section two because the changes in elevation, vegetation, and soil, occurred over a much smaller distance. The second leg was more homogeneous and thus sampled less frequently (Smartt 1978).

2.4.1 Elevation and Slope

Relative elevation was sampled along the transects using a stadia rod and laser level, at 0.25 m intervals in the first leg and at 1.0-5.0 m intervals in second leg, depending on marsh heterogeneity; flat areas were sampled less frequently than sloping areas. The slope was calculated between each measurement of elevation along the transect. The slope for each creek zone was calculated by averaging all measurements of slope in that zone. Within Brownsville, a laser level was used to tie the elevations to benchmarks within the marsh (http://atlantic.evsc.virginia.edu/~crc7m/gps.html.). The vertical error for this method ranges from $\pm$ 1.0 – $\pm$25.0 mm, with higher errors occurring at sites located far from benchmarks (Topcon 1998).

For sites north and south of Brownsville, relative elevations were converted to an absolute elevation above MSL using a Trimble 4000 SE GPS unit. Elevations above MSL are based on the vertical datum of the 1929 National Geodetic Survey. MSL was determined for the three most southern marshes (Indiantown, Oyster, and Cushman's Landing), from the high precision benchmark VCR1. Indiantown and Oyster are close to this benchmark, so the estimated vertical error was small, 2.46 mm and 1.86 mm, respectively. The vertical error for Cushman's Landing was 10.2 mm.

MSL for transects in Woodlands, Mill Creek, and Boxtree were tied to the permanent benchmark BRNV located in Brownsville marsh. The estimated vertical error for Woodland and Mill Creek were 1.89 mm and 1.67 mm, respectively. At Boxtree Marsh the PVC pipes demarking the transect were missing, so the position of the PVC was estimated. This increased the vertical error by an undetermined amount in addition to the known error of 1.58 mm.

Mean sea level for Bellevue and Kegotank was determined from an intermediate benchmark at Nickawampus farm, because these marshes were located too far from existing benchmarks for a single reading to be taken. The estimated vertical error for Kegotank and Bellevue was 17.89 mm and 4.39 mm, respectively; the use of a temporary benchmark increased the vertical error.

2.4.2 Holes and Vegetation

Holes in the marsh sediment were counted and their diameter was measured with calipers within a 0.25 m x 0.25 m quadrats. The quadrat was placed at 0.5 m intervals in leg one, and at 1.0-5.0 m intervals in leg two. The average maximum height of *S. alterniflora* and percent cover for each species present was measured within a 0.5 m x 0.5 m quadrat. The quadrat was placed at 1.0 m intervals in leg one, and at 1.0-5.0 m intervals in leg two. The average maximum height of *S. alterniflora* was calculated as an average of nine measurements within each quadrat. The quadrat was divided into nine equally sized cells and the tallest plant within each cell was measured with a meter stick. I will refer to average maximum height of *S. alterniflora* simply as *S. alterniflora* height throughout the rest of this paper.

2.4.3 Soil Collection and Analysis

A total of 117 soil cores, taken to >10.0 cm depth, were collected from 10 of the tidal creeks in Brownsville. Twelve cores were taken at each creeks except for a single creek where only nine cores were taken because the transect length was extremely short. Six of the total 12 cores at each site were taken without bias in the first leg of the transect, and the remaining cores taken, without bias, throughout the second leg. The elevation and position on the transect was recorded for each core. The cores were then capped and stored in a cold room at 3^{o} C in the aluminum tubes they were collected in until they could be analyzed.

Bulk density, percent total soil organic matter (SOM), and percent macro-organic matter (MOM), were determined for each core. Each soil core was extruded from the aluminum pipe, and then cut to 10 cm length (measured from the top). Any vegetation protruding above the surface of the core was removed with scissors. The core was then split in half lengthwise, and the two halves were made even by moving material back and forth until the two halves weighed within 2.0 g of each other. One half was dried at 70^{o} C and then analyzed for bulk density and SOM, while the other half was soaked in water for at least 24 hours, and analyzed for MOM.

Bulk density was determined by weighing the dried core and then dividing the dry mass by the volume of the sample. A rough estimate of the total volume was determined by calculating the volume of a 10.0 cm cylinder of soil with a diameter equal to inside of the aluminum tubes used to collect the cores. However, many of the cores were riddled with fiddler crab (*Ucu* spp.) burrows, which reduces the actual volume of soil in the core. This caused the bulk density of the remaining soil to be underestimated. The volume occupied by the holes in each core was estimated using the information on hole density and diameter collected along the transects. If the core was collected at the same position along the transect as the measurements of holes, then the hole density measured in the area of the quadrat was used to estimate the number of holes that would have occurred in an area equal to the inside of the aluminum tube used to take cores. The density was then multiplied by the average area of a hole (the area of each hole in the quadrat was calculated from its diameter and then the areas were averaged), and then multiplied by the 10 cm length of the core to estimate the volume occupied by holes. If hole data was not available in the exact position of the core, the two nearest measurements of holes were averaged to obtain an estimate of density and area of holes. I was unable to estimate the volume occupied by holes by counting holes in the top of the core because the holes are not vertical, and often enter and exit the side of the core. This calculation increased the average bulk density of the cores from 0.365 g/cm^3 to 0.373 g/cm^3, which was an insignificantly small adjustment. Cores with low SOM would have increased in bulk density by these calculations more than highly organic cores.

MOM was determined by separating the roots and benthic organisms from the sediment by rinsing the core in a size 18 (1.0 mm openings) mesh screen (Gallagher 1974). The wetted core being analyzed for MOM was then placed in a shallow rubber bucket filled with water, and then agitated with a kitchen hand mixer to remove fine particles. The contents of the bucket were then poured through the screen, and any large sand grains and pebbles were removed from the bottom of the bucket. This process was repeated until the water in the bucket was clear, and no large grained sediment remained in the bucket. The MOM was then dried at 70 ^{o}C and weighed. The MOM mass was then divided by the dry weight of the sister half of the core to determine MOM as a percent of the total.

Total SOM was determined by finely grinding the dried half of each core using an Ika M20 grinding mill, and a mortar and pestle. The ground soil was then dried at 100 ^{o}C, and the loss on ignition (LOI) was determined by burning samples in a muffle furnace for 3 h at 500 ^{o}C.

2.5 Repeat Sample Plots

Three 1.0 m x 1.0 m plots were placed adjacent to each other, one plot was established within the basin zone, one was established in the transition zone, and the last plot was established in the front terrace. These plots were used to map and study the change in size of the holes in the marsh surface over time. A map was constructed of the holes in each of the plots by placing a 1.0 m x 1.0 m quadrat with 10.0 cm x 10.0 cm grids over each of the permanent plots. The position and maximum diameter of each hole was recorded. The map was redrawn at 6-month intervals for 1.5 years, and a repeated measured ANOVA (SPSS 10.0) was preformed to describe the change in diameter that occurred in the holes over time, within each zone.

2.6 Remote Sensing

I attempted to estimate the rate of headward erosion (i.e., transgression) in tidal creeks by comparing the location of the terminus of tidal creeks between 1963 and 1994. A black and white 1963 declassified satellite image of Brownsville with 2.0 m resolution was compared to a color 1994 DOQQ of Brownsville with 1.0 m resolution. However, the resolution of 1963 image was too low to see the terminus of the tidal creeks. The results produced unrealistically high transgression rates ranging from 1.0-4.0 m/year. This improbable finding is a product of the lower resolution of the 1963 image. I could not locate the smaller sections of the tidal creeks near the terminus, making it appear as though the creeks were restricted to areas further down stream.

2.7 Data Analysis

The creek classes and zones within each creek class were compared with the non-parametric Kruskal-Wallis (KW) test using StatXact 4 (Cytel, Cambridge, MA). Significance was defined at $\alpha = 0.05$. *Post-hoc* pair-wise contrasts of the groups were performed using the non-parametric Mann-Whitney U (M-W U) test using StatXact 4. Three pair-wise contrasts were run to compare the three creek classes, so the α level (α = 0.05) was divided by three, and the new α level ($\alpha = 0.0167$) was used for these *post hoc* tests. Six pair-wise contrasts were run to compare the creek zones, so the α level (α = 0.05) was divided by six, and the new α level (α = 0.008) was used for these *post hoc* tests.

The following variables were analyzed using the KW and M-W U tests: distance, elevation, slope, average hole density, average hole diameter, percent cover of holes, *S. alterniflora* height, percent cover of *S. alterniflora*, MOM, SOM, and bulk density (α=0.05). Data collected from the upland boundary were excluded from the statistical analysis across zones and classes, because this zone was incompletely sampled.

A discriminant function analysis (DFA) was used to determine which variables were most important in separating the three creek classes, and to quantitatively verify the existence of the three creek classes that I had visually identified. Soil data could not be included in the DFA because soil was only collected from 10 of the 23 tidal creeks. Before the DFA was performed, all of the variables were transformed to ensure that all of the variables would be equally weighted, despite the various units of measure. For each variable, the mean was subtracted from each observation and then divided by the standard deviation. The assumption of normality was tested with the Shapiro-Wilk test. The Shapiro-Wilk test was chosen over other tests of normality because it is robust when sample sizes are smaller than 50. The assumption of equality of covariance matrices was tested with Box's–M test.

I entered all of the variables (excluding soil data) from all of the creeks into the DFA model and then used Wilks' Lambda stepwise analysis to determine which variables contributed most to the discrimination of the three classes. Variables were entered into the model when the p-value for F was p = 0.05, and variables were removed from the model when the p-value for F was p = 0.10. The DFA created two independent (orthogonal) functions that were used to discriminate among the three creek classes. The first function described most of the variation among the creek classes, and the second function was able to describe the remaining variation. The results of the DFA were cross-validated using the leave-one-out option in SPSS that reclassifies each creek by recalculated functions one and two that were derived without the data from that case.

The equations for functions one and two were reported so that new tidal creeks can be placed into one of the three creek classes using a minimum number of quantifiable creek characteristics. However, only four of the 23 tidal creeks sampled were ST creeks, which is too low to produce reliable results. Thus, the results of the DFA are considered experimental and should not be used for practical applications without further investigation.

3. Results

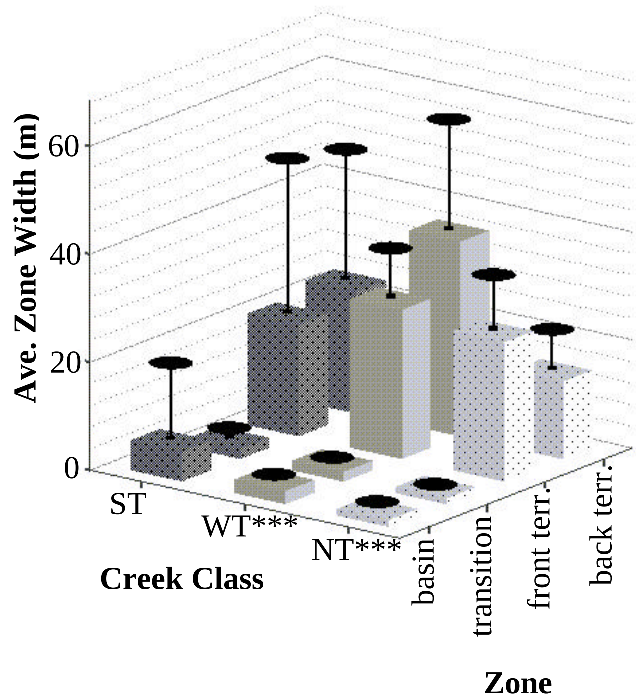
A total of 23 tidal creeks were surveyed at the VCR LTER. Of these 23 creeks, I visually classified four creeks as strong wasting terrace (ST), 10 creeks as weak wasting terrace (WT) creeks, and nine as no wasting terrace (NT).

3.1 Physical Characteristics

Three physical characteristics were measured including the width of each zone, elevation, and slope. The transition zone was consistently the most narrow of the zones and the terrace zones were much wider (Figure 3.1a and Table 3.1). The greatest average width for the basin was found at ST creeks, although this is partly due to a creek in Brownsville that had an exceptionally large basin 18 m in width. The mean width of the basin zone was the most narrow in NT creeks, and at several NT sites the basin zone was entirely absent. The terrace zones were the most variable in width, and were the widest of the four zones measured.

The KW test showed that zone width was significantly different across the zones in WT creeks ($p = 0.000$) and NT creeks ($p = 0.000$) (Table 3.2). The pair-wise contrasts for the WT and NT creeks indicated that the terrace zones were significantly wider than the basin and transition zones ($p = 0.000$) (See APPENDIX A and APPENDIX B for complete *post hoc* results). The pair-wise contrasts for the NT creeks indicated that the terrace zones were significantly wider than the basin and transition zones ($p = 0.000$). The average elevation increased from the basin to the upland boundary for all creek types (Figure 3.1b and Table 3.1). The upland boundary occurred at approximately 1.1 m MSL

(a)



(b)

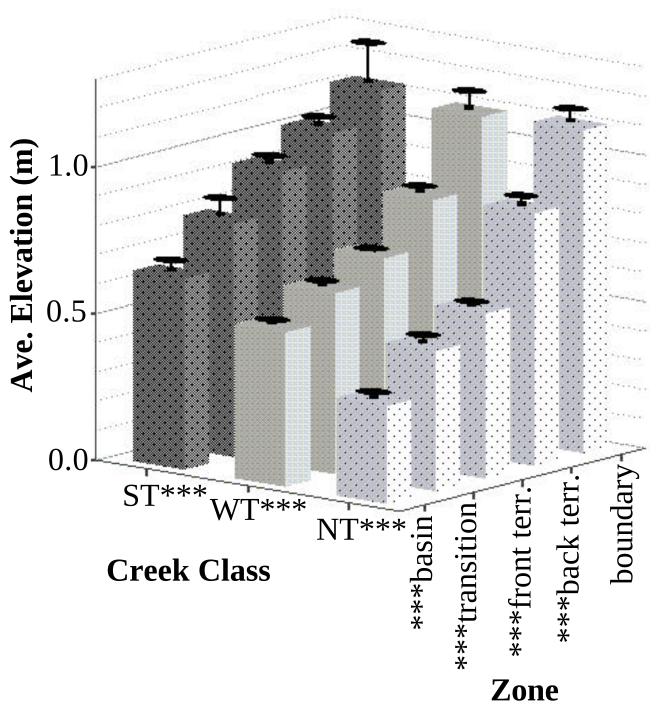


Figure 3.1. Average physical data across creek classes and zones. Error bars represent 95% confidence intervals of the means (lower bars not shown). Key to symbols for KW: * p= 0.10, ** p= 0.05, *** p= 0.01. Upland boundary was excluded from statistical analyses.

(c)

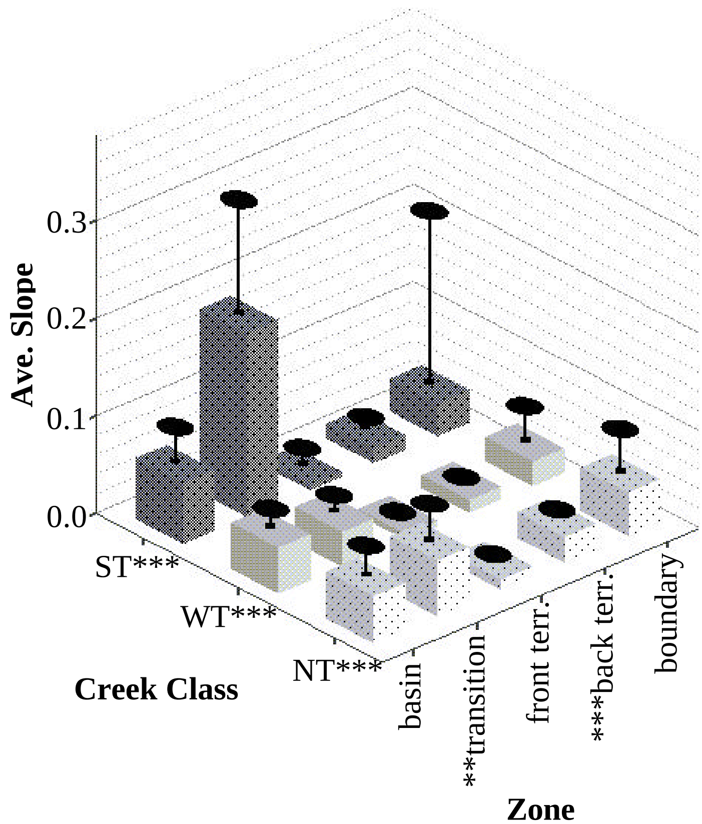


Figure 3.1. Completed.

Table 3.1. Summary of the averages for physical, soil, hole, and vegetation characteristics for all of the creek zones and classes.

	Zone Width (m)	Distance (m)	Elevation (m)	Slope	MOM	POM	OM	Bulk Density (g/cm^3)	Hole Density (holes/0.0625 m^2)	Hole Diameter (mm)	% Cover Holes	*S. alterniflora* Height (cm)	% Cover *S. alterniflora*
Basin													
ST	5.55	2.78	0.651	0.11	10.48	9.82	20.30	0.196	7.1	13.4	2.9	80.4	44.6
WT	2.45	1.23	0.527	0.08	6.08	7.37	13.45	0.269	6.1	13.9	4.0	58.8	25.4
NT	1.26	0.63	0.336	0.09	1.96	4.66	6.44	0.388	7.4	9.8	1.4	80.2	26.5
Transition													
ST	1.83	6.46	0.737	0.24	13.97	13.68	27.65	0.162	8.0	16.9	12.4	59.5	46.3
WT	1.81	3.35	0.616	0.04	6.65	8.68	15.33	0.272	6.9	20.3	4.7	45.2	29.2
NT	1.44	2.23	0.449	0.08	2.89	4.07	6.96	0.414	9.1	10.9	2.1	51.4	22.1
Front Terrace													
ST	20.63	17.69	0.879	0.00	17.12	15.25	32.66	0.177	1.8	5.7	0.3	54.8	69.6
WT	27.62	17.94	0.676	0.01	8.80	8.59	17.39	0.283	1.8	11.4	0.8	37.8	40.7
NT	25.86	18.65	0.547	0.01	3.85	4.02	7.87	0.419	5.4	12.0	1.3	39.8	32.8
Back Terrace													
ST	22.63	39.56	1.011	0.01	12.87	13.04	25.91	0.300	1.4	5.7	0.8	26.9	23.4
WT	36.15	49.78	0.843	0.02	6.69	6.41	13.10	0.523	2.8	7.2	0.8	24.8	18.6
NT	14.39	33.42	0.705	0.04	1.02	2.14	3.16	0.733	4.7	13.0	1.8	15.6	8.3
Upland Boundary													
ST	.	58.90	1.122	0.03	.	.	.	.	0.6	3.7	0.3	38.2	0.3
WT	.	61.57	1.090	0.03	1.52	7.71	9.23	0.450	2.7	10.4	1.2	9.1	3.4
NT	.	44.98	1.102	0.04	0.88	4.21	5.09	0.603	2.6	6.7	0.7	0.0	0.0

Table 3.2 Kruskal-Wallace results comparing zones within each creek class.

	ST			WT		
	d.f.	Chi-square	P	d.f.	Chi-square	P
Width	3	5.617	0.131	3	29.533	0.000
Distance	3	7.787	0.033	3	34.528	0.000
Elevation	3	120.361	0.000	3	272.712	0.000
Slope	3	22.006	0.000	3	29.820	0.000
MOM	3	2.093	0.578	3	1.951	0.598
SOM	3	2.658	0.457	3	0.937	0.826
Bulk density	3	2.911	0.424	3	0.960	0.082
Ave. hole density	3	41.118	0.000	3	55.730	0.000
Ave. hole diameter	3	27.902	0.000	3	41.497	0.000
% cover of holes	3	44.157	0.000	3	68.971	0.000
Spartina height	3	39.970	0.000	3	52.687	0.000
% cover *Spartina*	3	28.514	0.000	3	72.949	0.000

	NT		
	d.f.	Chi-square	P
Width	3	21.068	0.000
Distance	3	29.523	0.000
Elevation	3	221.544	0.000
Slope	3	28.980	0.000
MOM	3	23.475	0.000
SOM	3	27.574	0.000
Bulk density	3	24.853	0.000
Ave. hole density	3	15.411	0.001
Ave. hole diameter	3	4.463	0.214
% cover of holes	3	6.846	0.071
Spartina height	3	86.901	0.000
% cover *Spartina*	3	88.226	0.000

in all creek classes, but the remaining zones showed very distinct differences in elevation among the creek classes. ST creeks occurred at the highest elevation in all of the zones, WT creeks occurred at an intermediate elevation, and NT creeks occurred at the lowest mean elevation (Figure 3.1b and Table 3.1).

The KW test indicated that elevation was significantly different for all contrasts among zones (p = 0.000) (Table 3.2). The pair-wise contrasts of zones within the ST creeks showed that all of the contrasts were significant (p = 0.001) except between the front terrace and back terrace (p = 0.131). All of the pair-wise contrasts of elevation between the zones of the WT and NT creek classes were significant (p = 0.000).

The KW test indicated that elevation was significantly different for all contrasts among creek classes (p = 0.000) (Table 3.3). The pair-wise contrasts of creek classes were all significant in the basin, transition, and front terrace zones (p = 0.000). The pair-wise contrasts of creek classes in the back terrace indicated that WT and NT creeks were occurred at a significantly lower elevation than the ST creeks (p = 0.000).

The basin and transition zones had the highest slopes, while the terrace zone had a much more gentle slope (Figure 3.1c and Table 3.1). The highest mean slope occurred in the transition zone of ST creeks, while the front terrace had the lowest slope in all of the creek types.

The KW tests indicated that the slope of the zones were significantly different in all three creek classes (p = 0.000) (Table 3.2). Pair-wise contrasts of slope across the zones of ST creeks showed that the basin had a significantly higher slope than the front terrace (p = 0.001), and the transition zone has a significantly higher slope than either of the

Table 3.3 Kruskal-Wallace results comparing creek classes in each zone.

	Basin			Transition		
	d.f.	Chi-square	P	d.f.	Chi-square	P
Width	2	3.575	0.166	2	2.943	0.235
Distance	2	3.575	0.018	2	2.599	0.287
Elevation	2	97.670	0.000	2	71.234	0.000
Slope	2	0.021	0.992	2	7.829	0.022
MOM	2	12.007	0.000	2	21.487	0.000
SOM	2	9.432	0.004	2	25.466	0.000
Bulk density	2	9.913	0.003	2	26.651	0.000
Ave. hole density	2	1.454	0.485	2	1.758	0.419
Ave. hole diameter	2	5.269	0.072	2	17.374	0.000
% cover of holes	2	2.305	0.313	2	7.589	0.021
Spartina height	2	7.994	0.018	2	1.368	0.510
% cover *Spartina*	2	12.647	0.001	2	5.050	0.076
	Front Terrace			Back Terrace		
	d.f.	Chi-square	P	d.f.	Chi-square	P
Width	2	0.638	0.740	2	3.003	0.233
Distance	2	0.028	0.988	2	2.577	0.284
Elevation	2	259.517	0.000	2	39.257	0.000
Slope	2	2.455	0.293	2	17.645	0.000
MOM	2	17.074	0.000	2	13.169	0.001
SOM	2	14.694	0.000	2	15.725	0.000
Bulk density	2	8.734	0.005	2	13.615	0.001
Ave. hole density	2	67.316	0.000	2	21.879	0.000
Ave. hole diameter	2	20.064	0.000	2	22.964	0.000
% cover of holes	2	43.083	0.000	2	25.827	0.000
Spartina height	2	35.659	0.000	2	11.809	0.002
% cover *Spartina*	2	47.117	0.000	2	13.846	0.000

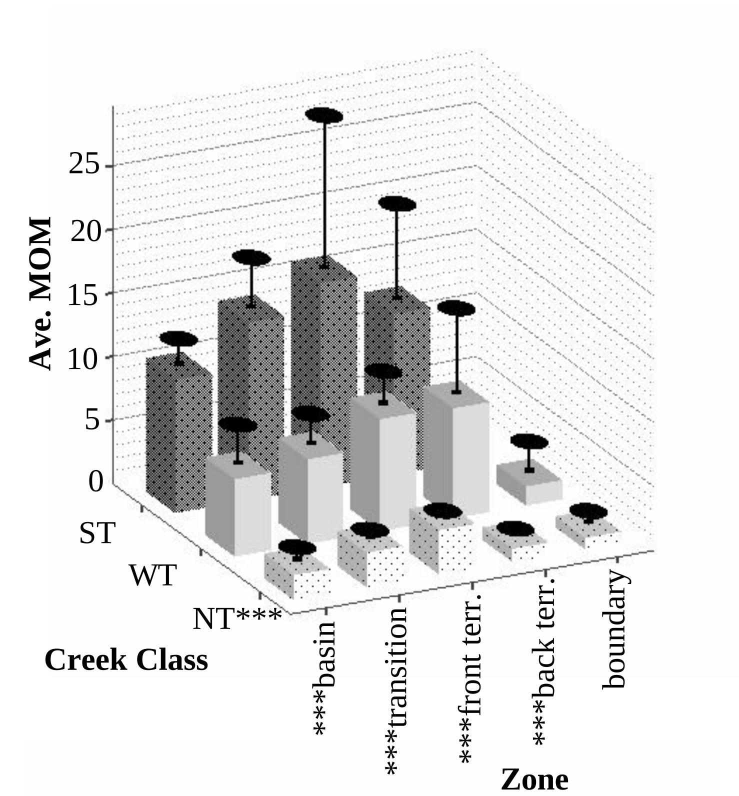
terrace zones (p = 0.002). Pair-wise contrasts of slope across the zones of WT creeks indicated that the slope of the basin and transition zones was higher than the terrace zones (p = 0.004). Pair-wise contrasts of slope across the zones of NT creeks indicated that the slope of the transition zone was significantly higher than the slope of the terrace zones (p = 0.006), and the back terrace had a significantly higher slope than the front terrace (p = 0.000).

The KW test indicated that the slope of the transition zone and back terrace was significantly different among the classes (p = 0.022) (Table 3.2 and Table 3.3). In the transition zone, slope was highest in the ST creeks, intermediate in the WT creeks, and lowest in the NT creeks. The pair-wise contrasts indicated that the slope in the transition zone was significant across all contrasts (p = 0.000). In the back terrace, pair-wise contrasts showed that the slope in NT creeks was significantly higher than in the ST or WT creeks (p = 0.006).

3.2 Soil Organic Matter

The average macro organic matter (MOM) increased from the basin to the transition zone in all creek classes (Figure 3.2a, and Table 3.1). Average MOM decreased from the front terrace to the back terrace in the ST and NT creeks, but continued to increase in the NT creeks. The average MOM was much reduced in the upland boundary in all creek classes. The average MOM was highest in the ST creeks, intermediate in the WT creeks, and lowest in the NT creeks in all of the zones (Figure 3.2a, and Table 3.1).

(a)



(b)

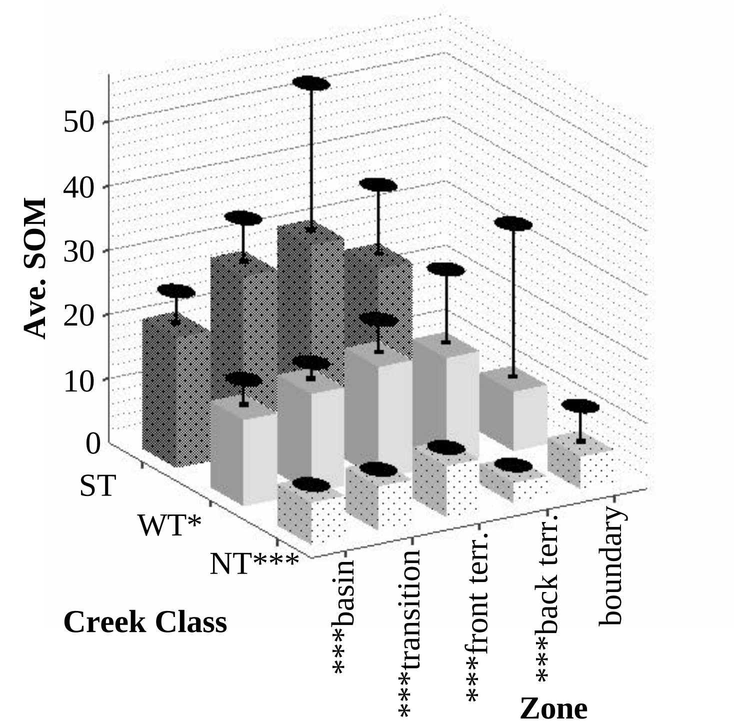


Figure 3.2. Average soil data across creek classes and zones. Error bars represent 95% confidence intervals of the means (lower bars not shown). Key to symbols for KW: * p= 0.10, ** p= 0.05, *** p= 0.01. Upland boundary was excluded from statistical analyses.

(c)

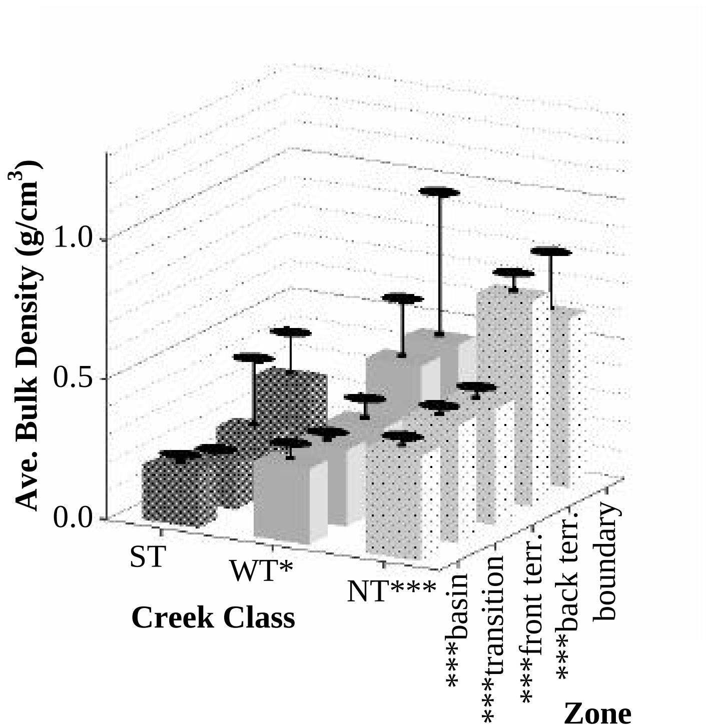


Figure 3.2. Concluded.

The KW test indicated that MOM was significantly different across the zones in the NT creeks only (p = 0.000) (Table 3.2). Pair-wise contrasts of the zones in NT creeks indicated that the front terrace had significantly higher MOM than the basin or the back terrace, and the transition zone has significantly higher MOM than the back terrace (p = 0.006).

The KW test showed that MOM was significantly different across the creek classes in all of the zones (p = 0.001) (Table 3.3). Pair-wise contrasts in the basin zone showed that the ST creeks had significantly higher MOM than the WT or NT creeks (p = 0.007). Pair-wise contrasts in the transition zone showed that the ST creeks had the highest MOM, WT creeks had an intermediate amount of MOM, and NT creeks had the lowest MOM (p = 0.007). Pair-wise contrasts in the front terrace showed that WT and ST creeks had significantly higher MOM than the NT creeks (p = 0.001). Pair-wise contrasts in the back terrace showed that the ST creeks had significantly higher MOM than the NT creeks (p = 0.000).

The average soil organic matter (SOM) increased from the basin the transition zone in all creek classes (Figure 3.2a and Table 3.1). Average SOM decreased from the front terrace to the back terrace in the ST and NT creeks, but continued to increase in the NT creeks. The average SOM decreased drastically in the upland boundary in all creek classes. The average SOM was highest in the ST creeks, intermediate in the WT creeks, and lowest in the NT creeks in all of the zones (Figure 3.2b, and Table 3.1).

The KW test indicated that SOM was significantly different across the zones in the NT creeks only (p = 0.000) (Table 3.2). Pair-wise contrasts of the zones in NT creeks indicated that the basin, transition, and front terrace all had significantly higher SOM than the back terrace.

The KW test showed that SOM was significantly different across the creek classes in all of the zones (p = 0.004) (Table 3.3). Pair-wise contrasts in the basin zone showed that the ST creeks had significantly higher SOM than the NT creeks (p = 0.003). Pair-wise contrasts in the transition zone showed that the ST creeks had the highest SOM, WT creeks had an intermediate amount of SOM, and NT creeks had the lowest SOM (p = 0.002). Pair-wise contrasts in the front terrace and back terrace showed that both the ST and WT creeks had significantly higher SOM than the NT creeks (p = 0.015).

In all zones, the average bulk density was lowest at ST creeks, intermediate at WT creeks, and highest at NT creeks (Figure 3.2c and Table 3.1). In all creek classes bulk density was highest in the back terrace.

The KW test indicated that bulk density was significantly different across the zones in the NT creeks only (p = 0.000) (Table 3.2). Pair-wise contrasts of the zones in NT creeks indicated that the back terrace all had a significantly higher bulk density than the basin, transition, and front terrace zones.

The KW test showed that bulk density was significantly different across the creek classes in all of the zones (p = 0.005) (Table 3.3). Pair-wise contrasts in the basin zone showed that the NT creeks had significantly higher bulk density than the NT creeks (p = 0.003). Pair-wise contrasts in the transition zone showed that the NT creeks had the highest bulk density, WT creeks had an intermediate bulk density, and ST creeks had the lowest bulk density (p = 0.000). Pair-wise contrasts in the front terrace showed that the bulk density in NT creeks was significantly higher than the WT creeks (p = 0.005). Pair wise contrasts in the back terrace showed that the NT creeks had significantly higher bulk density than both the ST or WT creeks (p = 0.015).

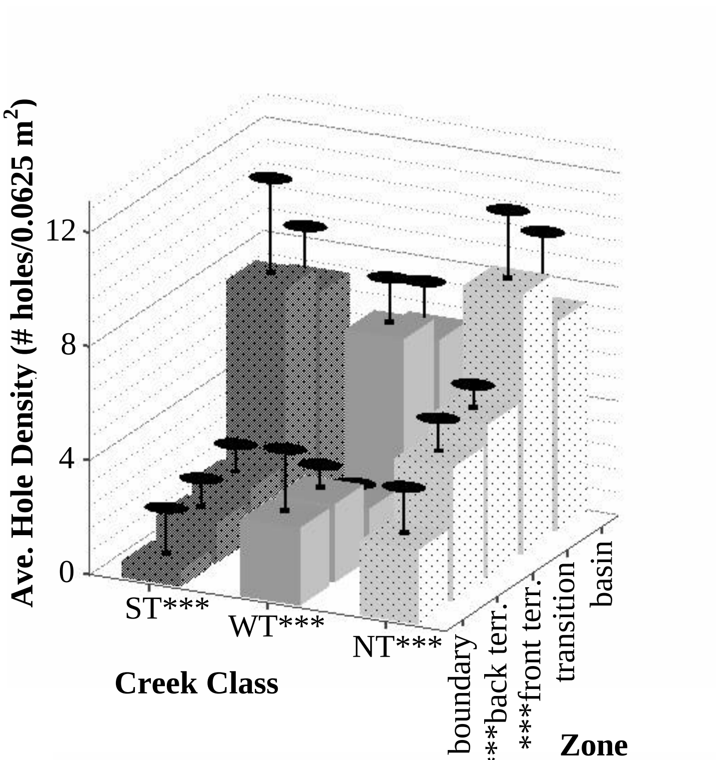
3.3 Sediment Holes

Average hole density was highest in the transition zone for all creek types, and the terrace zones had the lowest hole densities (Figure 3.3a and Table 3.1). NT creeks had the highest density of holes in all zones among the creek classes.

The KW test indicated that the average hole density was significantly different across the zones in all three of the creek classes (p = 0.001) (Table 3.2). Pair-wise contrasts between the zones in ST and WT creeks showed that the density of holes in the basin and transition zone was significantly higher than in the terrace zones (p = 0.001). Pair-wise contrasts at the NT creeks showed that the average density of holes in the transition zone was significantly higher than the terrace zones (p = 0.001).

The KW test indicated that the average hole density was significantly different across the creek classes in the front terrace and back terrace zones (p = 0.000) (Table 3.3). Pair-wise contrasts between the classes in the front terrace showed that the average hole density was higher in the NT creeks compared to the ST or WT creeks (p = 0.000). Pair-wise contrasts between the classes in the back terrace showed that the average hole density was significantly higher in the ST creeks and the NT creeks, and the NT creeks were significantly higher than the WT creeks (p = 0.000). The average hole diameter was greater in the basin and transition zones than in the terrace zones in the ST and WT

(a)



(b)

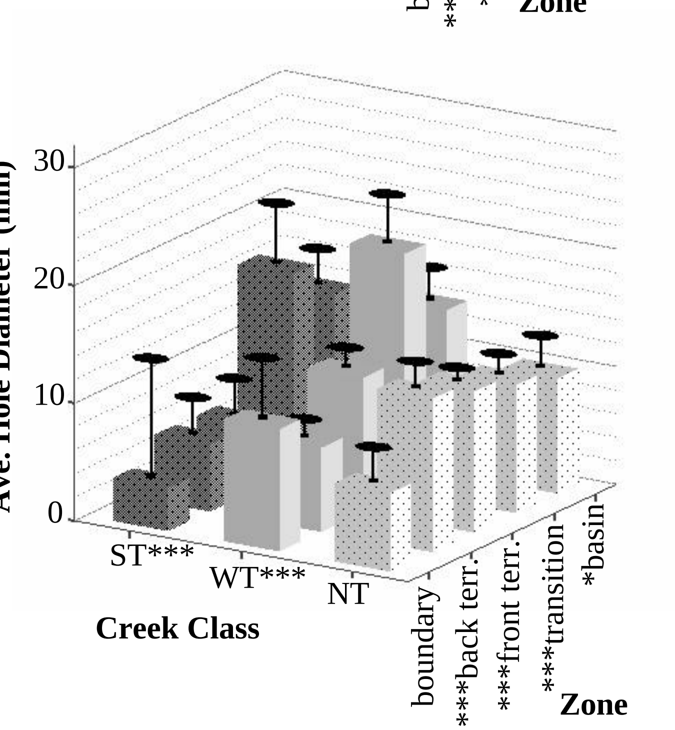


Figure 3.3. Average hole data across creek classes and zones. Error bars represent 95% confidence intervals of the means (lower bars not shown). Key to symbols for KW: * p= 0.10, ** p= 0.05, *** p= 0.01. Upland boundary was excluded from statistical analyses. Note that the zone axis begins with marsh edge.

(c)

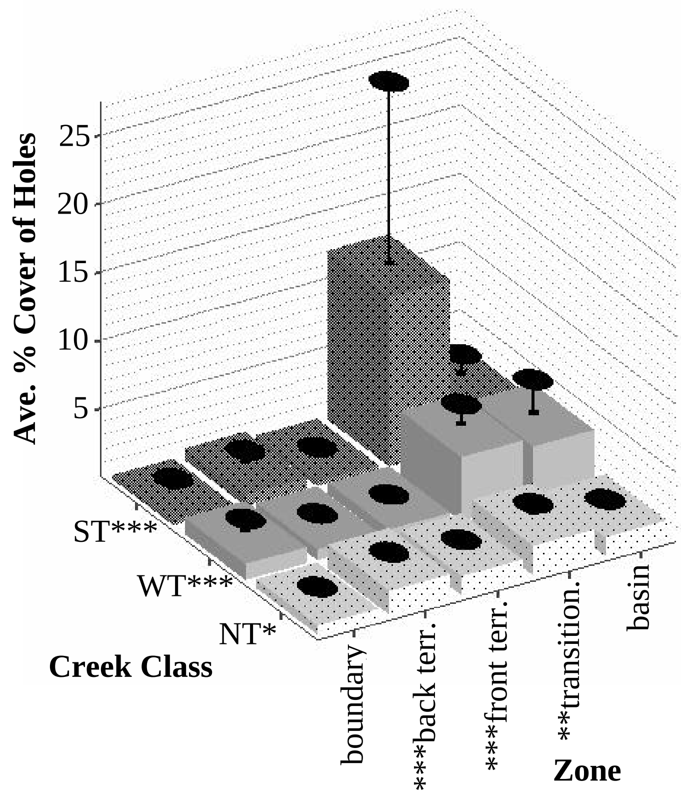


Figure 3.3. Concluded.

creeks (Figure 3.3b and Table 3.1). In the NT creeks the average hole diameter increased from the basin to the back terrace. In the ST and WT creek classes, the largest hole diameter occurred in the transition zone, but at NT creeks, the highest average hole diameter occurred in the back terrace

The average hole diameter was significantly different among the zones in the ST and WT creek classes (p = 0.000) (Table 3.2). Pair-wise contrasts for ST creeks showed that the average hole diameter was significantly higher in the basin and transition zones compared to the terrace zones (p = 0.000). In the WT creeks, pair-wise contrasts showed that the average hole diameter was significantly higher in the basin than in the back terrace, the transition zones was significantly higher than in the front terrace and back terrace zones, and the front terrace was significantly higher than the back terrace (p = 0.000).

Average hole diameter was significantly different across the creek classes in the transition and terrace zones (p = 0.000) (Table 3.3). Pair-wise contrasts between creek classes in the transition zone showed that the average hole diameter was significantly higher in the ST creeks were significantly higher than the NT creeks, and the WT creeks compared the NT creeks (p = 0.009). In the terrace zones, the pair-wise contrasts indicated that the average hole diameter was significantly higher in the NT creeks than the WT and ST creeks (p = 0.001).

The largest average percent cover of holes occurred in the transition zone for all of the creek classes (Figure 3.3c and Table 3.1). The highest average percent cover of holes in basin, transition, and terrace zones occurred in the WT, ST, and NT creeks respectively.

The KW test indicated that the average percent cover of holes was significantly different among the zones in the ST and WT creeks (p = 0.000) (Table 3.2). In the ST creeks, pair-wise contrasts of the zones indicated that average percent cover of holes was significantly higher in the basin and transition zones compared to the terrace zones (p = 0.000). At the WT creeks, pair-wise contrasts of the zones indicated that the average percent cover of holes was significantly higher in the basin and transition zones, compared to the terrace zones (p = 0.000).

The KW test indicated that the average percent cover of holes was significantly different among the creek classes in the transition zone and in both terrace zones (p = 0.021) (Table 3.3). Pair-wise contrasts between creek classes in transition zone showed that the average percent cover of holes was significantly higher in the NT creeks than in the WT creeks (p = 0.007). Pair-wise contrasts between creek classes in the front terrace zone showed that the average percent cover of holes was lowest in the ST creeks, intermediate in the WT creeks, and highest in the NT creeks (p = 0.007). Pair-wise contrasts between creek classes in the back terrace zone showed that the average percent cover of holes was significantly higher in the NT creeks compared to the WT and ST creeks (p = 0.000).

3.4 Analysis of Hole Dynamics

A repeated measures ANOVA was used to test if the diameter of holes changed in size over time in three plots that were repeatedly sampled. One hundred eleven holes were mapped and monitored in the basin plot, and the results show that the mean diameter of holes in the plots fluctuated over time. At the initial time period, the mean diameter was 6.9 mm, 7 months later the mean diameter had decreased to 5.0 mm, and the following fall the mean diameter had risen to 7.7 mm (Table 3.3). No significant difference was found in the hole diameter over time (p = 0.157) (Table 3.4). Fiddler crabs were seen in the basin plot on all three dates, but were most abundant during the initial and final dates (both in the fall) when hole diameters were larger.

The greatest density of holes was found in the transition zone where 172 holes were mapped and monitored over time. The mean diameter of the holes mapped in the transition zone when the plots were first installed was 8.9 mm. Seven months later the average diameter of the holes had increased to 10.6 mm, and 4 months after that the mean diameter had increased significantly to 13.7 mm (p = 0.003) (Table 3.4 and 3.5). Few fiddler crabs were seen in the transition zone.

The lowest density of holes among the three plots was found in the front terrace. A total of 22 holes was mapped and measured over in the front terrace plot. The mean diameter of the holes was 16.0 mm when the plots were first installed. Seven months later the average diameter of the holes had increased to 17.9 mm, and 4 months after that the mean diameter had increased to 22.1 mm (p = 0.003) (Table 3.4). Although the greatest increase in mean diameter occurred in the front terrace, the change in diameter was not statistically significant (p = 0.309) (Table 3.5). During this time, only one fiddler crab was seen in the front terrace plot.

Table 3.4. Descriptive statistics for hole diameter (mm) measured in repeat sample plots.

		6-Oct-00		1-May-01		15-Sep-01	
	n	mean	st.dev	mean	st.dev	mean	st.dev
Basin	111	7.0	10.6	5.0	8.1	7.7	9.3
Transition	172	8.9	12.9	10.6	16.4	13.7	18.6
Front Terr.	22	16.0	15.5	17.9	16.6	22.1	18.7

3.5 Vegetation Characteristics

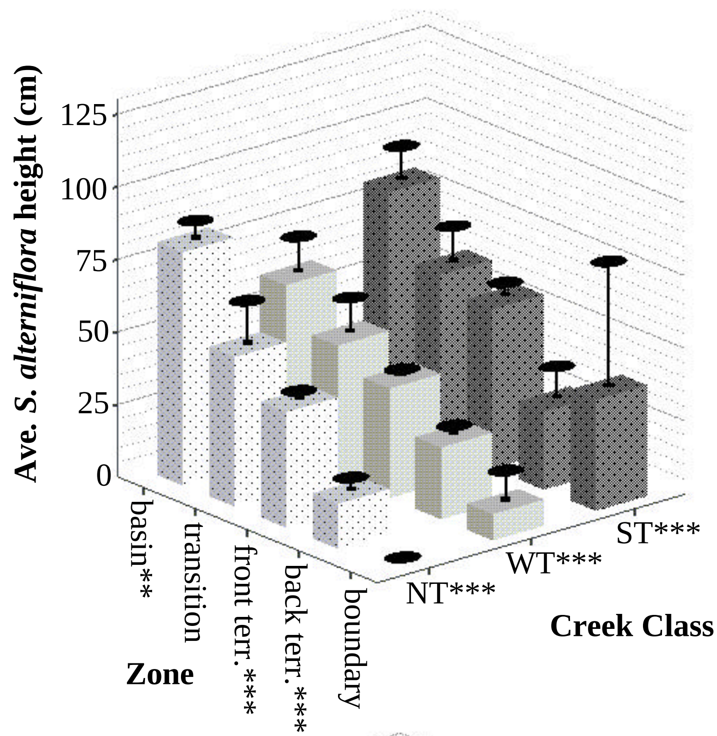
Spartina alterniflora was tallest near the creek channel and decreased with distance from the channel in NT and WT creeks (Figure 3.4a and Table 3.1). The same pattern was found at ST creeks, with the exception that the average height of *S. alterniflora* increased slightly in upland boundary zone at one ST site. *S. alterniflora* was absent from the upland boundary zone in NT creeks. The average *S. alterniflora* height was significantly different across the creek zones in all three creek classes (p = 0.000) (Table 3.2). In the ST creeks, pair-wise contrasts between creek zones indicated that the average height of *S. alterniflora* in front terrace was significantly taller than in the basin and back terrace zones, and the basin zone was significantly taller than the back terrace (p = 0.005). In the WT creeks, pair-wise contrasts between creek zones indicated that the average height of *S. alterniflora* in front terrace was significantly taller than in the basin, transition, and back terrace zones (p = 0.003). In the NT creeks, pair-wise contrasts between creek zones indicated that the average height of *S. alterniflora* in front terrace was significantly taller than in the basin, transition, and back terrace zones, and the basin was significantly taller than the back terrace. (p = 0.003).

The average *S. alterniflora* height was significantly different across the creek classes in the basin and both terrace zones (p = 0.018) (Table 3.3). In the basin zone, pair-wise contrasts showed that *S. alterniflora* height was significantly taller in the ST creek than in the WT or NT creeks (p = 0.009). In the front terrace, pair-wise contrasts showed that *S. alterniflora* was tallest in the ST creeks, intermediate in the WT creeks, and shortest in the NT creeks (p = 0.000). In the back terrace, pair-wise contrasts showed that *S.*

Table 3.5. Repeated measures ANOVA, Greenhouse-Geisser test comparing hole diameter over time in the repeat sample plots.

	Type III Sum of Squares	d.f.	Mean Sq. Error	F	p
Basin	428	1.610	266	1.186	0.157
Transition	1986	1.580	1257	6.691	0.003
Front Terr.	430	1.906	226	1.881	0.309

(a)



(b)

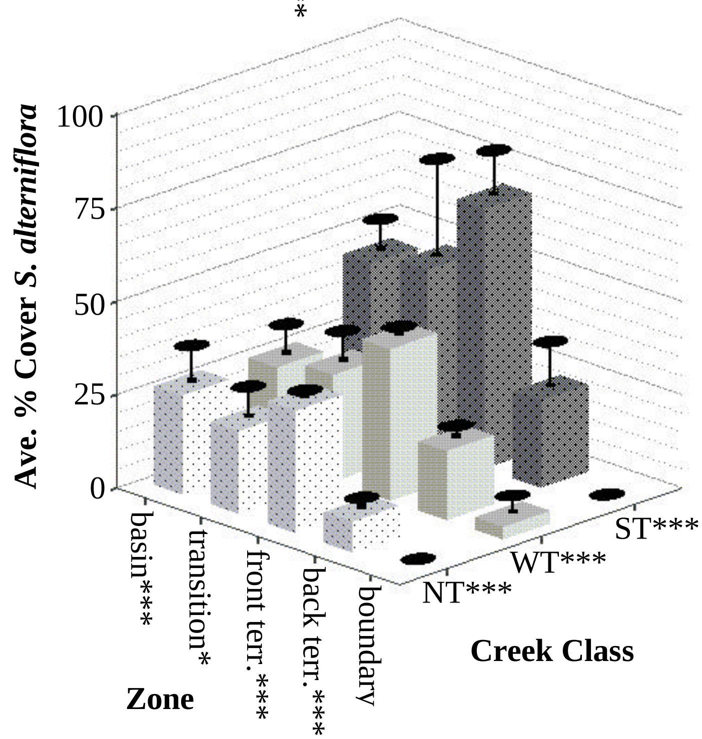


Figure 3.4. Average vegetation data across creek classes and zones. Error bars represent 95% confidence intervals of the means (lower bars not shown). Key to symbols for KW: * p= 0.10, ** p= 0.05, *** p= 0.01. Upland boundary was excluded from statistical analyses.

alterniflora was significantly taller in the WT creeks compared to the NT creeks (p = 0.000).

For all creek classes, the percent cover of *S. alterniflora* generally increased from the basin to the front terrace, and then fell to lower values in the back terrace and upland boundary (Figure 3.4b and Table 3.1). The percent cover of *S. alterniflora* was highest in the ST creeks for all creek classes.

The KW test indicated that the average percent cover of *S. alterniflora* was significantly different among the zones for all creek classes (p = 0.000) (Table 3.2). In the ST creeks, all pair-wise contrasts between the zones indicated that the average percent cover of *S. alterniflora* was significantly higher in the basin and front terrace compared to the back terrace, and the front terrace was significantly higher than the back terrace (p = 0.005). Pair-wise contrasts for WT creeks showed that the front terrace had a significantly higher average percent coverage of *S. alterniflora* compared to the basin, transition, and back terrace (p = 0.003). For the NT creeks, pair-wise contrasts between the zones indicated that the average percent coverage of *S. alterniflora* was significantly higher in the transition and basin zones than in the back terrace, and the front terrace was significantly higher than both the transition zone, and the back terrace (p = 0.003).

The KW test indicated that the percent cover of *S. alterniflora* was significantly different across creek classes in the basin and in both terrace zones (p = 0.001). Pair-wise contrasts between the creek classes in the basin zone indicated that the average percent cover of *S. alterniflora* in the ST creeks than in the WT or NT creeks (p = 0.009). Pair-wise contrasts between the creek classes in the front terrace zone indicated that the average percent cover of *S. alterniflora* was highest in the ST creeks, intermediate in the WT creeks, and lowest in the NT creeks (p = 0.000). Pair-wise contrasts between the creek classes in the back terrace zone indicated that the average percent cover of *S. alterniflora* was significantly higher in the WT creeks than in the NT creeks (p = 0.000).

3.6 Species Composition

Spartina alterniflora was the only species found in the basin, transition, and front terrace zones (Table 3.6). In the basin zone, tall form *S. alterniflora* was found at 18 of the 23 sites, four sites did not have a basin zone, and the basin zone at the Bellevue marsh was free of all vegetation. A mixture of tall and short form *S. alterniflora* occurred in the transition zone at 21 of the 23 sites, two creeks in Brownsville did not have any vegetation present in the transition zone. *S. alterniflora* occurred in all front terrace zones. In the back terrace, *S. alterniflora*, *D. spicata*, *Salicornia* spp., *S. patens, Borrichia frutescens*, *Limonium nashii* Small, *Aster tenuifolius* L., and *Juncus roemerianus* Scheele were found (Table 3.6). The greatest number of species were found in the upland boundary zone, including: *I. frutescens*, *S. patens*, *D. spicata*, *B. frutescens*, *L. nashii*, *A. tenuifolius*, *Salicornia* spp., *S. alterniflora*, *Scirpus robustus,* and *P. australis* (Table 3.6).

3.7 Discriminate Function Analysis

The DFA was run to verify the classification of creeks into one of three creek classes (ST, WT, or NT), and to determine which variables contribute most to the discrimination

Table 3.6. Percent frequency of vascular plant occurrences at 23 tidal creeks sites, and elevation above mean sea level for selected species. Percent frequency of each species is listed by zone.

Scientific Name	Elev. (m)	Basin	Trans.	Front Terr.	Back Terr.	Upland Bound.
Spartina alterniflora	0.190-1.119	78	91	96	96	4
Spartina patens	0.655-1.320				39	70
Distichlis spicata	0.489-1.320				83	65
Juncus roemerianus					9	
Scirpus robustus						4
Limonium nashii					26	4
Iva frutescens						96
Phragmites australis						4
Aster tenuifolius					13	13
Borrichia frutescens					30	43
Salicornia spp.	0.536-1.160				74	9

of the three creek classes. The assumption of normal distribution within each of the groups was tested with the Shaprio-Wilk test. Only two of the 12 groups were not normally distributed: WT transition percent holes ($p = 0.008$), and NT front terrace hole density ($p = 0.008$). The equality of variance/covariance was tested with Box's M test. The test was significant ($p = 0.000$; $F = 4.014$), but the DFA is robust to deviations in the variance/covariance matrix, and Box's M test is considered unnecessarily stringent (Kevin O'Brien, personal communication, 2002).

The Wilks' Lambda stepwise analysis identified four variables that were included in the DFA model: basin percent cover of *S. alterniflora*, transition percent cover of holes, front terrace hole density, and back terrace distance. Using only these four variables, the DFA was able to correctly classify all 23 tidal creeks, and 21 of the 23 creeks (91%) were correctly classified in the cross validation test. Functions 1 and 2 were used to transform and classify each creek. These functions may be used in the future to place new creeks within one of the three creek classes based on Figure 3.5.

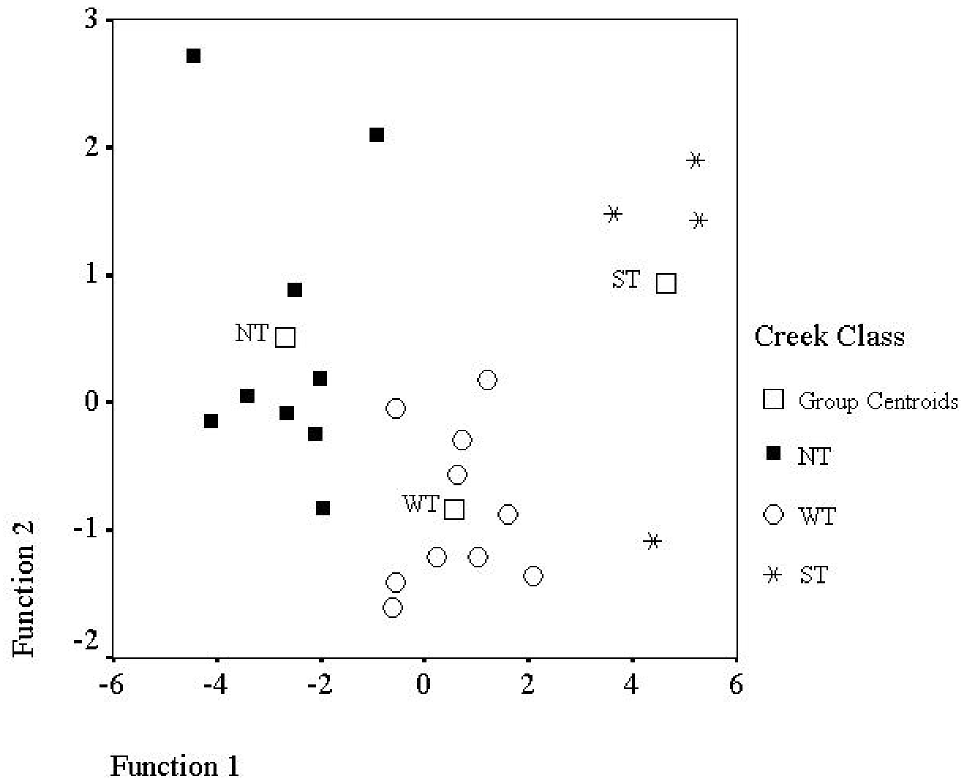


Figure 3.5. Distribution of 23 tidal creeks for discriminate functions one and two.

Function 1 = (W – 22.135) * 0.0784 + (X – 5.701) * 0.1744 + (Y – 3.066) * -0.3829 + (Z – 41.59783) * 0.0402

Function 2 = (W – 22.135) * 0.0264 + (X – 5.701) * 0.0869 + (Y – 3.066) * 0.4231 + (Z – 41.598) * 0.0129

W = Basin % cover *S. alterniflora*

X = Transition % cover holes

Y = Front terrace hole density

Z = Back terrace distance

3.8 Summary of Results

Most of the patterns of physical, soil, and plant variables showed distinct patterns that corroborated some of the visual observations. The patterns described below can be examined by consulting in Table 3.1.

NT creeks have the shortest distance between the tidal creek head and the upland boundary. The distance from the tidal creek head to the upland boundary is typically farther in ST and WT creeks. NT creeks have the highest slope from upland boundary to creek head.

The marsh edge at the forest boundary occurred at about 1.10 m MSL at all of the creek types, but the basin, transition, front terrace, and back terrace zones were all lowest at NT creeks, intermediate at WT creeks, and highest at ST creeks (Figure 3.1b). The slope of the marsh surface in the transition zone was very important in differentiating the three creek classes. Slope was highest in the transition zone of ST creeks, and lowest in the transition zone of NT creeks. In contrast, the slope of the back terrace was significantly higher in NT creeks compared to ST or WT creeks.

Hole density was an important factor for differentiating the creeks classes in both of the terrace zones. Hole density in the front terrace was low in the ST and WT marshes compared to the higher density of holes found at the NT creeks. Hole density in the back terrace was low at ST creeks, intermediate at WT creeks, and high at NT creeks.

Average hole diameter was important for differentiating the creek classes in the transition zone and in both of the terrace zones. Hole diameter was lowest at NT creeks, intermediate at ST creeks, and highest at WT creeks in both the transition and front terrace zones. Hole diameter was low in the ST and WT creeks and highest at the NT creeks in the back terrace zone.

Percent cover of holes was important for differentiating the creek classes in the transition zone, and in both of the terrace zones. Percent cover of holes was high in both the ST and WT creeks and low in the NT creeks in the transition zone. Percent cover of holes was highest in the ST creeks, intermediate in the WT creeks, and low in the NT creeks in the front terrace.   Percent cover of holes was low in both the ST and WT creeks in the front terrace, and high in the NT creeks in the back terrace.

The height of *S. alterniflora* was different among the creek classes in the basin and both of the terrace zones. The height of *S. alterniflora* was highest at the ST creeks, intermediate the NT creeks, and lowest at the WT creeks in the basin and front terrace zones. The height of *S. alterniflora* was high in the back terrace at both ST and WT creeks, and was low at NT creeks.

The percent cover of *S. alterniflora* was different among the creek classes in the basin, front terrace, and back terrace. In the basin, the percent cover of *S. alterniflora* was highest in ST creeks and low in both WT and NT creeks. In the front terrace, the percent cover of *S. alterniflora* was lowest in the WT creeks, intermediate in the ST creeks, and highest at NT creeks. In the back terrace, the percent cover of *S. alterniflora* was lowest at NT creeks, intermediate at WT creeks, and highest at ST creeks.

SOM was different among the creek classes in all of the zones. In each zone SOM was lowest at the NT creeks, intermediate at WT creeks, and highest at ST creeks. Bulk density is inversely related to SOM. In each zone the bulk density was lowest at ST creeks, intermediate at WT creeks, and highest at NT creeks.

4. Discussion

The data collected for this study will be used to establish the geomorphic conditions in which each creek class is found, and the changes that occur in vegetation, soils, holes, and physical characteristics for each creek class in the process of transgression. I will also discuss the sediment dynamics of tidal creeks and discuss the rate of headward erosion in each of the three creek classes in the context of the measured variables.

4.1 Geographic Position and the Effects of Slope in Determining Creek Class

Creek class was determined by the presence and thickness of organic rich soil that had accumulated in each of the marshes. ST creeks had a thick deposit of highly organic soil, WT creeks had a thin deposit of organic soil, and NT creeks had little to no organic rich deposits. As a general rule, higher accumulations of OM occur in the more poorly drained and hydrodynamically inactive areas (Brown et al. 1979). Thus, the type of creek class found in a particular area may be determined by the drainage conditions of the marsh into which it is eroding. Thus, ST creeks were found in the most poorly drained areas, WT creeks were found in moderately drained areas, and NT creeks were found in relatively well-drained areas (Figure 2.4). The slope of the Pleistocene surface may be the primary determinant of drainage condition in the studied marshes. Higher slopes facilitate drainage and therefore better aeration of the soils. Conversely, lower slopes, poorer drainage, and greater anoxia suppress decomposition, thus allowing formation of organic rich soils over the Pleistocene surface.

An additional factor may be the geographic isolation from an estuarine water source. For example, ST creeks were generally found in protected hammock or valley marshes (*sensu* Oertel and Woo 1994) in areas more distant from the lagoons. The longer distance also suggests that the Pleistocene surface has a very low slope.

The elevated and flat surface of organic matter in the terrace zones is effective at storing and retaining water. Precipitation is the main source of water for these flats, although high spring tides and storm tides may occasionally inundate these areas (Stasavich 1998). WT and NT creek classes may have correspondingly better drainage due to greater slope and less isolation from the lagoon, which reduces their capacity for accumulating organic matter.

4.2 A Comparison of Transgression Among the Creek Classes

The lagoon that lies between the barrier islands and the mainland at the VCR LTER has a low sediment supply because watersheds on the Eastern Shore are small and contribute little sediment to this system (Christiansen et al. 2000). Under conditions of rising sea level, marshes in low sediment areas erode at the boundary between marsh and lagoon, as opposed to marshes with a large sediment supply that prograde out into the lagoon (Chapman 1960, Redfield 1972, Reed 1988, Brinson et al. 1995). At the VCR LTER, transgression along coastlines experiencing sea level rise occurs in a predictable pattern where lagoon ecosystems overtake the seaward edges of low marshes, low marshes replace high marshes, and high marshes overtake adjacent upland forests (Brinson et al. 1995). As marshes migrate inland, tidal creeks are simultaneously eroding headward into the newly occupied marshland. The patterns of transgression appear to differ among the three creek classes, and these patterns can be compared by examining differences in vegetation, holes in the soil, soil properties, and other physical characteristics.

When the upland boundary is converted to the back terrace, the transitional forest species (*Iva frutescens, Scirpus robustus,* and *Phragmites australis*) are excluded by the effects low oxygen, higher salinity, and higher levels of sulfide in the soils (Williams et al. 1999, Pennings and Moore 2001). This allows several halophyte species to dominate in the back terrace (Table 3.6). The average elevation of the back terrace in ST creeks occurred above the mean high water at spring tide (MHWS) and was dominated by *Spartina patens* and *Distichlis spicata*. The mean elevations of the WT and NT back terraces were below MHWS, so short from *S. alterniflora* prevailed in the back terrace. However, at WT creeks small patches of high marsh were sometimes found near the boundary between the back terrace and upland boundary where the elevation was slightly higher than average. No high marsh vegetation was found at NT creeks, perhaps due frequent wrack deposition in this area that prevents plant establishment.

When the upland boundary is converted to back terrace, organic matter accumulates in the soil of marshes inundated by WT and especially ST creeks. The buildup of organic matter over the Pleistocene surface creates a very flat surface in the back terrace. The broad and flat shape of terrace zones of ST creeks may produce anoxic conditions that persist for a long period of time. In contrast, the higher slope of the back terrace in WT and NT creeks allows soil to more effectively drain thus facilitating decomposition.

In ST and WT creeks the highest density of holes was observed in the basin and transition zones due to the high density of erosional holes in the these zones. The greatest average hole diameter in ST and WT creeks also occurred in the basin and transition zones, due to the large size of these erosional holes.

NT creeks did not have any erosional holes in the sediments, instead all of the holes were created by burrowing fiddler crabs. The highest density of holes was found in the basin and transition zones, while the greatest diameter of holes was found in the terrace zones. The pattern of density and diameter of the holes may reflect the density and size of the fiddler crabs living in a particular area.

Klassen and Ens (1993) found that fiddler crabs live within the tidal zone, but that larger crabs preferred to live in the upper end of the tidal zone. They report that this area is preferred because the crabs can dig deeper burrows that offer more protection against predators, there is more time between high tides to forage and dig holes, and the substrate is better for reproduction. This finding suggests that the larger fiddler crabs prefer to live in the back terrace zone, which is at the upper end of the tidal zone. Thus, the greatest average diameter of holes was found in the back terrace, and decreased steadily to the basin zone. The greatest density of holes was found in the basin and transition zones of NT creeks suggesting that the smaller crabs, that may be more numerous, are displaced from the prime habitat in the back terrace, and instead live in the lower portions of regularly flood zone between the back terrace and the tidal creek. Thus, the greatest density of holes was found in the basin and transition zones.

As the back terrace is converted to the front terrace, the height and percent cover of *S. alterniflora* increases, in parallel with several other features of the plant community. For example, all halophytes except for short form *S. alterniflora* are excluded from the front terrace, in all of the creek classes. A possible explanation for this persistence is that *S. alterniflora* has the most well developed aerenchyma system of the halophytes found in salt marshes, and therefore can tolerate longer periods of submergence and anoxia that other halophytes (Teal and Kanwisher 1966, Gleason and Zieman 1981, Mendelssohn 1982, Bertness 1991). However, *S. alterniflora* did not follow the typically observed pattern of greater heights closer to a tidal creek, and in soils with a greater mineral content (DeLaune et al. 1979, DeLaune et al. 1983, and Howes et al. 1986). Rather, *S. alterniflora* height was consistently taller and percent cover of *S. alterniflora* was greater in the more highly organic soils of the ST creeks. Greater nutrient availability, less anoxic conditions, lower salinity, or lower amounts of sulfide in the organic soils may have contributed to the greater height and percent cover of *S. alterniflora* in the organic soil. The lower bulk density (and thus greater porewater space) may facilitate flushing by tides, precipitation, and runoff, thus reducing sulfide levels and preventing accumulation of high concentrations of salt in the soil. Hmieleski (1994) measured higher soil salinity and sulfide in transects that had a low slope, compared to those with a high slope at the Virginia Coast Reserve – Long Term Ecological Research (VCR – LTER) site.

SOM and MOM were higher in the front terrace than back terrace for all creek classes in the ST and WT creeks. This conversion of back terrace to front terrace corresponds to a substantial decrease in bulk density. In all of the creek classes, the slope and elevation decreased from the front terrace to the back terrace. Thus, the front terrace was flooded more frequently and perhaps less efficiently drained, which may have decreased the rate of decomposition. Moreover, the front terrace is chronologically older than the back terrace, and time alone may be an important factor in organic matter accumulation. Anoxic soil conditions in the ST and WT creeks may have influenced the low density of crab holes in the front terrace. A higher density of crabs in the NT creeks may have been due to lower soil anoxia, although this variable was not directly measured.

As the front terrace is converted to the transition zone, there are sharp changes in many of the measured factors. A decrease in the percent coverage of *S. alterniflora* occurred in all of the creek classes from the front terrace to the transition zone, but the decrease was most striking in the WT and especially the NT creeks. Perhaps the most unexpected observation was an increase in the height of *S. alterniflora* from the front terrace to the transition. This is somewhat misleading in the ST and WT creeks, however, because the transition zone is vegetated by a mixture of stressed short form plants, and healthy tall plants. The short form plants appear to be the remnants of front terrace plants, while the tall form plants are produced from runners from tall plants in the adjacent basin zone. What causes the death of the short form plants is unknown, but this may be due to the short plants being poorly adapted to higher duration and frequency of inundation and the complete submergence of their leaves during high tide in contrast to its taller companions.

The decrease in SOM during the shift from the front terrace to the transition zone suggests that decomposition contributes to the decrease in elevation. The steep slope and proximity to the tidal creek head may facilitate SOM removal through mechanical erosion and flushing that may facilitate decomposition. The size of the holes in this zone may indicate an interaction between the two processes.

Erosional holes are much larger and shallower than fiddler crab holes, and crabs were rarely observed in the transition zone of ST and WT creeks where the hole density was highest. Erosional holes appeared to form first in the front terrace adjacent to the transition zone, but in the front terrace these holes changed very little in size over 11 months (Table 3.4). These holes may be formed when culms of dead *S. alterniflora* decompose, leaving pores in the soil. Once initiated, these holes may enlarge through a positive feedback in which the hole allows oxygen to enter the sediment, thus facilitating decomposition. The holes eventually coalesce and the surface collapses. The growth of holes over 11 months in the transition zone suggests the occurrence of decomposition and erosion around these holes (Table 3.4). Mechanical erosion may also contribute to hole enlargement when water quickly runs off the marsh surface and down the steep slope of the transition zone.

The holes observed in the basin zone were of a size and shape consistent with fiddler crab burrows, but many of the holes disappeared and new holes appeared over the 6 month period. The disappearance of old holes was most likely due to the frequent flooding in the basin, which disturbed the sediment and quickly filled in holes that are not maintained by fiddler crabs. The formation of new holes was probably due to the excavation of new burrows. The size of the holes measured in the basin zone appeared to be seasonal. In the fall, the average hole size was slightly larger than in the spring. This may be a reflection of the size of the fiddler crabs themselves, which tend to be smaller in the spring and then grow throughout the summer reaching a larger size by fall.

Erosion may also drive a decrease in SOM of NT creeks, although mixing with inorganic sediment sources cannot be ruled out. The density of holes also increased from front terrace to the transition zone of NT creeks. Many fiddler crabs were observed in this zone, and the diameter of the holes was consistent with fiddler crab burrows.

In all three creek classes, the shift from the transition zone to the basin was accompanied by dominance by tall form *S. alterniflora.* Short form *S. alterniflora* was likely excluded from the basin zone due the frequency and depth of inundation, which completely submerged plants even during the lowest high tides. Perhaps the long and frequent inundation prevented short form plants from persisting under conditions of deeper and more frequent flooding. The percent cover of *S. alterniflora* decreased in both the ST and WT creeks, but a slight increased the percent cover was observed in the NT creeks.

The basin zone of all three creek classes contained a high density of holes. The diameter and depth of the holes was consistent with fiddler crab burrows, unlike many of the holes in the transition zone. In all of the creek classes, the SOM decreased indicating that decomposition of organic matter continued to occur in the shift from transition zone to basin or that sources of inorganic sediment became influential. Headward erosion of the creek channel within the basin may occur as the transition zone is eroded, which expands the size of the basin zone.

4.3 Sediment Dynamics of Tidal Creeks

Researchers examining the spatial variability of sediment deposition found that sedimentation rates were highest near tidal creek channels and decrease further from the channel (French and Spencer 1993, Letzch and Frey 1980, Cahoon and Turner 1989). These studies suggest that the area around a tidal creek is a depositional environment. If this is true, then how can tidal creeks be eroding headward? A probable answer is that the headmost portion of the creek may be an erosional environment, while downstream portions of the creeks (where the studies cited above were carried out) are depositional. To understand the sediment dynamics occurring around tidal creeks it is important to understand how water circulates on the marsh surface.

At the onset of high tide, water levels are not high enough to enter marshes from downstream portions of creeks due to the presence of levees on either side of the creek channel. Instead, the rising tidewater is funneled onto the marsh surface at the most headward portion of the tidal creek where levees are absent (Boon 1975, Christiansen 2000). Once the water depth exceeds levee height, sedimentation on the levee may occur. At the onset of a falling tide, water covers the marsh uniformly, but once the ebbing tidewater has fallen below the level of the creek levees, the exiting water is once again funneled out of the marsh through the head-most portion of the tidal creek.

The concentrated flow of water in this region, and the high velocity of the water entering the marsh at this point prevent sediment deposition at tidal creek heads. The lower portions of the tidal creek were able to widen when sediment is eroded from the creek side of the levees and deposited on the marsh side when the levees are finally over topped during high tide (Chapman 1960). The simultaneous migration of levees toward the marsh plain, and erosion of creeks headward, creates the characteristic dendritic form of creeks in tidal marshes.

4.4 Inferring the Rate of Headward Erosion

Although the rate of erosion for each of the creek classes could not be determined from aerial photographs, some information on the rate of erosion may be inferred from the slope of the marsh surface, and studies of shoreline erosion. ST creeks were found in marshes with organic rich formations associated with poorly drained areas. These marshes may be poorly drained due to low slope of the Pleistocene surface upon which they form. The effects of transgression in a low sloping marsh occur over a much greater horizontal area. Thus, creeks found in low sloping marshes may erode headward at a relatively fast rate. WT creeks occurred in intermediately sloping marshes, and NT creeks occur in highly sloping marshes where the horizontal effects of transgression associated with rising sea level were much lower compared to gently sloping marshes. Based upon slope alone, the expected rate of erosion for the three creek classes from lowest to greatest is NT<WT<ST. However, I was unable to directly measure the rate of erosion in this study, and this question may be more completely addressed in the future research.

Soil cohesion and the presence of vegetation may also determine how quickly sediments are mechanically eroded by waves or runoff. Wilcock et al. (1998) and Zabawa and Ostrom (1980) found that the cohesive strength of soil particles was the most important soil property for determining the rate of shoreline erosion. They found that loose sediments, free of vegetation, were most quickly eroded, while more densely vegetated and more cohesive soils eroded much more slowly. The presence of roots in the soil helps to increase the cohesiveness of the soil, and the above ground portions of the plant slow the flow of water reducing shear stress on the sediments.

The deeper organic rich deposits found at ST creeks were more loosely consolidated compared to most of the mineral soils, and the peat became less fibric, and therefore less cohesive with depth. However, the front terrace and transition zones were more densely vegetated in the highly organic soils of the ST creeks, and the dense root system of the *S. patens* turf had a stabilizing effect on the soil. In some areas, the lower portion of the peat layer appeared to be less consolidated and thus was eroded from under the root mat causing beam failure in which the overhanging turf breaks off (Schwimmer 2001).

At WT creeks, the thin organic rich later was often densely rooted, appearing to make it more resistant to erosion than the deeper peat deposits at ST creeks. The most cohesive sediments were clay-sand sediments found at NT creeks. However, the transition zone at NT creeks also had the lowest percent cover of vegetation compared to the transition zone of ST and WT creeks. Thus, NT creeks may benefit less from the stabilizing effect of roots.

Overall, it is probable that ST and WT creeks are eroding faster than NT creeks and this may be primarily due to the lower slope of the marsh surface, greater loss by decomposition, and higher rate of mechanical erosion in the transition zone. The strong consolidation of the sediments and high slope at NT creeks are probably able to overcome erosion associated with lower density of vegetation.

For the ST and WT creeks, it is probable that ST creeks are eroding more rapidly. Although both have organic rich deposits that must be removed for the transition to the basin zone to occur, the entire depth of the organic rich soil is more thickly rooted at WT creeks, while the lower portions of peat deposits at ST creeks are more sapric, and less cohesive. Additionally, the steep slope of the ST transition zone may contribute to more rapid mechanical erosion as water reaches a higher velocity when it flows over the steeper transition zone and runs off the surface of the marsh. Among these factors, low slope of the marsh surface from the tidal creek to the upland boundary is likely the master variable causing ST creeks to erode the fastest.

4.5 Conclusions

The rate of transgression in marshes with low sediment supply is determined primarily by the slope of the marsh (Brinson et al. 1995, Ricker 1999). The marsh surfaces eroded by tidal creeks during transgression has other attributes, also ultimately determined by slope, that contribute to the pattern and process of headward erosion. Marshes with a low slope have accumulated thick deposits of organic rich soil due persistent anoxic conditions over many years. Strong wasting (ST) creeks erode into marshes with thick deposits of organic rich soil, and the rate of erosion is probably relatively high in these creeks. As the thick organic rich layer is eroded in the transition zone, a scarp is created with a steep slope. Small holes in the transition zone may be formed by the removal of *S. alterniflora* culms either through mechanical removal, or through chemical changes in the soil that kill the plants. Organic matter may begin to decompose around these holes as oxygen penetrates the sediments. This process may create the abundance of large holes observed in the transition zone of ST creeks. ST creeks erode headward as sediment and organic matter are eroded or decomposed from the transition zone.

Marshes with an intermediate slope have accumulated a thin layer of organic rich soil due to anoxic conditions that slow the rate of decomposition. Weakly wasting (WT) creeks erode into marshes with a thin deposit of organic rich soil, and the rate of erosion is probably intermediate in these creeks. The organic rich deposits may not be as thick as in ST marshes because they have a slightly higher slope or because WT marshes have not been accumulating organic matter for such a long time. The thin organic rich layer erodes within the transition zone creating a fringe where the organic material is removed. Small holes in the transition zone may be formed through mechanical removal of *S. alterniflora* culms, or through chemical changes in the soil that kills the plants. Organic matter may decompose around these holes as oxygen penetrates the sediments, and this process may create the large holes observed in the transition zone of WT creeks. WT creeks erode headward as sediment and organic matter are eroded and decomposed from the transition zone.

Marshes with a high slope do not accumulate organic rich sediments, perhaps because water does not pond on the surface of the marsh, so the persistent anoxic conditions needed to accumulate organic matter do not occur. No wasting terrace (NT) creeks erode into marshes with little to no organic rich soil, and the rate of erosion is probably relatively low in these creeks. The slope of the transition zone ranges from low to high, but does not show any erosional features. Fiddler crabs were commonly observed in the terrace and transition zones. Thus, many small holes were observed in the sediment. These holes may not increase in size because there is little organic matter in the soil available for decomposition. NT creeks erode headward when sediments are mechanically eroded, but decomposition does not play a role in the headward erosion of NT creeks.

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APPENDIX A. Mann-Whitney U Post Hoc Tests Across Creek Zones.

				d.f.	M.W.U	W	Z	P					d.f.	M.W.U	W	Z	P
Distance									Elevation								
ST	BA	*	TR	1	4	14	-1.16	0.343	ST	BA	*	TR	1	958	5423	-3.46	0.001
	BA	*	FT	1	2	12	-1.73	0.114		BA	*	FT	1	941	5406	-8.51	0.000
	BA	*	BT	1	1	11	-2.02	0.057		BA	*	BT	1	139	4604	-9.13	0.000
	TR	*	FT	1	3	13	-1.44	0.200		TR	*	FT	1	694	1289	-4.13	0.000
	TR	*	BT	1	1	11	-2.02	0.057		TR	*	BT	1	212	807	-5.69	0.000
	FT	*	BT	1	5	15	-0.87	0.486		FT	*	BT	1	1613	4853	-1.51	0.131
WT	BA	*	TR	1	11	66	-2.99	0.002	WT	BA	*	TR	1	1476	5754	-5.99	0.000
	BA	*	FT	1	0	55	-3.78	0.000		BA	*	FT	1	2144	6422	-11.47	0.000
	BA	*	BT	1	0	55	-3.78	0.000		BA	*	BT	1	291	4569	-11.94	0.000
	TR	*	FT	1	0	55	-3.78	0.000		TR	*	FT	1	4187	6743	-6.68	0.000
	TR	*	BT	1	0	55	-3.78	0.000		TR	*	BT	1	737	3293	-9.70	0.000
	FT	*	BT	1	5	60	-3.40	0.000		FT	*	BT	1	5443	35824	-10.17	0.000
NT	BA	*	TR	1	10	55	-2.75	0.004	NT	BA	*	TR	1	303	1206	-6.21	0.000
	BA	*	FT	1	0	45	-3.59	0.000		BA	*	FT	1	1541	2444	-8.06	0.000
	BA	*	BT	1	0	45	-3.59	0.000		BA	*	BT	1	9	912	-9.21	0.000
	TR	*	FT	1	1	46	-3.53	0.000		TR	*	FT	1	5320	6860	-4.52	0.000
	TR	*	BT	1	0	45	-3.58	0.000		TR	*	BT	1	190	1730	-9.34	0.000
	FT	*	BT	1	14	59	-2.34	0.019		FT	*	BT	1	2623	51764	-11.85	0.000

				d.f.	M.W.U	W	Z	P					d.f.	M.W.U	W	Z	P
Width									Slope								
ST	BA	*	TR	1	7	17	-0.29	0.886	ST	BA	*	TR	1	1227	5692	-2.01	0.045
	BA	*	FT	1	5	15	-1.02	0.343		BA	*	FT	1	2660	5900	-3.32	0.001
	BA	*	BT	1	2	12	-1.73	0.114		BA	*	BT	1	1747	2875	-2.02	0.043
	TR	*	FT	1	4	14	-1.16	0.343		TR	*	FT	1	753	3993	-3.76	0.000
	TR	*	BT	1	0	10	-2.31	0.029		TR	*	BT	1	471	1599	-3.15	0.002
	FT	*	BT	1	7	17	-0.29	0.886		FT	*	BT	1	1622	4862	-1.29	0.197
WT	BA	*	TR	1	36	91	-1.10	0.280	WT	BA	*	TR	1	2853	5268	-0.88	0.380
	BA	*	FT	1	0	55	-3.78	0.000		BA	*	FT	1	7500	37881	-4.53	0.000
	BA	*	BT	1	1	56	-3.75	0.000		BA	*	BT	1	4277	12027	-2.92	0.004
	TR	*	FT	1	0	55	-3.79	0.000		TR	*	FT	1	6469	36850	-3.02	0.003
	TR	*	BT	1	0	55	-3.80	0.000		TR	*	BT	1	3762	11512	-1.39	0.165
	FT	*	BT	1	44	99	-0.45	0.684		FT	*	BT	1	12064	42445	-3.29	0.001
NT	BA	*	TR	1	33	78	-0.71	0.489	NT	BA	*	TR	1	985	1888	-0.81	0.416
	BA	*	FT	1	0	45	-3.59	0.000		BA	*	FT	1	5182	54323	-2.23	0.026
	BA	*	BT	1	0	45	-3.59	0.006		BA	*	BT	1	1741	5746	-0.63	0.526
	TR	*	FT	1	0	45	-3.58	0.000		TR	*	FT	1	5291	54432	-4.04	0.000
	TR	*	BT	1	14	59	-2.34	0.019		TR	*	BT	1	1670	5675	-2.75	0.006
	FT	*	BT	1	22	67	-1.64	0.113		FT	*	BT	1	10221	59362	-3.84	0.000

				d.f.	M.W.U	W	Z	P					d.f.	M.W.U	W	Z	P
Hole Density									% Cover of Holes								
ST	BA	*	TR	1	139	490	-0.54	0.609	ST	BA	*	TR	1	112	463	-1.38	0.174
	BA	*	FT	1	143	809	-4.78	0.000		BA	*	FT	1	106	772	-5.30	0.000
	BA	*	BT	1	109	637	-4.96	0.000		BA	*	BT	1	133	661	-4.57	0.000
	TR	*	FT	1	62	728	-3.88	0.000		TR	*	FT	1	40	706	-4.42	0.000
	TR	*	BT	1	49	577	-4.03	0.000		TR	*	BT	1	50	578	-4.01	0.000
	FT	*	BT	1	519	1047	-0.81	0.418		FT	*	BT	1	557	1085	-0.27	0.784
WT	BA	*	TR	1	781	2107	-1.19	0.234	WT	BA	*	TR	1	621	1947	-2.56	0.010
	BA	*	FT	1	1999	12439	-4.94	0.000		BA	*	FT	1	2103	12543	-4.59	0.000
	BA	*	BT	1	1573	6724	-4.03	0.000		BA	*	BT	1	1379	6530	-4.80	0.000
	TR	*	FT	1	827	11267	-6.44	0.000		TR	*	FT	1	729	11169	-6.74	0.000
	TR	*	BT	1	774	5925	-5.24	0.000		TR	*	BT	1	509	5660	-6.55	0.000
	FT	*	BT	1	7059	12210	-0.41	0.684		FT	*	BT	1	6359	11510	-1.73	0.084
NT	BA	*	TR	1	297	597	-0.92	0.356	NT	BA	*	TR	1	289	589	-1.06	0.291
	BA	*	FT	1	1684	16390	-1.43	0.153		BA	*	FT	1	1831	16537	-0.85	0.393
	BA	*	BT	1	633	3118	-1.81	0.071		BA	*	BT	1	823	1123	-0.15	0.879
	TR	*	FT	1	1495	16201	-3.43	0.001		TR	*	FT	1	1702	16408	-2.70	0.007
	TR	*	BT	1	571	3056	-3.43	0.001		TR	*	BT	1	846	3331	-1.30	0.192
	FT	*	BT	1	5472	7957	-1.05	0.294		FT	*	BT	1	5535	20241	-0.92	0.359
Hole Diameter									Spartina Height								
ST	BA	*	TR	1	104	455	-1.65	0.100	ST	BA	*	TR	1	41	77	-2.33	0.018
	BA	*	FT	1	187	853	-4.12	0.000		BA	*	FT	1	96	502	-4.28	0.000
	BA	*	BT	1	203	731	-3.45	0.001		BA	*	BT	1	53	431	-5.06	0.000
	TR	*	FT	1	75	741	-3.54	0.000		TR	*	FT	1	100	506	-0.46	0.668
	TR	*	BT	1	70	598	-3.45	0.001		TR	*	BT	1	36	414	-2.89	0.003
	FT	*	BT	1	563	1091	-0.19	0.850		FT	*	BT	1	133	511	-4.16	0.000
WT	BA	*	TR	1	634	1960	-2.46	0.014	WT	BA	*	TR	1	191	422	-1.77	0.077
	BA	*	FT	1	3199	13639	-1.39	0.166		BA	*	FT	1	538	5291	-4.48	0.000
	BA	*	BT	1	1518	6669	-4.25	0.000		BA	*	BT	1	432	5685	-5.33	0.000
	TR	*	FT	1	1547	11987	-3.78	0.000		TR	*	FT	1	808	5561	-1.48	0.138
	TR	*	BT	1	616	5767	-6.02	0.000		TR	*	BT	1	560	5813	-3.45	0.001
	FT	*	BT	1	5515	10666	-3.32	0.001		FT	*	BT	1	2837	8090	-5.21	0.000
NT	BA	*	TR	1	288	588	-1.08	0.279	NT	BA	*	TR	1	26	162	-3.42	0.000
	BA	*	FT	1	1782	2082	-1.04	0.297		BA	*	FT	1	71	6176	-5.30	0.000
	BA	*	BT	1	651	951	-1.65	0.099		BA	*	BT	1	8	1661	-5.67	0.000
	TR	*	FT	1	2427	17133	-0.18	0.854		TR	*	FT	1	493	6598	-2.84	0.005
	TR	*	BT	1	846	1281	-1.30	0.192		TR	*	BT	1	142	1795	-4.36	0.000
	FT	*	BT	1	5194	19900	-1.61	0.107		FT	*	BT	1	888	2541	-7.61	0.000

% Cover S. altern.				d.f.	M.W.U	W	Z	P
ST	BA	*	TR	1	80	356	-0.57	0.580
	BA	*	FT	1	160	436	-3.10	0.002
	BA	*	BT	1	167	545	-2.84	0.005
	TR	*	FT	1	53	89	-2.29	0.024
	TR	*	BT	1	54	432	-2.19	0.034
	FT	*	BT	1	97	475	-4.81	0.000
WT	BA	*	TR	1	234	585	-0.85	0.395
	BA	*	FT	1	573	924	-4.30	0.000
	BA	*	BT	1	1064	6317	-1.57	0.118
	TR	*	FT	1	603	834	-2.96	0.003
	TR	*	BT	1	744	5997	-2.21	0.027
	FT	*	BT	1	1591	6844	-8.30	0.000
NT	BA	*	TR	1	94	230	-0.46	0.650
	BA	*	FT	1	485	576	-1.93	0.054
	BA	*	BT	1	113	1766	-4.03	0.000
	TR	*	FT	1	482	618	-2.96	0.003
	TR	*	BT	1	222	1875	-3.24	0.001
	FT	*	BT	1	447	2100	-9.16	0.000

SOM				d.f.	M.W.U	W	Z	P
ST	BA	*	TR	1	20	65	-1.81	0.077
	BA	*	FT	1	9	54	-1.39	0.199
	BA	*	BT	1	44	89	-0.42	0.710
	TR	*	FT	1	13	58	-0.77	0.503
	TR	*	BT	1	46	112	-0.27	0.824
	FT	*	BT	1	19	85	-0.39	0.753
WT	BA	*	TR	1	32	77	-0.75	0.489
	BA	*	FT	1	19	64	-0.94	0.388
	BA	*	BT	1	39	84	-0.13	0.931
	TR	*	FT	1	22	67	-0.59	0.607
	TR	*	BT	1	37	82	-0.31	0.796
	FT	*	BT	1	23	68	-0.47	0.689
NT	BA	*	TR	1	20	30	-0.85	0.442
	BA	*	FT	1	13	23	-1.70	0.100
	BA	*	BT	1	0	78	-2.91	0.001
	TR	*	FT	1	28	163	-2.05	0.041
	TR	*	BT	1	2	80	-4.22	0.000
	FT	*	BT	1	3	81	-4.25	0.000

MOM				d.f.	M.W.U	W	Z	P
ST	BA	*	TR	1	26	71	-1.28	0.222
	BA	*	FT	1	9	54	-1.39	0.199
	BA	*	BT	1	46	112	-0.27	0.824
	TR	*	FT	1	15	60	-0.46	0.710
	TR	*	BT	1	36	102	-1.03	0.331
	FT	*	BT	1	20	86	-0.26	0.851
WT	BA	*	TR	1	29	74	-1.02	0.340
	BA	*	FT	1	14	59	-1.53	0.145
	BA	*	BT	1	40	85	-0.04	1.000
	TR	*	FT	1	18	63	-1.06	0.328
	TR	*	BT	1	39	84	-0.13	0.931
	FT	*	BT	1	23	68	-0.47	0.689
NT	BA	*	TR	1	16	26	-1.27	0.233
	BA	*	FT	1	4	14	-2.60	0.006
	BA	*	BT	1	8	86	-1.94	0.058
	TR	*	FT	1	66	171	-1.70	0.093
	TR	*	BT	1	23	101	-3.16	0.001
	FT	*	BT	1	2	80	-4.29	0.000

Bulk Density				d.f.	M.W.U	W	Z	P
ST	BA	*	TR	1	23	68	-1.60	0.113
	BA	*	FT	1	11	21	-1.09	0.330
	BA	*	BT	1	40	85	-0.72	0.503
	TR	*	FT	1	11	21	-1.09	0.330
	TR	*	BT	1	35	80	-1.14	0.261
	FT	*	BT	1	17	27	-0.65	0.571
WT	BA	*	TR	1	35	80	-0.49	0.666
	BA	*	FT	1	23	68	-0.54	0.607
	BA	*	BT	1	31	76	-0.84	0.436
	TR	*	FT	1	26	71	-0.18	0.846
	TR	*	BT	1	35	80	-0.53	0.605
	FT	*	BT	1	22	43	-0.59	0.607
NT	BA	*	TR	1	18	28	-1.12	0.277
	BA	*	FT	1	26	36	-0.45	0.665
	BA	*	BT	1	0	10	-2.91	0.001
	TR	*	FT	1	91	211	-0.61	0.561
	TR	*	BT	1	2	107	-4.22	0.000
	FT	*	BT	1	5	125	-4.18	0.000

APPENDIX B. Mann-Whitney U Post Hoc Tests Across Creek Classes.

		d.f.	M.W.U	W	Z	P			d.f.	M.W.U	W	Z	P
Distance							Elevation						
Basin	NT * WT	1	23	68	-1.84	0.065	Basin	NT * WT	1	200	1103	-8.31	0.000
	WT * ST	1	17	27	-0.50	0.632		WT * ST	1	2243	6521	-5.67	0.000
	ST * NT	1	12	57	-1.02	0.330		ST * NT	1	311	1214	-7.83	0.000
Trans.	NT * WT	1	27	72	-1.51	0.133	Trans.	NT * WT	1	625	2165	-6.53	0.000
	WT * ST	1	14	24	-0.85	0.454		WT * ST	1	521	3077	-4.70	0.000
	ST * NT	1	14	59	-0.70	0.503		ST * NT	1	136	1676	-6.75	0.000
Front Terr.	NT * WT	1	43	88	-0.16	0.905	Front Terr.	NT * WT	1	19199	68340	-10.18	0.000
	WT * ST	1	15	21	0.00	1.000		WT * ST	1	1236	31617	-11.75	0.000
	ST * NT	1	13	58	-0.09	1.000		ST * NT	1	601	49742	-13.15	0.000
Back Terr.	NT * WT	1	25	70	-1.63	0.133	Back Terr.	NT * WT	1	5327	13202	-0.80	0.427
	WT * ST	1	15	25	-0.71	0.374		WT * ST	1	1121	8996	-6.37	0.000
	ST * NT	1	16	61	-0.31	0.825		ST * NT	1	1100	5286	-4.80	0.000
Width							Slope						
Basin	NT * WT	1	23	68	-1.84	0.065	Basin	NT * WT	1	1864	2767	-0.13	0.897
	WT * ST	1	17	27	-0.50	0.635		WT * ST	1	4209	83.3.5	-0.06	0.953
	ST * NT	1	12	57	-1.02	0.330		ST * NT	1	1948	2851	-0.12	0.903
Trans.	NT * WT	1	25	70	-1.66	0.113	Trans.	NT * WT	1	1440	3855	-1.86	0.063
	WT * ST	1	18	28	-0.36	0.733		WT * ST	1	816	3231	-2.51	0.012
	ST * NT	1	12	57	-1.01	0.330		ST * NT	1	731	2109	-1.35	0.176
Front Terr.	NT * WT	1	42	87	-0.29	0.780	Front Terr.	NT * WT	1	36025	66406	-1.31	0.191
	WT * ST	1	14	24	-0.85	0.454		WT * ST	1	9387	12627	-0.62	0.536
	ST * NT	1	15	25	-0.46	0.710		ST * NT	1	11487	14727	-1.14	0.254
Back Terr.	NT * WT	1	27	72	-1.51	0.133	Back Terr.	NT * WT	1	3712	11462	-4.07	0.000
	WT * ST	1	14	24	-0.92	0.539		WT * ST	1	2762	3890	-0.53	0.597
	ST * NT	1	11	56	-1.16	0.825		ST * NT	1	1486	2614	-2.77	0.006

		d.f.	M.W.U	W	Z	P			d.f.	M.W.U	W	Z	P
Hole Density							% Cover of Holes						
Basin	NT * WT	1	549	1875	-0.73	0.468	Basin	NT * WT	1	502	802	-1.25	0.210
	WT * ST	1	554	1880	-1.18	0.236		WT * ST	1	640	1966	-0.25	0.800
	ST * NT	1	307	607	-0.11	0.915		ST * NT	1	236	536	-1.48	0.139
Trans.	NT * WT	1	422	1088	-1.33	0.184	Trans.	NT * WT	1	319	754	-2.68	0.007
	WT * ST	1	193	859	-0.55	0.583		WT * ST	1	198	864	-0.43	0.668
	ST * NT	1	159	237	-0.43	0.682		ST * NT	1	116	551	-1.68	0.094
Front Terr.	NT * WT	1	6282	16722	-7.57	0.000	Front Terr.	NT * WT	1	8434	18878	-4.83	0.000
	WT * ST	1	2217	2883	-1.40	0.163		WT * ST	1	1862	2528	-2.69	0.007
	ST * NT	1	1460	2126	-4.99	0.000		ST * NT	1	1269	1935	-5.56	0.000
Back Terr.	NT * WT	1	2458	7609	-3.48	0.000	Back Terr.	NT * WT	1	2204	7355	-4.29	0.000
	WT * ST	1	1272	1800	-1.96	0.051		WT * ST	1	1347	1875	-1521	0.128
	ST * NT	1	554	1082	-4.19	0.000		ST * NT	1	569	1097	-4.07	0.000
Hole Diameter							Spartina Height						
Basin	NT * WT	1	424	724	-2.15	0.031	Basin	NT * WT	1	91	442	-2.34	0.018
	WT * ST	1	606	957	-0.62	0.535		WT * ST	1	180	531	-2.40	0.017
	ST * NT	1	221	521	-1.78	0.075		ST * NT	1	147	238	-0.10	0.922
Trans.	NT * WT	1	217	652	-4.03	0.000	Trans.	NT * WT	1	143	374	-0.77	0.457
	WT * ST	1	198	276	-0.43	0.668		WT * ST	1	61	292	-1.12	0.279
	ST * NT	1	85	520	-2.57	0.009		ST * NT	1	59	195	-0.34	0.742
Front Terr.	NT * WT	1	11995	22435	-0.40	0.692	Front Terr.	NT * WT	1	5147	11252	-0.44	0.662
	WT * ST	1	1708	2374	-3.26	0.001		WT * ST	1	410	5163	-5.62	0.000
	ST * NT	1	1428	2094	-5.07	0.000		ST * NT	1	478	6583	-5.63	0.000
Back Terr.	NT * WT	1	2219	7370	-4.24	0.000	Back Terr.	NT * WT	1	1970	3623	-3.43	0.001
	WT * ST	1	1402	1930	-1.21	0.226		WT * ST	1	1332	6585	-0.26	0.792
	ST * NT	1	635	1163	-3.59	0.000		ST * NT	1	568	2221	-2.04	0.041

		d.f.	M.W.U	W	Z	P			d.f.	M.W.U	W	Z	P
% Cover S. altern.							MOM						
Basin	NT * WT	1	159	510	-0.32	0.758	Basin	NT * WT	1	4	14	-2.16	0.034
	WT * ST	1	135	486	-3.30	0.001		WT * ST	1	13	58	-2.43	0.014
	ST * NT	1	71	162	-2.60	0.009		ST * NT	1	0	10	-2.78	0.003
Trans.	NT * WT	1	134	270	-1.07	0.294	Trans.	NT * WT	1	21	126	-2.65	0.007
	WT * ST	1	49	280	-1.72	0.093		WT * ST	1	4	49	-3.22	0.000
	ST * NT	1	31	167	-2.03	0.045		ST * NT	1	0	105	-3.97	0.000
Front Terr.	NT * WT	1	3125	9230	-5.20	0.000	Front Terr.	NT * WT	1	0	120	-3.50	0.000
	WT * ST	1	647	5400	-4.25	0.000		WT * ST	1	6	27	-1.28	0.257
	ST * NT	1	583	6688	-5.13	0.000		ST * NT	1	1	121	-2.90	0.001
Back Terr.	NT * WT	1	1835	3488	-3.93	0.000	Back Terr.	NT * WT	1	22	100	-2.27	0.023
	WT * ST	1	1259	1637	-0.69	0.488		WT * ST	1	35	80	-1.10	0.295
	ST * NT	1	663	2316	-1.09	0.275		ST * NT	1	9	87	-3.51	0.000
SOM							Bulk Density						
Basin	NT * WT	1	6	16	-1.85	0.076	Basin	NT * WT	1	5	50	-2.02	0.050
	WT * ST	1	20	65	-1.81	0.077		WT * ST	1	20	65	-1.86	0.063
	ST * NT	1	0	10	-2.78	0.003		ST * NT	1	0	45	-2.78	0.003
Trans.	NT * WT	1	1	106	-3.91	0.000	Trans.	NT * WT	1	1	46	-3.92	0.000
	WT * ST	1	7	52	-2.96	0.002		WT * ST	1	1	46	-3.50	0.000
	ST * NT	1	0	105	-3.97	0.000		ST * NT	1	0	45	-3.98	0.000
Front Terr.	NT * WT	1	0	120	-3.50	0.000	Front Terr.	NT * WT	1	10	31	-2.73	0.005
	WT * ST	1	6	27	-1.28	0.257		WT * ST	1	6	16	-1.28	0.257
	ST * NT	1	6	126	-2.40	0.014		ST * NT	1	12	22	-1.81	0.080
Back Terr.	NT * WT	1	20	98	-2.42	0.015	Back Terr.	NT * WT	1	20	65	-2.42	0.015
	WT * ST	1	31	76	-1.41	0.175		WT * ST	1	34	100	-1.22	0.230
	ST * NT	1	4	82	-3.82	0.000		ST * NT	1	10	76	-3.48	0.000

APPENDIX C. Latitude and Longitude Coordinates for all Sites.

Creek	Marsh	W. Latitude	W. Longitude
Antero	Brownsville	37.45428	75.83907
Blanca	Brownsville	37.45437	75.83752
Bross	Brownsville	37.45060	75.83076
Cameron	Brownsville	37.45242	75.82978
Columbia	Brownsville	37.45972	75.83427
Culebra	Brownsville	37.46099	75.83559
Democrat	Brownsville	37.45153	75.83021
El Diente	Brownsville	37.45384	75.83235
Elbert	Brownsville	37.45656	75.82825
Gray's	Brownsville	37.45412	75.84099
Huron	Oyster	37.28519	75.91752
Kit Carson	Brownsville	37.45394	75.82164
La Plata	Bellevue	37.62324	75.67041
Lincoln	Woodland's	37.47729	75.81932
Little Bear	Brownsville	37.45223	75.82444
Missouri	Boxtree	37.39399	75.87104
Pikes	Kegotank	37.78100	75.55649
Quandry	Brownsville	37.45923	75.83268
Red Cloud	Brownsville	37.45670	75.82150
Shavano	Brownsville	37.45303	75.82663
Sunlight	Cushman's	37.17392	75.94363
Tabeguache	Indiantown	37.34590	75.90126
Torries	Mill Creek	37.41208	75.85848

APPENDIX D. Physical Data.

Creek	Zone	Physical Data: Distance (m)	Physical Data: Elevation (m)	Physical Data: Slope	Creek	Zone	Physical Data: Distance (m)	Physical Data: Elevation (m)	Physical Data: Slope
Antero	basin	0.25	0.634	0.196	Blanca	front terr	3.50	0.429	-0.016
		0.50	0.683	0.052			3.75	0.425	0.028
		0.75	0.696	-0.108			4.00	0.432	-0.064
		1.00	0.669	0.176			4.25	0.416	0.280
		1.25	0.713	0.008			4.50	0.486	-0.080
		1.50	0.715	-0.004			4.75	0.466	-0.072
		1.75	0.714	0.024			5.00	0.448	-0.060
		2.00	0.720	0.004			5.25	0.433	0.032
		2.25	0.721	0.020			5.50	0.441	-0.048
		2.50	0.726	0.040			5.75	0.429	0.020
	transition	2.75	0.736	-0.016			6.00	0.434	0.048
		3.00	0.732	-0.012			6.25	0.446	0.000
		3.25	0.729	-0.016			6.50	0.446	-0.012
		3.50	0.725	0.012			6.75	0.443	0.032
		3.75	0.728	0.020			7.00	0.451	-0.060
	front terr	4.00	0.733	0.004			7.25	0.436	0.100
		4.25	0.734	-0.004			7.50	0.461	-0.016
		4.50	0.733	0.008			7.75	0.457	0.012
		4.75	0.735	0.024			8.00	0.460	0.072
		5.00	0.741	0.001			8.25	0.478	-0.064
	back terr	10.00	0.747	0.003			8.50	0.462	-0.008
		15.00	0.761	0.007			8.75	0.460	0.040
		20.00	0.794	0.007			9.00	0.470	0.004
		25.00	0.829	0.015			9.25	0.471	0.004
		30.00	0.904	0.016			9.50	0.472	0.000
		35.00	0.986	0.008			9.75	0.472	0.000
		40.00	1.027	0.004			10.00	0.472	0.000
		42.50	1.036	0.032			10.25	0.472	0.036
		45.00	1.116	0.016			10.50	0.481	-0.028
		47.50	1.155	0.014			10.75	0.474	0.060
		50.00	1.189	0.004		back terr	11.00	0.489	-0.020
	boundary	52.50	1.200	0.015			11.25	0.484	0.028
		54.00	1.223	.			11.50	0.491	0.024
Blanca	basin	0.25	0.169	0.156			11.75	0.497	-0.032
		0.50	0.208	0.364			12.00	0.489	0.041
		0.75	0.299	-0.024			15.00	0.611	0.051
	transition	1.00	0.293	0.180			17.50	0.739	0.042
		1.25	0.338	0.092			20.00	0.843	0.069
		1.50	0.361	0.096		boundary	22.50	1.015	-0.001
		1.75	0.385	-0.124			24.00	1.013	.
		2.00	0.354	0.136	Bross	transition	0.25	0.418	0.252
	front terr	2.25	0.388	0.084			0.50	0.481	0.100
		2.50	0.409	-0.036			0.75	0.506	0.044
		2.75	0.400	0.036			1.00	0.517	0.104
		3.00	0.409	0.012			1.25	0.543	0.008
		3.25	0.412	0.068			1.50	0.545	0.048

Creek	Zone	Physical Data Distance (m)	Physical Data Elevation (m)	Physical Data Slope	Creek	Zone	Physical Data Distance (m)	Physical Data Elevation (m)	Physical Data Slope
Bross	transition	1.75	0.557	0.092	Bross	back terr	33.50	0.984	0.046
		2.00	0.580	0.048			34.00	1.007	0.010
Bross	front terr	2.25	0.592	0.044			34.50	1.012	0.074
		2.50	0.603	0.032			35.00	1.049	-0.070
		2.75	0.611	0.024			35.50	1.014	0.046
		3.00	0.617	0.036			36.00	1.037	0.060
		3.25	0.626	0.000			36.50	1.067	0.040
		3.50	0.626	0.040			37.00	1.087	-0.050
		3.75	0.636	0.016			37.50	1.062	-0.004
		4.00	0.640	-0.008			38.00	1.060	0.016
		4.25	0.638	0.012			38.50	1.068	0.030
		4.50	0.641	0.012			39.00	1.083	-0.004
		4.75	0.644	-0.024			39.50	1.081	0.012
		5.00	0.638	0.032		boundary	40.00	1.087	0.146
		5.25	0.646	-0.008			40.50	1.160	0.000
		5.50	0.644	0.000			41.00	1.160	.
		5.75	0.644	0.016	Cameron	transition	0.25	0.533	0.480
		6.00	0.648	-0.012			0.40	0.605	0.360
		6.25	0.645	0.016			0.50	0.641	0.048
		6.50	0.649	-0.036			0.75	0.653	-0.060
		6.75	0.640	0.040			1.00	0.638	0.052
		7.00	0.650	-0.012		front terr	1.25	0.651	0.080
		7.25	0.647	0.012			1.30	0.655	0.040
		7.50	0.650	0.016			1.50	0.663	-0.015
		7.75	0.654	-0.028			1.70	0.660	-0.040
		8.00	0.647	-0.052			1.75	0.658	0.100
		8.25	0.634	0.092			2.00	0.683	-0.064
		8.50	0.657	-0.012			2.25	0.667	0.088
		8.75	0.654	-0.024			2.50	0.689	-0.072
		9.00	0.648	0.032			2.75	0.671	0.020
		9.25	0.656	0.008			3.00	0.676	0.016
		9.50	0.658	-0.028			3.25	0.680	0.052
		9.75	0.651	0.024			3.50	0.693	0.190
		10.00	0.657	-0.004			3.60	0.712	0.060
		12.50	0.647	0.004			3.75	0.721	0.007
		15.00	0.656	0.005			3.90	0.722	0.010
	back terr	17.50	0.668	0.012			4.00	0.723	-0.010
		20.00	0.697	0.020			4.20	0.721	-0.020
		22.50	0.747	0.017			4.25	0.720	0.044
		25.00	0.790	0.020			4.50	0.731	0.044
		27.50	0.841	0.008			4.75	0.742	0.020
		30.00	0.861	0.082			5.00	0.747	0.012
		30.50	0.902	0.016			5.25	0.750	0.024
		31.00	0.910	0.010			5.50	0.756	-0.016
		31.50	0.915	0.054			5.75	0.752	0.016
		32.00	0.942	0.026			6.00	0.756	0.028
		32.50	0.955	0.030			6.25	0.763	-0.024
		33.00	0.970	0.028			6.50	0.757	0.024

Creek	Zone	Physical Data: Distance (m)	Physical Data: Elevation (m)	Slope	Creek	Zone	Physical Data: Distance (m)	Physical Data: Elevation (m)	Slope
Cameron	front terr	6.75	0.763	0.012	Cameron	boundary	72.50	1.154	-0.003
		7.00	0.766	-0.012			74.00	1.149	.
		7.25	0.763	0.024	Columbia	basin	0.25	0.360	0.448
		7.50	0.769	0.020			0.50	0.472	-0.292
		7.75	0.774	-0.012			0.75	0.399	0.268
		8.00	0.771	0.000			1.00	0.466	0.000
		8.25	0.771	-0.008			1.25	0.466	0.004
		8.50	0.769	0.024			1.50	0.467	-0.048
		8.75	0.775	-0.008			1.75	0.455	0.068
		9.00	0.773	-0.004			2.00	0.472	-0.048
		9.25	0.772	-0.016			2.25	0.460	-0.004
		9.50	0.768	0.012			2.50	0.459	0.272
		9.75	0.771	0.024			2.75	0.527	0.112
		10.00	0.777	-0.016			3.00	0.555	-0.100
		10.25	0.773	-0.024			3.25	0.530	-0.232
		10.50	0.767	0.040			3.50	0.472	0.340
		10.75	0.777	-0.096			3.75	0.557	0.140
		11.00	0.753	-0.005			4.00	0.592	0.044
		12.50	0.745	-0.001			4.25	0.603	0.028
		15.00	0.742	-0.005			4.50	0.610	0.008
		17.50	0.730	0.001			4.75	0.612	0.004
		20.00	0.732	-0.003			5.00	0.613	0.152
		22.50	0.725	-0.009			5.25	0.651	0.107
		25.00	0.703	0.002			5.40	0.667	0.110
		27.50	0.709	-0.002			5.50	0.678	-0.220
		30.00	0.705	-0.002			5.75	0.623	0.076
		32.50	0.699	-0.002			6.00	0.642	0.004
		35.00	0.695	-0.001			6.25	0.643	0.076
		37.50	0.692	0.005			6.50	0.662	-0.008
		40.00	0.704	-0.002			6.75	0.660	0.060
	back terr	42.50	0.700	0.003			7.00	0.675	-0.016
		45.00	0.707	-0.003			7.25	0.671	-0.012
		47.50	0.699	0.003			7.50	0.668	0.084
		50.00	0.706	-0.001			7.75	0.689	0.104
		52.50	0.703	0.001			8.00	0.715	-0.048
		55.00	0.706	0.002			8.25	0.703	-0.040
		57.50	0.710	0.006			8.50	0.693	0.132
		60.00	0.725	0.006			8.75	0.726	-0.092
		62.50	0.741	0.011			9.00	0.703	0.072
		65.00	0.768	0.020			9.25	0.721	0.028
		66.00	0.788	0.050			9.50	0.728	0.008
		67.00	0.838	-0.094			9.75	0.730	0.056
		67.50	0.791	0.198			10.00	0.744	0.048
		68.00	0.890	0.070			10.25	0.756	-0.020
		69.00	0.960	0.060			10.50	0.751	0.075
		70.00	1.020	0.072			10.70	0.766	0.080
		71.00	1.092	0.067			10.75	0.770	-0.036
	boundary	72.00	1.159	-0.010			11.00	0.761	0.092

Creek	Zone	Physical Data			Creek	Zone	Physical Data		
		Distance (m)	Elevation (m)	Slope			Distance (m)	Elevation (m)	Slope
Columbia	basin	11.25	0.784	-0.028	Columbia	front terr	22.50	1.058	-0.032
		11.50	0.777	0.020			22.75	1.050	0.000
		11.75	0.782	-0.016			23.00	1.050	0.008
		12.00	0.778	0.076			23.25	1.052	0.016
		12.25	0.797	-0.028			23.50	1.056	-0.020
		12.50	0.790	0.044			23.75	1.051	-0.004
		12.75	0.801	-0.012			24.00	1.050	0.024
		13.00	0.798	0.032			24.25	1.056	0.000
		13.25	0.806	0.012			24.50	1.056	-0.024
		13.50	0.809	0.000			24.75	1.050	0.032
		13.75	0.809	0.012			25.00	1.058	-0.004
		14.00	0.812	-0.036			25.25	1.057	0.040
		14.25	0.803	0.068			25.50	1.067	-0.056
		14.50	0.820	0.056			25.75	1.053	0.024
		14.75	0.834	-0.024			26.00	1.059	-0.012
		15.00	0.828	0.044			26.25	1.056	0.000
		15.25	0.839	0.044			26.50	1.056	-0.008
		15.50	0.850	-0.004			26.75	1.054	0.064
		15.75	0.849	0.032			27.00	1.070	-0.028
		16.00	0.857	-0.008			27.25	1.063	-0.028
		16.25	0.855	-0.008			27.50	1.056	0.036
		16.50	0.853	0.040			27.75	1.065	0.008
		16.75	0.863	0.032			28.00	1.067	0.004
		17.00	0.871	0.070			28.25	1.068	-0.032
		17.20	0.885	0.060			28.50	1.060	0.024
		17.25	0.888	-0.100			28.75	1.066	0.008
		17.50	0.863	0.140			29.00	1.068	0.012
		17.75	0.898	0.008			29.25	1.071	0.000
		18.00	0.900	0.068			29.50	1.071	0.024
		18.25	0.917	-0.008			29.75	1.077	-0.036
		18.50	0.915	0.044			30.00	1.068	-0.002
		18.75	0.926	0.044			35.00	1.060	0.001
	transition	19.00	0.937	0.008			40.00	1.065	-0.002
		19.25	0.939	-0.160			45.00	1.053	0.002
		19.50	0.899	0.068			46.00	1.055	0.002
		19.75	0.916	0.028			50.00	1.062	-0.001
		20.00	0.923	-0.036			55.00	1.057	-0.001
		20.25	0.914	0.367			60.00	1.053	0.000
		20.40	0.969	0.370			64.00	1.053	0.000
		20.50	1.006	-0.264		back terr	65.00	1.053	-0.002
		20.75	0.940	0.220			70.00	1.045	0.004
		21.00	0.995	0.040			75.00	1.065	0.012
		21.20	1.003	0.040			78.00	1.100	0.012
		21.25	1.005	0.088			80.00	1.123	0.019
		21.50	1.027	0.044			85.00	1.216	-0.009
		21.75	1.038	0.012			89.00	1.179	-0.009
		22.00	1.041	-0.032			90.00	1.170	0.014
	front terr	22.25	1.033	0.100			94.00	1.226	0.014

Creek	Zone	Physical Data Distance (m)	Elevation (m)	Slope
Columbia	back terr	95.00	1.240	0.004
		97.50	1.250	0.140
	boundary	98.00	1.320	.
Culebra	basin	0.25	0.019	1.340
		0.30	0.086	0.680
		0.50	0.222	0.120
		0.60	0.234	0.160
		0.75	0.258	0.020
		1.00	0.263	0.364
		1.25	0.354	0.280
		1.50	0.424	0.156
		1.75	0.463	-0.140
		1.80	0.456	-0.110
	transition	2.00	0.434	0.572
		2.25	0.577	1.120
		2.40	0.745	0.840
		2.50	0.829	-0.204
		2.75	0.778	0.807
		2.90	0.899	0.610
	back terr	3.00	0.960	0.012
		3.25	0.963	0.192
		3.50	1.011	0.048
		3.75	1.023	-0.004
		4.00	1.022	0.004
		4.25	1.023	0.072
		4.50	1.041	-0.044
		4.75	1.030	0.024
		5.00	1.036	0.040
		5.25	1.046	-0.092
		5.50	1.023	0.028
		5.75	1.030	0.044
		6.00	1.041	0.020
		6.25	1.046	-0.036
		6.50	1.037	-0.024
		6.75	1.031	0.004
		7.00	1.032	0.072
		7.25	1.050	0.012
		7.50	1.053	-0.016
		7.75	1.049	0.008
		8.00	1.051	.
Democrat	basin	0.25	0.390	0.060
		0.50	0.405	0.408
	transition	0.75	0.507	-0.104
		1.00	0.481	0.040
		1.20	0.489	0.080
		1.25	0.493	0.080
		1.50	0.513	0.108
		1.75	0.540	-0.060

Creek	Zone	Physical Data Distance (m)	Elevation (m)	Slope
Democrat	transition	1.80	0.537	-0.025
		2.00	0.532	-0.270
		2.10	0.505	-0.353
		2.25	0.452	0.064
		2.50	0.468	0.416
		2.75	0.572	-0.004
		3.00	0.571	0.035
		3.20	0.578	0.080
		3.25	0.582	0.048
		3.50	0.594	0.064
	front terr	3.75	0.610	-0.028
		4.00	0.603	0.080
		4.10	0.611	0.107
		4.25	0.627	-0.052
		4.50	0.614	0.040
		4.75	0.624	0.060
		5.00	0.639	0.020
		5.25	0.644	-0.056
		5.50	0.630	0.100
		5.75	0.655	-0.032
		6.00	0.647	0.000
		6.25	0.647	0.140
		6.50	0.682	-0.132
		6.75	0.649	0.004
		7.00	0.650	0.048
		7.25	0.662	0.008
		7.50	0.664	0.000
		7.75	0.664	-0.012
		8.00	0.661	0.004
		8.25	0.662	0.084
		8.50	0.683	0.048
		8.75	0.695	-0.088
		9.00	0.673	0.000
		10.00	0.673	0.000
		12.50	0.673	0.001
		15.00	0.676	-0.002
		17.50	0.672	0.002
		20.00	0.676	0.003
		22.50	0.683	0.004
		25.00	0.692	0.004
		26.00	0.696	0.005
		27.50	0.704	-0.003
		30.00	0.697	0.014
	back terr	32.50	0.732	-0.003
		35.00	0.725	0.007
		37.00	0.738	0.012
		37.50	0.744	0.011
		40.00	0.772	0.017

Creek	Zone	Physical Data Distance (m)	Elevation (m)	Slope	Creek	Zone	Physical Data Distance (m)	Elevation (m)	Slope
Democrat	back terr	41.00	0.789	0.037	El Diente	front terr	5.50	0.716	-0.004
		42.00	0.826	0.064			5.75	0.715	0.024
		42.50	0.858	0.088			6.00	0.721	0.004
		43.00	0.902	0.057			6.25	0.722	-0.012
		44.00	0.959	0.003			6.50	0.719	0.016
		45.00	0.962	0.030			6.75	0.723	0.000
		46.00	0.992	0.034			7.00	0.723	0.016
		47.00	1.026	0.002			7.25	0.727	0.028
		47.50	1.027	0.018			7.50	0.734	-0.016
		48.00	1.036	-0.011			7.75	0.730	0.052
		49.00	1.025	0.019			8.00	0.743	-0.028
		50.00	1.044	0.002			8.25	0.736	0.028
		51.00	1.046	0.009			8.50	0.743	0.004
		52.00	1.055	0.010			8.75	0.744	0.016
		52.50	1.060	0.012			9.00	0.748	0.026
		53.00	1.066	0.016			10.00	0.774	0.006
		54.00	1.082	0.006			11.00	0.780	0.001
		55.00	1.088	0.016			15.00	0.783	0.004
	boundary	56.00	1.104	-0.005			20.00	0.803	-0.006
		57.00	1.099	0.010			24.00	0.779	-0.008
		57.50	1.104	0.020			25.00	0.771	0.000
		58.00	1.114	-0.002			30.00	0.773	0.001
		59.00	1.112	-0.040		back terr	35.00	0.780	0.012
		60.00	1.072	.			38.00	0.817	0.010
El Diente	basin	0.25	0.583	-0.060			40.00	0.836	0.012
		0.30	0.580	-0.025			40.50	0.842	0.012
		0.50	0.575	0.400			41.00	0.848	0.036
	transition	0.75	0.675	0.060			41.50	0.866	0.000
		0.80	0.678	0.035			42.00	0.866	0.038
		1.00	0.685	-0.005			42.50	0.885	0.020
		1.20	0.684	-0.020			43.00	0.895	0.066
	front terr	1.25	0.683	-0.004			43.50	0.928	0.080
		1.50	0.682	0.024			44.00	0.968	0.030
		1.75	0.688	0.044			44.50	0.983	0.098
		2.00	0.699	-0.036			45.00	1.032	0.122
		2.25	0.690	0.004		boundary	45.50	1.093	-0.002
		2.50	0.691	-0.004			46.00	1.092	.
		2.75	0.690	0.016	Elbert	basin	0.25	0.587	0.120
		3.00	0.694	0.008			0.30	0.593	0.080
		3.25	0.696	-0.032			0.40	0.601	0.080
		3.50	0.688	-0.056			0.50	0.609	-0.024
		3.75	0.674	0.056			0.75	0.603	0.000
		4.00	0.688	0.008			0.90	0.603	0.000
		4.25	0.690	0.024			1.00	0.603	0.052
		4.50	0.696	-0.020			1.25	0.616	0.028
		4.75	0.691	0.028			1.50	0.623	0.070
		5.00	0.698	0.136		transition	1.70	0.637	0.040
		5.25	0.732	-0.064			1.75	0.639	0.044

Creek	Zone	Physical Data Distance (m)	Elevation (m)	Slope	Creek	Zone	Physical Data Distance (m)	Elevation (m)	Slope
Elbert	transition	2.00	0.650	-0.008	Elbert	front terr	30.00	0.777	-0.003
		2.25	0.648	0.000			32.50	0.769	0.002
		2.30	0.648	0.000			33.00	0.770	0.002
		2.50	0.648	0.076			35.00	0.773	0.003
		2.75	0.667	0.056			37.50	0.780	0.003
		3.00	0.681	-0.056			40.00	0.787	0.004
		3.25	0.667	0.072			42.50	0.798	0.008
		3.50	0.685	-0.076			45.00	0.818	-0.001
		3.75	0.666	0.124		back terr	47.50	0.815	0.011
		4.00	0.697	0.016			50.00	0.843	0.000
	front terr	4.25	0.701	-0.032			52.50	0.842	0.008
		4.50	0.693	0.024			55.00	0.862	0.001
		4.75	0.699	-0.004			57.50	0.865	0.001
		5.00	0.698	0.012			60.00	0.867	0.000
		5.25	0.701	0.000			62.50	0.867	-0.004
		5.50	0.701	0.036			65.00	0.858	-0.002
		5.75	0.710	-0.032			67.50	0.852	0.000
		6.00	0.702	0.016			69.00	0.852	0.001
		6.25	0.706	-0.008			70.00	0.853	0.004
		6.50	0.704	0.004			72.50	0.863	-0.001
		6.75	0.705	0.024			75.00	0.860	0.000
		7.00	0.711	-0.004			77.50	0.860	-0.003
		7.25	0.710	-0.024			80.00	0.853	-0.001
		7.50	0.704	0.064			82.50	0.850	0.000
		7.75	0.720	0.004			85.00	0.850	0.003
		8.00	0.721	0.000			87.50	0.858	0.005
		8.25	0.721	-0.024			89.00	0.865	0.005
		8.50	0.715	0.012			90.00	0.870	-0.005
		8.75	0.718	-0.012			91.00	0.865	0.012
		9.00	0.715	-0.012			91.50	0.871	0.044
		9.25	0.712	0.020			92.00	0.893	0.050
		9.50	0.717	0.004			92.50	0.918	0.034
		9.75	0.718	-0.008			93.00	0.935	-0.084
		10.00	0.716	-0.016			93.50	0.893	0.018
		10.25	0.712	0.032			94.00	0.902	0.032
		10.50	0.720	0.000			94.50	0.918	-0.006
		10.75	0.720	-0.008			95.00	0.915	0.040
		11.00	0.718	0.008			95.50	0.935	0.010
		11.25	0.720	-0.004			96.00	0.940	0.022
		11.50	0.719	0.000			96.50	0.951	0.018
		12.50	0.719	0.001			97.00	0.960	0.026
		14.00	0.721	0.004			97.50	0.973	0.014
		15.00	0.725	0.003			98.00	0.980	-0.010
		17.50	0.733	0.003			98.50	0.975	0.026
		20.00	0.741	0.001			99.00	0.988	0.026
		22.50	0.743	0.007			99.50	1.001	0.008
		25.00	0.760	0.003		boundary	100.00	1.005	.
		27.50	0.768	0.004	Gray's	basin	0.25	0.247	0.516

Creek	Zone	Physical Data			Creek	Zone	Physical Data		
		Distance (m)	Elevation (m)	Slope			Distance (m)	Elevation (m)	Slope
Gray's	basin	0.50	0.376	0.160	Gray's	front terr	20.00	0.877	0.007
		0.75	0.416	0.120			25.00	0.910	0.008
		1.00	0.446	-0.120	Gray's	back terr	30.00	0.950	0.003
		1.25	0.416	0.020			35.00	0.964	-0.001
		1.50	0.421	0.108			40.00	0.960	0.006
		1.75	0.448	0.292			42.50	0.974	0.028
		2.00	0.521	-0.064			45.00	1.045	0.010
		2.25	0.505	0.000			47.50	1.071	-0.011
		2.50	0.505	0.036			50.00	1.044	0.004
		2.75	0.514	0.060			52.50	1.054	0.008
	transition	3.00	0.529	0.040			55.00	1.074	0.004
		3.25	0.539	-0.032			57.50	1.084	0.008
		3.50	0.531	0.148			60.00	1.105	0.013
		3.75	0.568	-0.036			62.50	1.137	0.027
		4.00	0.559	0.116		boundary	65.00	1.205	.
		4.25	0.588	0.000	Huron	basin	0.25	0.260	0.084
		4.50	0.588	0.072			0.50	0.281	-0.084
		4.75	0.606	0.176			0.75	0.260	0.044
		5.00	0.650	0.040			1.00	0.271	0.144
		5.25	0.660	0.172			1.25	0.307	0.000
		5.50	0.703	-0.020			1.50	0.307	-0.080
		5.75	0.698	0.156			1.75	0.287	0.180
		6.00	0.737	0.056			2.00	0.332	-0.036
	front terr	6.25	0.751	0.168			2.25	0.323	-0.024
		6.50	0.793	-0.064			2.50	0.317	0.172
		6.75	0.777	0.008			2.75	0.360	-0.044
		7.00	0.779	0.052			3.00	0.349	0.000
		7.25	0.792	-0.016			3.25	0.349	-0.036
		7.50	0.788	0.000			3.50	0.340	0.048
		7.75	0.788	0.000			3.75	0.352	0.016
		8.00	0.788	0.016			4.00	0.356	-0.096
		8.25	0.792	0.000			4.25	0.332	0.020
		8.50	0.792	0.024			4.50	0.337	0.052
		8.75	0.798	-0.008			4.75	0.350	-0.024
		9.00	0.796	0.012			5.00	0.344	0.068
		9.25	0.799	-0.016			5.25	0.361	-0.028
		9.50	0.795	0.036		transition	5.50	0.354	0.040
		9.75	0.804	-0.064			5.75	0.364	-0.052
		10.00	0.788	0.028			6.00	0.351	0.076
		10.25	0.795	0.056		front terr	6.25	0.370	-0.024
		10.50	0.809	-0.020			6.50	0.364	0.044
		10.75	0.804	-0.004			6.75	0.375	-0.004
		11.00	0.803	0.016			7.00	0.374	0.076
		11.25	0.807	-0.008			7.25	0.393	0.000
		11.50	0.805	0.044			7.50	0.393	0.020
		11.75	0.816	-0.004			7.75	0.398	-0.048
		12.00	0.815	0.004			8.00	0.386	0.048
		15.00	0.826	0.010			8.25	0.398	-0.048

Creek	Zone	Physical Data: Distance (m)	Physical Data: Elevation (m)	Physical Data: Slope
Huron	front terr	8.50	0.386	0.064
		8.75	0.402	0.044
		9.00	0.413	-0.008
		10.00	0.405	-0.002
		15.00	0.397	0.001
		20.00	0.401	-0.004
		25.00	0.381	0.016
		30.00	0.459	0.033
		32.50	0.541	0.046
	back terr	35.00	0.655	0.207
	boundary	36.00	0.862	.
Kit Carson	basin	0.25	0.460	0.087
		0.40	0.473	0.080
		0.50	0.481	0.130
		0.60	0.494	0.060
		0.75	0.503	0.020
	transition	1.00	0.508	-0.020
		0.90	0.510	0.050
		1.00	0.515	0.168
	front terr	1.25	0.557	0.004
		1.50	0.558	0.012
		1.75	0.561	-0.040
		2.00	0.551	0.072
		2.25	0.569	0.040
		2.50	0.579	0.072
		2.75	0.597	-0.120
		3.00	0.567	0.040
		3.25	0.577	0.064
		3.50	0.593	-0.016
		3.75	0.589	0.044
		4.00	0.600	-0.036
		4.25	0.591	0.004
		4.50	0.592	0.020
		4.75	0.597	0.052
		5.00	0.610	-0.088
		5.25	0.588	0.104
		5.50	0.614	-0.008
		5.75	0.612	0.020
		6.00	0.617	0.028
		6.25	0.624	-0.028
		6.50	0.617	0.052
		6.75	0.630	0.032
		7.00	0.638	0.036
		7.25	0.647	-0.044
		7.50	0.636	-0.016
		7.75	0.632	0.024
		8.00	0.638	0.144
		8.25	0.674	-0.068
Kit Carson	front terr	8.50	0.657	-0.040
		8.75	0.647	0.028
		9.00	0.654	0.060
		9.25	0.669	-0.060
		9.50	0.654	0.056
		9.75	0.668	0.000
		10.00	0.668	0.012
		10.25	0.671	-0.020
		10.50	0.666	-0.012
		10.75	0.663	0.012
		11.00	0.666	0.002
		14.00	0.672	0.002
		15.00	0.674	0.015
		17.00	0.704	0.015
		20.00	0.749	0.019
	back terr	21.00	0.768	0.019
		22.50	0.796	0.023
		25.00	0.853	0.036
		27.50	0.942	0.048
		28.00	0.966	0.047
		30.00	1.060	0.021
		32.50	1.112	0.039
		34.00	1.171	0.039
	boundary	35.00	1.210	0.055
		36.00	1.265	.
La Plata	basin	0.25	0.581	0.080
		0.50	0.601	-0.012
		0.75	0.598	0.072
		1.00	0.616	0.108
		1.25	0.643	0.084
		1.50	0.664	0.072
	transition	1.75	0.682	0.128
		2.00	0.714	0.012
		2.25	0.717	0.024
		2.50	0.723	0.056
		2.75	0.737	0.032
		3.00	0.745	-0.008
	front terr	3.25	0.743	0.000
		3.50	0.743	0.064
		3.75	0.759	-0.016
		4.00	0.755	-0.024
		4.25	0.749	-0.012
		4.50	0.746	-0.012
		4.75	0.743	0.004
		5.00	0.744	0.012
		5.25	0.747	-0.016
		5.50	0.743	-0.008
		5.75	0.741	0.020

Creek	Zone	Physical Data Distance (m)	Elevation (m)	Slope	Creek	Zone	Physical Data Distance (m)	Elevation (m)	Slope
La Plata	front terr	6.00	0.746	0.008	Lincoln	transition	6.75	0.580	-0.024
		6.25	0.748	0.008			7.00	0.574	0.032
		6.50	0.750	-0.024	Lincoln	front terr	7.25	0.582	0.072
		6.75	0.744	0.016			7.50	0.600	0.036
		7.00	0.748	-0.024			7.75	0.609	-0.040
		7.25	0.742	-0.020			8.00	0.599	-0.040
		7.50	0.737	0.004			8.25	0.589	0.000
		7.75	0.738	0.000			8.50	0.589	-0.004
		8.00	0.738	0.006			8.75	0.588	0.036
		10.00	0.749	0.002			9.00	0.597	0.000
		15.00	0.757	0.002			9.25	0.597	-0.016
		20.00	0.767	0.000			9.50	0.593	0.044
		25.00	0.769	0.000			9.75	0.604	0.044
		30.00	0.770	0.000			10.00	0.615	0.002
		35.00	0.768	0.000			15.00	0.625	0.002
		40.00	0.769	0.001			20.00	0.635	0.003
		45.00	0.774	0.024			25.00	0.649	0.004
	back terr	50.00	0.896	-0.007			30.00	0.670	0.003
		55.00	0.863	0.028			35.00	0.683	0.004
		57.50	0.934	0.054		back terr	40.00	0.701	0.002
		60.00	1.070	0.036			45.00	0.711	0.001
	boundary	62.50	1.160	.			50.00	0.715	0.002
Lincoln	basin	0.25	0.448	0.100			55.00	0.723	0.003
		0.50	0.473	0.028			60.00	0.739	0.003
		0.75	0.480	-0.036			65.00	0.754	0.004
		1.00	0.471	0.036			70.00	0.775	0.014
		1.25	0.480	0.028			75.00	0.845	0.005
		1.50	0.487	-0.008			80.00	0.870	0.010
		1.75	0.485	-0.112			85.00	0.920	0.015
		2.00	0.457	0.076			87.50	0.957	0.078
		2.25	0.476	0.008		boundary	90.00	1.153	-0.002
		2.50	0.478	0.012			92.50	1.147	0.166
		2.75	0.481	0.208			93.00	1.230	.
		3.00	0.533	0.068	Little Bear	transition	0.25	0.370	0.620
		3.25	0.550	0.076			0.40	0.463	0.930
		3.50	0.569	-0.064			0.50	0.556	0.022
		3.75	0.553	-0.056			0.70	0.561	0.090
		4.00	0.539	0.036			0.75	0.565	0.232
		4.25	0.548	0.052			1.00	0.623	0.052
		4.50	0.561	0.008			1.25	0.636	0.124
		4.75	0.563	0.016			1.50	0.667	-0.025
	transition	5.00	0.567	0.012			1.60	0.665	-0.017
		5.25	0.570	-0.088		front terr	1.75	0.662	0.100
		5.50	0.548	0.116			2.00	0.687	0.064
		5.75	0.577	-0.004			2.25	0.703	-0.012
		6.00	0.576	0.000			2.50	0.700	0.056
		6.25	0.576	-0.004			2.75	0.714	-0.024
		6.50	0.575	0.020			3.00	0.708	0.044

Creek	Zone	Physical Data Distance (m)	Elevation (m)	Slope	Creek	Zone	Physical Data Distance (m)	Elevation (m)	Slope
Little Bear	front terr	3.25	0.719	-0.004	Missouri	front terr	5.00	0.244	0.196
		3.50	0.718	-0.020			5.25	0.293	-0.212
		3.75	0.713	0.016			5.50	0.240	0.020
		4.00	0.717	0.056			5.75	0.245	0.040
		4.25	0.731	0.000			6.00	0.255	-0.040
		4.50	0.731	0.008			6.25	0.245	0.200
		4.75	0.733	-0.024			6.50	0.295	-0.208
		5.00	0.727	0.040			6.75	0.243	0.076
		5.25	0.737	0.004			7.00	0.262	0.212
		5.50	0.738	0.004			7.25	0.315	-0.200
		5.75	0.739	0.016			7.50	0.265	0.200
		6.00	0.743	-0.008			7.75	0.315	-0.156
		6.25	0.741	-0.004			8.00	0.276	0.012
		6.50	0.740	0.012			10.00	0.300	-0.004
		6.75	0.743	-0.040			15.00	0.281	0.005
		7.00	0.733	0.006			20.00	0.304	-0.002
	back terr	10.00	0.751	0.004			25.00	0.295	0.002
		12.00	0.759	0.003			30.00	0.306	0.016
		15.00	0.766	0.006			35.00	0.386	0.016
		17.00	0.779	0.004			37.50	0.425	0.038
		20.00	0.791	0.012			40.00	0.519	0.092
		22.50	0.821	0.047		boundary	42.50	0.748	0.204
	boundary	25.00	0.939	0.049			45.00	1.259	.
		27.50	1.062	0.126	Pikes	basin	0.25	0.420	0.072
		28.00	1.125	0.032		transition	0.50	0.438	0.432
		30.00	1.188	0.015			0.75	0.546	0.040
		32.50	1.226	0.006			1.00	0.556	0.056
		33.00	1.229	0.003			1.25	0.570	0.020
		34.00	1.232	.			1.50	0.575	-0.020
Missouri	basin	0.25	0.192	0.044		front terr	1.75	0.570	0.024
		0.50	0.203	0.024			2.00	0.576	0.008
		0.75	0.209	0.024			2.25	0.578	0.004
	transition	1.00	0.215	-0.068			2.50	0.579	-0.044
		1.25	0.198	0.176			2.75	0.568	0.056
		1.50	0.242	-0.048			3.00	0.582	0.004
	front terr	1.75	0.230	-0.032			3.25	0.583	0.016
		2.00	0.222	0.028			3.50	0.587	0.008
		2.25	0.229	-0.056			3.75	0.589	0.000
		2.50	0.215	0.032			4.00	0.589	-0.008
		2.75	0.223	0.000			4.25	0.587	0.000
		3.00	0.223	0.048			4.50	0.587	0.000
		3.25	0.235	-0.036			4.75	0.587	-0.004
		3.50	0.226	-0.004			5.00	0.586	-0.004
		3.75	0.225	0.000			10.00	0.565	0.002
		4.00	0.225	0.072			15.00	0.576	0.009
		4.25	0.243	0.248			17.50	0.599	0.022
		4.50	0.305	-0.220		back terr	20.00	0.655	0.024
		4.75	0.250	-0.024			22.50	0.716	0.036

Creek	Zone	Physical Data			Creek	Zone	Physical Data		
		Distance (m)	Elevation (m)	Slope			Distance (m)	Elevation (m)	Slope
Pikes	back terr	25.00	0.806	0.020	Red Cloud	basin	1.00	0.353	0.016
		27.50	0.857	0.043			1.25	0.357	0.000
Pikes	boundary	30.00	0.965	-0.008			1.50	0.357	-0.084
		32.50	0.946	.			1.75	0.336	0.116
Quandry	basin	0.20	0.539	0.040			2.00	0.365	-0.012
		0.25	0.541	0.008		transition	2.25	0.362	0.048
		0.50	0.543	-0.075			2.50	0.374	-0.008
		0.70	0.528	0.160			2.75	0.372	0.016
		0.75	0.536	0.112			3.00	0.376	0.112
		1.00	0.564	0.195			3.25	0.404	-0.084
	transition	1.20	0.603	0.400			3.50	0.383	-0.028
		1.25	0.623	0.133		front terr	3.75	0.376	0.000
		1.40	0.643	0.100			4.00	0.376	0.012
		1.50	0.653	0.140			4.25	0.379	0.044
		1.75	0.688	-0.287			4.50	0.390	-0.020
		1.90	0.645	-0.290			4.75	0.385	0.020
		2.00	0.616	0.404			5.00	0.390	0.036
	front terr	2.25	0.717	0.036			5.25	0.399	-0.060
		2.50	0.726	0.020			5.50	0.384	0.024
		2.75	0.731	-0.008			5.75	0.390	0.028
		3.00	0.729	-0.480			6.00	0.397	0.144
		3.25	0.609	0.496			6.25	0.433	-0.152
		3.50	0.733	-0.008			6.50	0.395	0.016
		3.75	0.731	-0.012			6.75	0.399	-0.020
		4.00	0.728	0.044			7.00	0.394	0.036
		4.25	0.739	0.044			7.25	0.403	0.124
		4.50	0.750	-0.072			7.50	0.434	-0.084
		4.75	0.732	0.028			7.75	0.413	0.024
		5.00	0.739	0.026			8.00	0.419	-0.004
		10.00	0.870	-0.005			8.25	0.418	0.020
		12.00	0.861	-0.006			8.50	0.423	0.012
	back terr	15.00	0.844	-0.004			8.75	0.426	0.060
		20.00	0.824	0.001			9.00	0.441	-0.064
		25.00	0.828	0.006			9.25	0.425	0.004
		30.00	0.859	-0.004			9.50	0.426	0.068
		35.00	0.841	-0.003			9.75	0.443	-0.004
		36.00	0.838	-0.001			10.00	0.442	-0.032
		40.00	0.833	0.003			10.25	0.434	-0.060
		45.00	0.846	0.068			10.50	0.419	0.060
		47.50	1.015	-0.002			10.75	0.434	0.016
		48.00	1.014	-0.001			11.00	0.438	0.004
		50.00	1.012	0.018			15.00	0.452	0.004
		52.00	1.047	0.048			20.00	0.474	0.003
	boundary	52.50	1.071	0.020			25.00	0.487	0.003
		53.00	1.081	.			30.00	0.501	0.005
Red Cloud	basin	0.25	0.324	0.000			35.00	0.524	0.001
		0.50	0.324	0.024			40.00	0.530	0.001
		0.75	0.330	0.092		back terr	45.00	0.536	0.012

Creek	Zone	Physical Data: Distance (m)	Physical Data: Elevation (m)	Physical Data: Slope	Creek	Zone	Physical Data: Distance (m)	Physical Data: Elevation (m)	Physical Data: Slope
Red Cloud	back terr	50.00	0.598	0.040	Shavano	front terr	9.75	0.685	0.000
		52.50	0.699	0.038			10.00	0.685	0.008
		55.00	0.794	0.000			10.25	0.687	0.016
		57.50	0.794	0.069			10.50	0.691	0.000
	boundary	60.00	0.967	0.232			10.75	0.691	0.008
		61.00	1.199	.			11.00	0.693	0.000
Shavano	basin	0.25	0.450	0.016			11.25	0.693	-0.012
		0.50	0.454	0.012			11.50	0.690	0.012
		0.75	0.457	-0.004			11.75	0.693	0.012
		1.00	0.456	0.132			12.00	0.696	0.003
		1.25	0.489	0.040			15.00	0.706	0.005
		1.30	0.491	0.010		back terr	20.00	0.731	0.004
		1.50	0.493	-0.020			22.00	0.739	0.016
		1.75	0.488	0.040			22.50	0.747	0.061
		2.00	0.498	-0.016		boundary	25.00	0.899	0.110
		2.25	0.494	0.076			26.00	1.009	0.073
		2.50	0.513	0.020			27.50	1.119	0.045
		2.75	0.518	-0.060			29.00	1.187	0.067
		2.80	0.515	-0.015			30.00	1.254	0.007
	transition	3.00	0.512	0.040			31.00	1.261	.
		3.25	0.522	0.032	Sunlight	basin	0.25	0.383	-0.016
		3.50	0.530	0.480			0.50	0.379	0.120
		3.60	0.578	0.320			0.75	0.409	-0.040
		3.75	0.626	0.160			1.00	0.399	0.196
		3.80	0.634	0.040			1.25	0.448	-0.004
		4.00	0.642	-0.004			1.50	0.447	-0.056
		4.25	0.641	0.028			1.75	0.433	0.144
		4.50	0.648	-0.008		transition	2.00	0.469	0.056
	front terr	4.75	0.646	0.040			2.25	0.483	0.028
		5.00	0.656	-0.020			2.50	0.490	0.000
		5.25	0.651	0.016			2.75	0.490	0.032
		5.50	0.655	-0.012			3.00	0.498	-0.032
		5.75	0.652	0.036		front terr	3.25	0.490	0.020
		6.00	0.661	0.000			3.50	0.495	0.000
		6.25	0.661	0.020			3.75	0.495	0.000
		6.50	0.666	-0.016			4.00	0.495	0.000
		6.75	0.662	0.004			4.25	0.495	0.000
		7.00	0.663	0.024			4.50	0.495	0.016
		7.25	0.669	0.012			4.75	0.499	0.004
		7.50	0.672	0.024			5.00	0.500	0.007
		7.75	0.678	-0.008			10.00	0.536	0.002
		8.00	0.676	0.008			15.00	0.548	0.003
		8.25	0.678	-0.024			20.00	0.564	0.004
		8.50	0.672	0.028			25.00	0.584	0.000
		8.75	0.679	-0.008			30.00	0.584	-0.001
		9.00	0.677	0.008			35.00	0.581	0.002
		9.25	0.679	0.000		back terr	40.00	0.593	0.001
		9.50	0.679	0.024			45.00	0.596	0.001

Creek	Zone	Physical Data Distance (m)	Elevation (m)	Slope	Creek	Zone	Physical Data Distance (m)	Elevation (m)	Slope
Sunlight	back terr	50.00	0.603	0.000	Tabeguache	front terr	10.00	0.810	0.041
		55.00	0.603	0.002			15.00	1.013	-0.029
		60.00	0.612	0.002			20.00	0.868	0.016
		65.00	0.621	0.002			25.00	0.946	0.000
		70.00	0.629	0.002		back terr	30.00	0.944	-0.020
		75.00	0.641	0.000			35.00	0.844	0.036
		80.00	0.639	0.004			40.00	1.024	0.004
		85.00	0.657	-0.004			42.50	1.035	0.004
		90.00	0.639	-0.001		boundary	45.00	1.046	0.048
		95.00	0.636	0.001			46.00	1.094	.
		100.00	0.639	0.002	Torries	basin	0.25	0.425	0.048
		105.00	0.648	0.001			0.50	0.437	0.160
		110.00	0.653	-0.002			0.75	0.477	0.000
		115.00	0.642	0.004			1.00	0.477	-0.008
		120.00	0.660	0.000			1.25	0.475	0.052
		125.00	0.659	0.000			1.50	0.488	0.064
		130.00	0.658	0.002			1.75	0.504	0.072
		135.00	0.668	0.019			2.00	0.522	-0.048
	boundary	140.00	0.761	0.029			2.25	0.510	0.040
		145.00	0.908	.			2.50	0.520	0.032
Tabeguache	transition	0.25	0.474	0.080			2.75	0.528	0.024
		0.50	0.494	0.712			3.00	0.534	-0.020
		0.75	0.672	-0.048			3.25	0.529	0.100
		1.00	0.660	0.136			3.50	0.554	-0.028
		1.25	0.694	0.344			3.75	0.547	-0.032
		1.50	0.780	0.036		transition	4.00	0.539	0.028
	front terr	1.75	0.789	-0.004			4.25	0.546	0.192
		2.00	0.788	0.100			4.50	0.594	-0.032
		2.25	0.813	0.004			4.75	0.586	0.084
		2.50	0.814	0.052			5.00	0.607	-0.036
		2.75	0.827	-0.004		front terr	5.25	0.598	0.020
		3.00	0.826	-0.008			5.50	0.603	0.000
		3.25	0.824	0.012			5.75	0.603	0.000
		3.50	0.827	-0.052			6.00	0.603	-0.008
		3.75	0.814	0.048			6.25	0.601	0.020
		4.00	0.826	0.008			6.50	0.606	0.000
		4.25	0.828	0.016			6.75	0.606	-0.004
		4.50	0.832	0.032			7.00	0.605	0.016
		4.75	0.840	-0.064			7.25	0.609	0.012
		5.00	0.824	0.040			7.50	0.612	0.020
		5.25	0.834	0.036			7.75	0.617	-0.008
		5.50	0.843	-0.040			8.00	0.615	-0.012
		5.75	0.833	-0.024			8.25	0.612	0.020
		6.00	0.827	-0.016			8.50	0.617	0.032
		6.25	0.823	0.036			8.75	0.625	0.012
		6.50	0.832	-0.032			9.00	0.628	0.016
		6.75	0.824	0.012			9.25	0.632	0.040
		7.00	0.827	-0.006			9.50	0.642	0.044

Creek	Zone	Physical Data Distance (m)	Elevation (m)	Slope
		9.75	0.653	0.056
		10.00	0.667	0.006
Torries	front terr	15.00	0.698	0.000
		20.00	0.697	0.002
	back terr	25.00	0.705	0.003
		30.00	0.722	0.005
		35.00	0.745	0.001
		40.00	0.749	0.003
		45.00	0.763	0.004
		50.00	0.782	0.003
		55.00	0.798	0.009
		60.00	0.842	0.006
		62.50	0.857	0.030
		65.00	0.931	0.068
	boundary	67.50	1.101	-0.010
		70.00	1.076	.

APPENDIX E. Hole Data.

Creek	Zone	Hole Data				Creek	Zone	Hole Data			
		Dist. (m)	Hole Dens. [a]	Hole Diam. [b]	%Cover of Holes			Dist. (m)	Hole Dens. [a]	Hole Diam. [b]	%Cover of Holes
Antero	basin	0.25	0	0.0	0.0	Blanca	back terr	11.00	4	8.7	0.2
		0.50	5	26.8	4.9			15.00	10	7.9	0.9
		1.00	1	8.0	0.1			17.50	13	13.0	4.1
		1.50	0	0.0	0.0			20.00	10	16.9	5.4
		2.00	0	0.0	0.0		boundary	22.50	5	9.2	0.6
		2.50	2	14.0	0.5			24.00	1	13.0	0.2
	transition	3.00	0	0.0	0.0	Bross	transition	0.25	0	0.0	0.0
		3.50	2	32.5	2.7			0.50	20	12.7	6.6
	front terr	4.00	0	0.0	0.0			1.00	16	9.4	2.1
		4.50	0	0.0	0.0			1.50	10	13.8	2.8
		5.00	0	25.0	0.0			2.00	9	14.9	2.8
	back terr	10.00	0	0.0	0.0		front terr	2.50	9	13.3	2.3
		15.00	0	0.0	0.0			3.00	7	10.9	1.2
		20.00	0	0.0	0.0			3.50	7	12.9	2.3
		25.00	0	0.0	0.0			4.00	9	9.1	1.3
		30.00	0	0.0	0.0			4.50	5	13.4	1.2
		35.00	0	0.0	0.0			5.00	5	9.4	0.6
		40.00	1	25.0	0.8			5.50	7	10.9	1.2
		42.50	0	0.0	0.0			6.00	2	17.5	0.9
		45.00	7	11.1	1.3			6.50	6	15.5	2.3
		47.50	11	12.1	2.2			7.00	6	16.3	3.2
		50.00	1	13.0	0.2			7.50	4	13.5	1.1
	boundary	52.50	1	31.0	1.2			8.00	6	7.7	0.6
		54.00	3	22.3	2.0			8.50	2	9.5	0.3
Blanca	basin	0.25	0	0.0	0.0			9.00	4	10.8	0.6
		0.50	14	8.9	1.8			9.50	3	14.3	0.8
	transition	1.00	16	14.9	7.2			10.00	2	11.5	0.3
		1.50	22	9.0	2.9			12.50	1	14.0	0.3
		2.00	5	22.4	3.6			15.00	1	51.0	3.3
	front terr	2.50	9	11.8	2.0		back terr	17.50	0	0.0	0.0
		3.00	5	8.4	0.6			20.00	0	0.0	0.0
		3.50	1	6.0	0.1			22.50	6	11.0	1.4
		4.00	1	12.0	0.2			25.00	7	15.4	2.4
		4.50	19	11.0	3.3			27.50	1	6.0	0.1
		5.00	22	11.4	5.8			30.00	7	17.6	3.3
		5.50	2	22.5	1.4			31.00	11	14.6	4.1
		6.00	4	26.3	3.7			32.00	8	16.0	3.4
		6.50	2	16.5	0.7			33.00	16	10.4	2.7
		7.00	2	21.0	1.6			34.00	4	9.0	0.4
		7.50	5	20.6	3.2			35.00	1	22.0	0.6
		8.00	1	16.0	0.3			36.00	4	11.0	0.7
		8.50	4	5.3	0.1			37.00	0	0.0	0.0
		9.00	0	0.0	0.0			38.00	0	0.0	0.0
		9.50	3	7.3	0.2			39.00	2	17.0	0.8
		10.00	1	6.0	0.1		boundary	40.00	3	8.0	0.3
		10.50	5	9.8	0.7			41.00	1	16.0	0.3

Creek	Zone	Hole Data				Creek	Zone	Hole Data			
		Dist. (m)	Hole Dens. [a]	Hole Diam. [b]	%Cover of Holes			Dist. (m)	Hole Dens. [a]	Hole Diam. [b]	%Cover of Holes
Cameron	transition	0.25	0	0.0	0.0	Cameron	back terr	70.00	17	10.4	2.6
		0.50	24	11.8	8.5			71.00	7	14.6	1.9
		1.00	13	11.9	2.5		boundary	72.00	5	10.8	0.8
	front terr	1.50	14	8.4	1.4			74.00	7	11.9	1.2
		2.00	24	10.3	6.3	Columbia	basin	0.25	10	8.3	1.2
		2.50	9	7.9	0.8			1.00	15	11.5	2.8
		3.00	5	12.4	1.0			2.00	7	8.6	0.8
		3.50	15	11.8	2.9			3.00	13	9.2	1.5
		4.00	15	20.1	27.7			4.00	10	11.3	1.7
		4.50	15	9.9	2.0			5.00	17	10.0	2.7
		5.00	4	10.5	0.6			6.00	8	13.9	2.6
		5.50	4	7.5	0.4			7.00	7	18.1	3.1
		6.00	5	9.6	0.7			8.00	5	12.6	1.0
		6.50	2	10.0	0.3			9.00	4	23.3	3.9
		7.00	2	9.5	0.2			10.00	4	28.0	6.2
		7.50	3	13.7	0.8			11.00	4	36.8	8.1
		8.00	3	9.7	0.5			12.00	7	12.1	1.5
		8.50	3	8.7	0.3			13.00	8	12.1	1.8
		9.00	7	10.1	1.0			14.00	4	15.5	1.2
		9.50	2	13.5	0.5			15.00	2	14.0	0.5
		10.00	8	9.5	1.0			16.00	5	12.2	1.0
		10.50	2	10.0	0.3			17.00	4	10.3	0.7
		11.00	2	13.5	0.5			18.00	9	14.4	2.9
		12.50	2	14.5	0.8		transition	19.00	9	20.8	5.9
		15.00	3	19.3	2.1			20.00	5	25.0	7.1
		17.50	1	36.0	1.6			21.00	8	23.8	6.7
		20.00	0	0.0	0.0			22.00	5	13.0	1.2
		22.50	0	0.0	0.0		front terr	23.00	3	11.3	0.6
		25.00	0	0.0	0.0			24.00	2	24.5	1.6
		27.50	0	0.0	0.0			25.00	0	0.0	0.0
		30.00	0	0.0	0.0			26.00	0	0.0	0.0
		32.50	0	0.0	0.0			27.00	0	0.0	0.0
		35.00	0	0.0	0.0			28.00	0	0.0	0.0
		37.50	1	27.0	0.9			29.00	0	0.0	0.0
		40.00	1	36.0	1.6			30.00	0	0.0	0.0
	back terr	42.50	1	42.0	2.2			35.00	0	0.0	0.0
		45.00	2	16.0	0.7			40.00	0	0.0	0.0
		47.50	3	23.7	2.3			45.00	0	0.0	0.0
		50.00	2	21.5	1.2			50.00	0	0.0	0.0
		52.50	1	32.0	1.3			55.00	0	0.0	0.0
		55.00	0	0.0	0.0			60.00	0	0.0	0.0
		57.50	2	31.5	2.5		back terr	65.00	0	0.0	0.0
		60.00	3	22.3	2.3			70.00	1	25.0	0.8
		62.50	1	41.0	2.1			75.00	0	0.0	0.0
		65.00	0	0.0	0.0			80.00	7	11.1	1.3
		67.50	3	21.3	2.1			85.00	11	12.1	2.2
		68.00	24	16.7	13.0			90.00	1	13.0	0.2
		69.00	19	16.8	8.4			95.00	1	31.0	1.2

Creek	Zone	Hole Data				Creek	Zone	Hole Data			
		Dist. (m)	Hole Dens. [a]	Hole Diam. [b]	%Cover of Holes			Dist. (m)	Hole Dens. [a]	Hole Diam. [b]	%Cover of Holes
Columbia	back terr	97.50	3	22.3	2.0	Democrat	back terr	35.00	3	15.7	1.0
	boundary	98.00	0	0.0	0.0			37.50	3	13.7	0.8
Culebra	basin	0.25	0	0.0	0.0			40.00	1	11.0	0.2
		0.50	9	10.4	0.4			41.00	3	20.3	1.7
		1.00	8	13.0	18.6			42.00	3	21.3	1.1
		1.50	15	9.3	8.3			43.00	6	24.8	8.0
	transition	2.00	5	16.4	2.3			44.00	5	19.8	3.8
		2.50	17	17.8	71.8			45.00	10	14.6	3.4
	back terr	3.00	10	12.6	14.5			46.00	6	20.3	3.3
		3.50	0	0.0	0.0			47.00	8	16.8	3.5
		4.00	1	14.0	0.3			47.50	12	11.8	2.2
		4.50	0	0.0	0.0			48.00	11	10.4	1.5
		5.00	0	0.0	0.0			49.00	6	18.2	2.9
		5.50	0	0.0	0.0			50.00	0	0.0	0.0
		6.00	0	0.0	0.0			51.00	0	0.0	0.0
		6.50	0	0.0	0.0			52.00	0	0.0	0.0
		7.00	0	0.0	0.0			52.50	0	0.0	0.0
		7.50	0	0.0	0.0			53.00	0	0.0	0.0
		8.00	0	0.0	0.0			54.00	0	0.0	0.0
Democrat	basin	0.25	0	0.0	0.0			55.00	0	0.0	0.0
		0.50	9	11.3	2.0		boundary	56.00	0	0.0	0.0
	transition	1.00	3	17.0	1.1			57.00	0	0.0	0.0
		1.50	12	12.2	2.8			57.50	0	0.0	0.0
		2.00	7	11.1	1.2			58.00	0	0.0	0.0
		2.50	5	15.0	1.7			59.00	0	0.0	0.0
		3.00	7	12.4	1.5			60.00	0	0.0	0.0
		3.50	10	11.1	1.6	El Diente	basin	0.25	2	15.0	0.6
	front terr	4.00	4	12.5	0.9			0.50	9	15.1	3.2
		4.50	7	12.6	1.7		transition	1.00	10	15.1	4.1
		5.00	8	10.0	1.3		front terr	1.50	3	16.7	1.3
		5.50	2	11.5	0.3			2.00	3	19.0	2.9
		6.00	3	15.7	1.0			2.50	6	13.8	2.6
		6.50	6	13.8	1.6			3.00	1	8.0	0.1
		7.00	5	21.8	3.9			3.50	5	23.8	5.0
		7.50	2	14.0	0.5			4.00	1	29.0	1.1
		8.00	1	22.0	0.6			4.50	3	19.3	1.9
		8.50	6	11.0	1.2			5.00	4	14.5	1.2
		9.00	1	14.0	0.3			5.50	0	0.0	0.0
		10.00	2	29.5	2.2			6.00	5	14.4	1.7
		12.50	1	11.0	0.2			6.50	0	0.0	0.0
		15.00	0	0.0	0.0			7.00	1	16.0	0.3
		17.50	7	10.9	1.1			7.50	2	17.5	0.8
		20.00	0	0.0	0.0			8.00	1	15.0	0.3
		22.50	0	0.0	0.0			8.50	6	12.7	1.4
		25.00	3	15.0	0.9			9.00	1	12.0	0.2
		27.50	3	15.3	1.1			10.00	10	17.9	6.0
		30.00	1	28.0	1.0			15.00	0	0.0	0.0
	back terr	32.50	1	35.0	1.5			20.00	0	0.0	0.0

Creek	Zone	Hole Data Dist. (m)	Hole Dens. [a]	Hole Diam. [b]	%Cover of Holes	Creek	Zone	Hole Data Dist. (m)	Hole Dens. [a]	Hole Diam. [b]	%Cover of Holes
El Diente	back terr	25.00	0	0.0	0.0	Elbert	back terr	50.00	0	0.0	0.0
		30.00	4	27.0	4.9			52.50	0	0.0	0.0
		35.00	1	9.0	0.1			55.00	0	0.0	0.0
		40.00	10	20.3	7.8			57.50	0	0.0	0.0
		41.00	3	27.7	3.1			60.00	1	10.0	0.1
		42.00	1	2.0	0.0			62.50	0	0.0	0.0
		43.00	6	15.5	2.3			65.00	0	0.0	0.0
		44.00	10	14.0	3.4			67.50	0	0.0	0.0
		45.00	25	12.9	6.1			70.00	0	0.0	0.0
	boundary	46.00	18	9.9	2.5			72.50	0	0.0	0.0
Elbert	basin	0.25	7	11.4	1.2			75.00	0	0.0	0.0
		0.50	5	14.8	1.7			77.50	0	0.0	0.0
		1.00	7	10.6	1.0			80.00	0	0.0	0.0
		1.50	6	14.2	1.5			82.50	0	0.0	0.0
	transition	2.00	9	11.1	1.6			85.00	0	0.0	0.0
		2.50	6	18.7	2.9			87.50	0	0.0	0.0
		3.00	7	15.6	2.8			90.00	0	0.0	0.0
		3.50	9	15.0	3.5			92.50	0	0.0	0.0
		4.00	2	13.5	0.5			95.00	0	0.0	0.0
	front terr	4.50	1	9.0	0.1			97.50	0	0.0	0.0
		5.00	1	18.0	0.4		boundary	100.00	0	0.0	0.0
		5.50	0	0.0	0.0	Gray's	basin	0.25	0	0.0	0.0
		6.00	1	23.0	0.7			0.50	15	13.2	3.8
		6.50	1	6.0	0.1			1.00	14	13.0	3.3
		7.00	0	0.0	0.0			1.50	6	18.2	2.6
		7.50	1	6.0	0.1			2.00	6	25.5	60.1
		8.00	1	12.0	0.2			2.50	6	22.3	4.0
		8.50	0	0.0	0.0		transition	3.00	2	48.5	6.0
		9.00	0	0.0	0.0			3.50	10	18.2	8.5
		9.50	1	15.0	0.3			4.00	2	38.0	4.1
		10.00	2	12.5	0.6			4.50	5	26.2	5.5
		10.50	1	10.0	0.1			5.00	6	14.7	1.7
		11.00	5	8.0	0.4			5.50	4	20.3	2.4
		12.50	1	22.0	0.6			6.00	4	19.0	1.9
		15.00	0	0.0	0.0		front terr	6.50	2	27.0	1.9
		17.50	1	20.0	0.5			7.00	0	0.0	0.0
		20.00	0	0.0	0.0			7.50	1	16.0	0.3
		22.50	0	0.0	0.0			8.00	0	0.0	0.0
		25.00	0	0.0	0.0			8.50	0	0.0	0.0
		27.50	1	17.0	0.4			9.00	0	0.0	0.0
		30.00	1	27.0	0.9			9.50	0	0.0	0.0
		32.50	0	0.0	0.0			10.00	1	9.0	0.1
		35.00	0	0.0	0.0			10.50	0	0.0	0.0
		37.50	0	0.0	0.0			11.00	1	8.0	0.1
		40.00	0	0.0	0.0			11.50	1	14.0	0.3
		42.50	1	25.0	0.8			12.00	0	0.0	0.0
		45.00	10	20.2	6.4			15.00	2	10.0	0.3
	back terr	47.50	1	20.0	0.5			20.00	2	10.0	0.3

Creek	Zone	Hole Data			
		Dist. (m)	Hole Dens. [a]	Hole Diam. [b]	%Cover of Holes
Gray's	front terr	25.00	3	13.3	0.7
	back terr	30.00	7	11.1	1.1
		35.00	7	7.7	0.6
		40.00	1	12.0	0.2
		42.50	8	6.9	0.6
		45.00	14	17.3	6.5
		47.50	12	14.3	4.0
		50.00	12	11.7	2.4
		55.00	6	13.5	1.8
		57.50	2	11.5	0.3
		60.00	1	10.0	0.1
		62.50	1	20.0	0.5
	boundary	65.00	1	12.7	1.3
Huron	basin	0.25	0	0.0	0.0
		0.50	3	19.3	1.4
		1.00	5	11.4	0.9
		1.50	12	8.7	1.8
		2.00	18	7.8	1.7
		2.50	13	6.9	0.9
		3.00	13	10.5	2.3
		3.50	12	12.3	2.9
		4.00	16	11.6	3.1
		4.50	9	13.6	2.3
		5.00	5	15.2	1.8
	transition	5.50	9	11.7	1.8
		6.00	12	13.0	3.7
	front terr	6.50	9	11.2	1.5
		7.00	11	12.1	2.2
		7.50	8	8.5	0.8
		8.00	12	12.9	2.6
		8.50	7	8.9	0.8
		9.00	5	13.0	1.1
		10.00	5	13.0	1.1
		15.00	11	13.6	2.8
		20.00	3	13.3	0.7
		25.00	8	15.8	2.6
		30.00	5	9.6	0.6
		32.50	3	11.7	0.6
	back terr	35.00	4	14.5	1.1
	boundary	36.00	1	17.0	0.4
Kit Carson	basin	0.25	0	0.0	0.0
		0.50	10	6.2	0.5
	transition	1.00	9	9.4	1.3
	front terr	1.50	10	13.0	2.6
		2.00	11	1.6	2.5
		2.50	5	9.4	0.7
		3.00	0	0.0	0.0
		3.50	1	11.0	0.2

Creek	Zone	Hole Data			
		Dist. (m)	Hole Dens. [a]	Hole Diam. [b]	%Cover of Holes
Kit Carson	front terr	4.00	1	10.0	0.1
		4.50	0	0.0	0.0
		5.00	4	9.8	0.5
		5.50	4	23.8	5.1
		6.00	0	0.0	0.0
		6.50	2	4.5	0.1
		7.00	9	9.9	1.4
		7.50	1	11.0	0.2
		8.00	8	9.8	1.3
		8.50	6	10.3	1.1
		9.00	2	13.0	0.4
		10.00	5	28.2	5.9
		15.00	7	10.9	1.4
		20.00	2	42.0	4.4
	back terr	22.50	8	15.3	3.1
		25.00	8	7.3	0.6
		27.50	7	6.9	0.4
		30.00	5	17.6	2.6
		32.50	11	10.0	1.7
	boundary	35.00	0	0.0	0.0
		36.00	0	0.0	0.0
La Plata	basin	0.25	1	40.0	2.0
		0.50	3	25.3	2.9
		1.00	7	11.7	1.4
		1.50	7	11.6	2.1
	transition	2.00	11	24.5	10.8
		2.50	9	24.9	12.7
		3.00	8	36.0	20.9
	front terr	3.50	3	10.0	0.5
		4.00	7	17.6	4.7
		4.50	6	12.5	2.3
		5.00	5	14.4	2.0
		5.50	3	9.3	0.4
		6.00	3	20.7	2.0
		6.50	1	20.0	0.5
		7.00	1	25.0	0.8
		7.50	3	18.7	1.5
		8.00	0	0.0	0.0
		10.00	1	43.0	2.3
		15.00	1	20.0	0.5
		20.00	2	18.5	1.0
		25.00	2	21.5	1.2
		30.00	2	19.5	1.0
		35.00	1	29.0	1.1
		40.00	1	25.0	0.8
		45.00	0	0.0	0.0
	back terr	50.00	10	0.0	0.9
		55.00	1	6.0	0.1

Creek	Zone	Hole Data Dist. (m)	Hole Dens. [a]	Hole Diam. [b]	%Cover of Holes	Creek	Zone	Hole Data Dist. (m)	Hole Dens. [a]	Hole Diam. [b]	%Cover of Holes
La Plata	back terr	57.50	10	9.1	1.1	Little Bear	front terr	2.50	8	14.0	3.1
		60.00	8	12.8	2.0			3.00	9	13.1	3.2
	boundary	62.50	4	12.3	0.8			3.50	8	10.5	1.2
Lincoln	basin	0.25	0	0.0	0.0			4.00	3	13.3	0.8
		0.50	0	0.0	0.0			4.50	0	0.0	0.0
		1.00	1	37.0	1.7			5.00	1	14.0	0.3
		1.50	1	31.0	1.2			5.50	0	0.0	0.0
		2.00	3	15.0	0.9			6.00	1	30.0	1.1
		2.50	18	15.4	7.2			6.50	2	12.5	0.4
		3.00	15	14.9	5.2			7.00	0	0.0	0.0
		3.50	21	25.3	19.9		back terr	10.00	0	0.0	0.0
		4.00	16	22.1	13.2			15.00	7	14.1	2.3
		4.50	9	36.1	24.1			20.00	4	12.5	1.1
	transition	5.00	9	23.6	11.1			22.50	0	0.0	0.0
		5.50	3	41.7	6.8		boundary	25.00	12	14.3	3.7
		6.00	3	18.7	1.8			27.50	15	14.1	4.7
		6.50	2	40.0	4.7			30.00	2	19.5	1.0
		7.00	1	15.0	0.3			32.50	0	0.0	0.0
	front terr	7.50	4	18.5	1.8			34.00	0	0.0	0.0
		8.00	4	29.8	5.0	Missouri	basin	0.25	0	0.0	0.0
		8.50	3	14.7	0.8			0.50	1	25.0	0.8
		9.00	4	35.3	7.9		transition	1.00	3	13.3	0.8
		9.50	2	50.0	6.5			1.50	4	9.5	0.5
		10.00	0	0.0	0.0		front terr	2.00	10	13.2	2.7
		15.00	1	34.0	1.5			2.50	4	13.5	1.0
		20.00	0	0.0	0.0			3.00	5	7.6	0.4
		25.00	1	18.0	0.4			3.50	3	17.3	1.2
		30.00	0	0.0	0.0			4.00	2	17.0	0.8
		35.00	2	26.0	1.0			4.50	24	9.6	3.8
	back terr	40.00	2	16.5	0.4			5.00	27	8.5	3.1
		45.00	0	0.0	0.0			5.50	7	8.3	0.7
		50.00	0	0.0	0.0			6.00	26	8.8	3.6
		55.00	0	0.0	0.0			6.50	8	14.9	2.6
		60.00	1	48.0	2.9			7.00	18	10.0	3.5
		65.00	4	11.5	0.7			7.50	21	10.7	4.0
		70.00	11	16.3	5.5			8.00	35	7.6	4.5
		75.00	6	15.7	3.0			10.00	20	1.4	4.4
		80.00	7	13.9	2.9			15.00	2	26.5	2.1
		85.00	8	18.3	4.2			20.00	3	28.3	3.1
		87.50	17	11.5	3.7			25.00	1	35.0	1.5
	boundary	90.00	2	22.5	1.4			30.00	1	16.0	0.3
		92.50	2	30.5	2.6			35.00	5	9.4	0.6
		93.00	0	0.0	0.0			37.50	6	6.2	0.3
Little Bear	transition	0.25	0	0.0	0.0			40.00	3	11.0	0.5
		0.50	6	10.5	0.9		boundary	42.50	6	12.2	1.2
		1.00	11	7.1	0.8			45.00	1	0.0	0.0
		1.50	17	6.4	1.1	Pikes	basin	0.25	0	0.0	0.0
	front terr	2.00	16	7.6	1.2		transition	0.50	16	15.7	6.1

Creek	Zone	Dist. (m)	Hole Dens. [a]	Hole Diam. [b]	%Cover of Holes
Pikes	front terr	1.00	0	0.0	0.0
		1.50	1	54.0	3.7
		2.00	0	0.0	0.0
		2.50	0	0.0	0.0
		3.00	0	0.0	0.0
		3.50	0	0.0	0.0
		4.00	0	0.0	0.0
		4.50	0	0.0	0.0
		5.00	0	0.0	0.0
		10.00	0	0.0	0.0
		15.00	1	0.0	1.6
		17.50	1	36.0	0.2
	back terr	20.00	0	11.0	0.0
		22.50	0	0.0	0.0
		25.00	0	0.0	0.0
		27.50	1	8.0	0.8
	boundary	30.00	0	0.0	0.0
		32.50	1	10.0	0.1
Quandry	basin	0.25	0	0.0	0.0
		0.50	1	21.0	0.6
		1.00	8	14.8	2.4
	transition	1.50	9	31.1	35.7
		2.00	2	17.0	0.7
	front terr	2.50	4	21.0	2.4
		3.00	2	9.0	0.2
		3.50	0	0.0	0.0
		4.00	1	42.0	2.2
		4.50	0	0.0	0.0
		5.00	1	19.0	0.5
		10.00	2	18.5	0.9
	back terr	15.00	0	0.0	0.0
		20.00	0	0.0	0.0
		25.00	0	0.0	0.0
		30.00	0	0.0	0.0
		35.00	0	0.0	0.0
		40.00	0	0.0	0.0
		45.00	1	8.0	0.1
		47.50	7	14.7	2.5
		50.00	0	0.0	0.0
	boundary	52.50	0	0.0	0.0
		53.00	3	18.3	1.5
Red Cloud	basin	0.25	4	20.5	2.2
		0.50	3	14.0	0.8
		1.00	20	11.3	3.8
		1.50	7	11.6	1.2
		2.00	3	9.3	0.3
	transition	2.50	4	11.0	0.7
		3.00	8	12.9	1.7
Red Cloud	transition	3.50	3	11.7	0.5
	front terr	4.00	5	9.0	0.5
		4.50	3	9.3	0.3
		5.00	4	9.5	0.5
		5.50	2	9.0	0.2
		6.00	10	11.6	1.8
		6.50	5	8.4	0.5
		7.00	14	8.4	1.6
		7.50	11	8.6	1.2
		8.00	3	8.3	0.3
		8.50	4	13.3	1.2
		9.00	10	9.8	1.3
		9.50	3	8.3	0.3
		10.00	1	8.0	0.1
		10.50	7	9.7	0.9
		11.00	1	10.0	0.1
		15.00	3	10.3	0.4
		20.00	4	9.5	0.5
		25.00	1	16.0	0.3
		30.00	1	12.0	0.2
		35.00	1	15.0	0.3
		40.00	0	0.0	0.0
	back terr	45.00	3	13.0	0.8
		50.00	1	16.0	0.3
		52.50	2	16.0	0.7
		55.00	0	0.0	0.0
		57.50	2	10.0	0.3
	boundary	60.00	4	15.3	1.4
		61.00	0	0.0	0.0
Shavano	basin	0.25	0	0.0	0.0
		0.50	1	23.0	0.7
		1.00	0	0.0	0.0
		1.50	1	8.0	0.1
		2.00	1	14.0	0.3
		2.50	7	9.1	1.0
	transition	3.00	13	11.9	3.1
		3.50	16	13.1	4.2
		4.00	17	14.8	8.2
		4.50	14	7.4	1.6
	front terr	5.00	9	12.7	2.5
		5.50	6	7.5	0.5
		6.00	5	15.2	1.8
		6.50	5	7.4	0.3
		7.00	2	8.5	0.2
		7.50	0	0.0	0.0
		8.00	1	7.0	0.6
		8.50	0	35.0	1.5
		9.00	0	0.0	0.0

Creek	Zone	Hole Data				Creek	Zone	Hole Data			
		Dist. (m)	Hole Dens. [a]	Hole Diam. [b]	%Cover of Holes			Dist. (m)	Hole Dens. [a]	Hole Diam. [b]	%Cover of Holes
Shavano	front terr	9.50	2	16.0	0.7	Sunlight	back terr	130.00	0	0.0	0.0
		10.00	5	14.8	2.3			135.00	0	0.0	0.0
		10.50	0	0.0	0.0		boundary	140.00	0	0.0	0.0
		11.00	2	12.5	0.4			145.00	0	0.0	0.0
		11.50	1	20.0	0.5	Tabeguache	transition	0.25	0	0.0	0.0
		12.00	0	0.0	0.0			0.50	6	8.3	0.9
		15.00	2	11.0	0.3			1.00	16	18.4	14.0
	back terr	20.00	1	12.0	0.2			1.50	14	10.8	2.6
		22.50	2	15.5	0.6		front terr	2.00	12	5.3	0.5
	boundary	25.00	12	21.7	8.7			2.50	8	8.6	0.9
		27.50	0	0.0	0.0			3.00	2	6.0	0.1
		30.00	0	0.0	0.0			3.50	9	5.7	0.4
		31.00	0	0.0	0.0			4.00	7	6.3	0.4
Sunlight	basin	0.25	6	0.0	1.7			4.50	2	14.5	0.7
		0.50	10	14.3	2.9			5.00	7	5.4	0.3
		1.00	6	13.5	1.5			5.50	4	6.3	0.3
		1.50	8	10.9	1.3			6.00	0	0.0	0.0
	transition	2.00	6	7.3	0.5			6.50	0	0.0	0.0
		2.50	6	12.5	1.8			7.00	0	0.0	0.0
		3.00	8	8.5	0.8			10.00	0	0.0	0.0
	front terr	3.50	10	9.5	1.2			15.00	0	0.0	0.0
		4.00	5	11.2	0.8			20.00	0	0.0	0.0
		4.50	9	8.2	0.8			25.00	0	0.0	0.0
		5.00	5	9.2	0.6		back terr	30.00	0	0.0	0.0
		10.00	1	11.0	0.2			35.00	0	0.0	0.0
		15.00	0	0.0	0.0			40.00	2	18.0	1.0
		20.00	0	0.0	0.0			42.50	0	0.0	0.0
		25.00	1	24.0	0.7		boundary	45.00	0	0.0	0.0
		30.00	0	0.0	0.0			46.00	0	0.0	0.0
		35.00	0	0.0	0.0	Torries	basin	0.25	0	0.0	0.0
	back terr	40.00	0	0.0	0.0			0.50	8	20.3	5.0
		45.00	1	16.0	0.3			1.00	9	17.2	3.6
		50.00	1	19.0	0.5			1.50	8	13.8	2.1
		55.00	1	10.0	0.1			2.00	13	13.8	3.3
		60.00	0	0.0	0.0			2.50	15	14.3	4.5
		65.00	2	9.0	0.2			3.00	14	11.7	3.2
		70.00	0	0.0	0.0			3.50	9	15.3	3.1
		75.00	0	0.0	0.0		transition	4.00	13	12.2	2.9
		80.00	0	0.0	0.0			4.50	12	24.5	16.3
		85.00	0	0.0	0.0			5.00	3	19.3	1.7
		90.00	0	0.0	0.0		front terr	5.50	2	18.0	0.8
		95.00	1	8.0	0.1			6.00	4	10.5	0.8
		100.00	0	0.0	0.0			6.50	2	14.5	0.5
		105.00	0	0.0	0.0			7.00	2	16.0	0.7
		110.00	0	0.0	0.0			7.50	1	15.0	0.3
		115.00	0	0.0	0.0			8.00	1	15.0	0.3
		120.00	0	0.0	0.0			8.50	2	16.0	0.7
		125.00	0	0.0	0.0			9.00	2	11.0	0.3

Creek	Zone	Hole Data			
		Dist. (m)	Hole Dens. [a]	Hole Diam. [b]	%Cover of Holes
Torries	front terr	9.50	2	17.5	0.8
		10.00	1	15.0	0.3
		15.00	0	0.0	0.0
		20.00	3	13.0	0.7
	back terr	25.00	1	15.0	0.3
		30.00	2	13.0	0.4
		35.00	2	12.5	0.4
		40.00	6	8.7	0.7
		45.00	4	11.5	0.8
		50.00	7	8.3	0.7
		55.00	2	6.0	0.1
		60.00	4	9.5	0.5
		62.50	3	9.0	0.3
		65.00	3	12.3	0.6
	boundary	67.50	5	12.4	1.0
		70.00	3	12.3	0.7

a. Measured in number of holes/0.0625 m^2
b. Measured in mm

APPENDIX F. Vegetation Data.

Creek	Zone	Vegetation Data: Distance (m)	S. alterniflora Height (cm)	Total % Cover	% Cover S. alterniflora	% Cover S. patens	% Cover D. spicata	% Cover Salicornia spp.	% Cover J. roemerianus	% Cover P. australis	% Cover I. frutescens	% Cover B. frutescens	% Cover S. robustus	% Cover A. tenuifolius	% Cover L. nashii
Antero	basin	0.25	59.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		1.00	40.0	45.0	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		2.00	43.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	transition	3.00	46.0	45.0	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	front terr	4.00	38.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		5.00	39.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	back terr	10.00	41.0	40.0	30.0	0.0	9.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		15.00	23.0	25.0	15.0	0.0	5.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		20.00	18.0	10.0	4.0	0.0	1.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		25.00	19.0	30.0	5.0	0.0	5.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		30.00	0.0	20.0	0.0	0.0	15.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		35.00	0.0	30.0	0.0	0.0	5.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		40.00	0.0	45.0	0.0	0.0	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		42.50	0.0	35.0	0.0	0.0	34.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		45.00	0.0	100.0	0.0	39.0	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		47.50	0.0	100.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		50.00	0.0	100.0	0.0	80.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	boundary	52.50	0.0	100.0	0.0	90.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		54.00	0.0	100.0	0.0	90.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Blanca	basin	0.25	94.0	15.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	transition	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		2.00	69.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	front terr	3.00	47.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		4.00	39.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		5.00	40.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		6.00	34.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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Creek	Zone	Vegetation Data													
		Distance (m)	*S. alterniflora* Height (cm)	Total % Cover	% Cover *S. alterniflora*	% Cover *S. patens*	% Cover *D. spicata*	% Cover *Salicornia* spp.	% Cover *J. roemerianus*	% Cover *P. australis*	% Cover *I. frutescens*	% Cover *B. frutescens*	% Cover *S. robustus*	% Cover *A. tenuifolius*	% Cover *L. nashii*
Blanca	front terr	7.00	33.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		8.00	32.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		9.00	33.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		10.00	32.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	back terr	11.00	31.0	30.0	15.0	0.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		15.00	35.0	15.0	10.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		17.50	0.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		20.00	0.0	25.0	0.0	0.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	boundary	22.50	0.0	45.0	0.0	25.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0	0.0	0.0
		24.00	0.0	75.0	0.0	75.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bross	transition	0.25	69.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		1.00	56.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		2.00	38.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	front terr	3.00	38.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		4.00	33.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		5.00	37.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		6.00	31.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		7.00	30.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		8.00	31.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		9.00	28.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		10.00	26.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		12.50	23.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		15.00	23.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	back terr	17.50	24.0	30.0	29.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		20.00	16.0	15.0	5.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		22.50	24.0	15.0	5.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		25.00	0.0	20.0	0.0	0.0	1.0	19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		27.50	0.0	20.0	0.0	0.0	5.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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Creek	Zone	Vegetation Data													
		Distance (m)	*S. alterniflora* Height (cm)	Total % Cover	% Cover *S. alterniflora*	% Cover *S. patens*	% Cover *D. spicata*	% Cover *Salicornia* spp.	% Cover *J. roemerianus*	% Cover *P. australis*	% Cover *I. frutescens*	% Cover *B. frutescens*	% Cover *S. robustus*	% Cover *A. tenuifolius*	% Cover *L. nashii*
Bross	back terr	30.00	0.0	25.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		31.00	0.0	30.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0
		32.00	0.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0	0.0	1.0
		33.00	0.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.0	0.0	0.0	0.0
		34.00	0.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	39.0	0.0	0.0	1.0
		35.00	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0
		36.00	0.0	50.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	49.0	0.0	0.0	0.0
		37.00	0.0	5.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0
		38.00	0.0	30.0	0.0	0.0	15.0	0.0	0.0	0.0	0.0	15.0	0.0	0.0	0.0
		39.00	0.0	35.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	20.0	0.0	0.0	5.0
	boundary	40.00	0.0	50.0	0.0	0.0	20.0	1.0	0.0	0.0	5.0	20.0	0.0	0.0	4.0
		41.00	0.0	55.0	0.0	0.0	0.0	20.0	0.0	0.0	0.0	25.0	0.0	10.0	0.0
Cameron	transition	0.25	67.0	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		1.00	55.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	front terr	2.00	52.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		3.00	48.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		4.00	48.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		5.00	35.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		6.00	29.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		7.00	30.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		8.00	30.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		9.00	33.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		10.00	31.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		11.00	29.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		12.50	27.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		15.00	31.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		17.50	39.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		20.00	28.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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Creek	Zone	Vegetation Data													
		Distance (m)	*S. alterniflora* Height (cm)	Total % Cover	% Cover *S. alterniflora*	% Cover *S. patens*	% Cover *D. spicata*	% Cover *Salicornia* spp.	% Cover *J. roemerianus*	% Cover *P. australis*	% Cover *I. frutescens*	% Cover *B. frutescens*	% Cover *S. robustus*	% Cover *A. tenuifolius*	% Cover *L. nashii*
Cameron	front terr	22.50	30.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		25.00	28.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		27.50	32.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		30.00	33.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		32.50	33.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		35.00	35.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		37.50	34.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		40.00	32.0	35.0	34.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	back terr	42.50	35.0	40.0	40.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		45.00	34.0	85.0	35.0	0.0	0.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		47.50	33.0	40.0	30.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		50.00	33.0	35.0	19.0	0.0	1.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		52.50	34.0	25.0	20.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		55.00	33.0	15.0	14.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		57.50	33.0	20.0	15.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		60.00	31.0	25.0	15.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		62.50	25.0	15.0	5.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		65.00	26.0	15.0	5.0	0.0	1.0	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		67.50	38.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	15.0	0.0	0.0	0.0
		70.00	0.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.0	0.0	0.0	0.0
	boundary	74.00	0.0	90.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0
Columbia	basin	0.25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		1.00	123.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		2.00	118.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		3.00	112.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		4.00	111.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		5.00	104.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		6.00	100.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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Creek	Zone	Distance (m)	*S. alterniflora* Height (cm)	Total % Cover	% Cover *S. alterniflora*	% Cover *S. patens*	% Cover *D. spicata*	% Cover *Salicornia* spp.	% Cover *J. roemerianus*	% Cover *P. australis*	% Cover *I. frutescens*	% Cover *B. frutescens*	% Cover *S. robustus*	% Cover *A. tenuifolius*	% Cover *L. nashii*
		Vegetation Data													
Columbia	basin	7.00	96.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		8.00	90.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		9.00	87.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		10.00	73.0	60.0	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		11.00	49.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		12.00	57.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		13.00	57.0	45.0	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		14.00	61.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		15.00	68.0	60.0	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		16.00	66.0	70.0	70.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		17.00	68.0	70.0	70.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		18.00	74.0	70.0	70.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	transition	19.00	67.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		20.00	64.0	70.0	70.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		21.00	42.0	65.0	65.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		22.00	46.0	75.0	75.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	front terr	23.00	47.0	90.0	90.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		24.00	47.0	95.0	95.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		25.00	45.0	90.0	90.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		26.00	48.0	95.0	94.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		27.00	48.0	90.0	90.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		28.00	52.0	95.0	95.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		29.00	54.0	95.0	95.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		30.00	51.0	95.0	95.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		35.00	54.0	90.0	90.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		40.00	43.0	90.0	90.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		45.00	49.0	90.0	90.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		50.00	47.0	90.0	90.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

		Vegetation Data													
Creek	Zone	Distance (m)	*S. alterniflora* Height (cm)	Total % Cover	% Cover *S. alterniflora*	% Cover *S. patens*	% Cover *D. spicata*	% Cover *Salicornia* spp.	% Cover *J. roemerianus*	% Cover *P. australis*	% Cover *I. frutescens*	% Cover *B. frutescens*	% Cover *S. robustus*	% Cover *A. tenuifolius*	% Cover *L. nashii*
Columbia	front terr	55.00	48.0	90.0	90.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		60.00	57.0	90.0	90.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	back terr	65.00	41.0	80.0	79.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		70.00	45.0	85.0	60.0	0.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		75.00	40.0	70.0	30.0	0.0	39.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		80.00	15.0	20.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	15.0
		85.00	0.0	35.0	0.0	1.0	8.0	0.0	0.0	0.0	0.0	25.0	0.0	1.0	0.0
		90.00	0.0	75.0	0.0	10.0	65.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		95.00	0.0	90.0	0.0	20.0	65.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
		97.50	0.0	80.0	0.0	20.0	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	boundary	98.00	0.0	100.0	0.0	85.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Culebra	basin	0.25	77.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		1.00	90.0	15.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	transition	2.00	77.0	50.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	back terr	3.00	0.0	60.0	0.0	0.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	30.0	0.0
		4.00	0.0	100.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		5.00	0.0	100.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		6.00	0.0	100.0	0.0	50.0	49.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
		7.00	0.0	100.0	0.0	50.0	45.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0
		8.00	0.0	100.0	0.0	70.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Democrat	basin	0.25	96.0	5.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	transition	1.00	90.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		2.00	77.0	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		3.00	51.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	front terr	4.00	46.0	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		5.00	46.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		6.00	44.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		7.00	33.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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Creek	Zone	Vegetation Data													
		Distance (m)	*S. alterniflora* Height (cm)	Total % Cover	% Cover *S. alterniflora*	% Cover *S. patens*	% Cover *D. spicata*	% Cover *Salicornia* spp.	% Cover *J. roemerianus*	% Cover *P. australis*	% Cover *I. frutescens*	% Cover *B. frutescens*	% Cover *S. robustus*	% Cover *A. tenuifolius*	% Cover *L. nashii*
Democrat	front terr	8.00	34.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		9.00	30.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		10.00	33.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		12.50	27.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		15.00	27.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		17.50	29.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		20.00	26.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		22.50	31.0	45.0	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		25.00	31.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		27.50	29.0	60.0	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		30.00	27.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	back terr	32.50	27.0	40.0	35.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		35.00	23.0	35.0	30.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		37.50	19.0	35.0	5.0	0.0	0.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		40.00	0.0	25.0	0.0	0.0	5.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		43.00	0.0	32.0	0.0	0.0	13.0	19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		45.00	0.0	40.0	0.0	0.0	25.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		47.50	0.0	5.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
		50.00	0.0	40.0	0.0	0.0	25.0	0.0	0.0	0.0	0.0	14.0	0.0	0.0	1.0
		52.50	0.0	35.0	0.0	0.0	25.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0
		55.00	0.0	10.0	0.0	0.0	9.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
	boundary	57.50	0.0	80.0	0.0	5.0	70.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0
		60.00	0.0	85.0	0.0	19.0	65.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
El Diente	basin	0.25	71.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	transition	1.00	50.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	front terr	2.00	53.0	45.0	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		3.00	48.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		4.00	53.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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		Vegetation Data													
Creek	Zone	Distance (m)	*S. alterniflora* Height (cm)	Total % Cover	% Cover *S. alterniflora*	% Cover *S. patens*	% Cover *D. spicata*	% Cover *Salicornia* spp.	% Cover *J. roemerianus*	% Cover *P. australis*	% Cover *I. frutescens*	% Cover *B. frutescens*	% Cover *S. robustus*	% Cover *A. tenuifolius*	% Cover *L. nashii*
El Diente	front terr	5.00	50.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		6.00	53.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		7.00	57.0	65.0	65.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		8.00	57.0	70.0	70.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		9.00	53.0	70.0	70.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		10.00	60.0	75.0	75.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		15.00	58.0	70.0	70.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		20.00	65.0	75.0	75.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		25.00	65.0	70.0	70.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		30.00	51.0	65.0	65.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	back terr	35.00	43.0	55.0	55.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		40.00	48.0	45.0	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		41.00	41.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		42.00	36.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		43.00	38.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		44.00	48.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		45.00	55.0	90.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	boundary	46.00	60.0	90.0	0.0	0.0	0.0	0.0	0.0	0.0	90.0	0.0	0.0	0.0	0.0
Elbert	basin	0.25	78.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		1.00	72.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	transition	2.00	77.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		3.00	77.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		4.00	34.0	65.0	65.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	front terr	5.00	33.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		6.00	38.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		7.00	31.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		8.00	36.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		9.00	33.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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Creek	Zone	Distance (m)	Vegetation Data: *S. alterniflora* Height (cm)	Total % Cover	% Cover *S. alterniflora*	% Cover *S. patens*	% Cover *D. spicata*	% Cover *Salicornia* spp.
Elbert	front terr	10.00	29.0	35.0	35.0	0.0	0.0	0.0
		11.00	33.0	40.0	40.0	0.0	0.0	0.0
		12.50	33.0	50.0	50.0	0.0	0.0	0.0
		15.00	35.0	50.0	50.0	0.0	0.0	0.0
		17.50	35.0	45.0	45.0	0.0	0.0	0.0
		20.00	33.0	45.0	45.0	0.0	0.0	0.0
		22.50	35.0	40.0	40.0	0.0	0.0	0.0
		25.00	39.0	40.0	40.0	0.0	0.0	0.0
		27.50	41.0	50.0	50.0	0.0	0.0	0.0
		30.00	45.0	50.0	50.0	0.0	0.0	0.0
		32.50	26.0	35.0	35.0	0.0	0.0	0.0
		35.00	30.0	50.0	50.0	0.0	0.0	0.0
		37.50	33.0	50.0	50.0	0.0	0.0	0.0
		40.00	39.0	45.0	45.0	0.0	0.0	0.0
		42.50	40.0	45.0	45.0	0.0	0.0	0.0
		45.00	47.0	50.0	50.0	0.0	0.0	0.0
	back terr	47.50	36.0	40.0	40.0	0.0	5.0	10.0
		50.00	31.0	40.0	25.0	0.0	15.0	25.0
		52.50	25.0	65.0	25.0	0.0	5.0	1.0
		55.00	24.0	45.0	39.0	0.0	0.0	5.0
		57.50	15.0	45.0	40.0	0.0	0.0	30.0
		60.00	21.0	60.0	30.0	0.0	0.0	5.0
		62.50	20.0	40.0	35.0	0.0	0.0	1.0
		65.00	24.0	50.0	49.0	0.0	0.0	1.0
		67.50	30.0	50.0	49.0	0.0	0.0	1.0
		70.00	30.0	50.0	49.0	0.0	0.0	5.0
		72.50	35.0	40.0	35.0	0.0	0.0	1.0
		75.00	22.0	35.0	34.0	0.0	0.0	15.0

Creek	Zone	Distance (m)	% Cover *J. roemerianus*	% Cover *P. australis*	% Cover *I. frutescens*	% Cover *B. frutescens*	% Cover *S. robustus*	% Cover *A. tenuifolius*	% Cover *L. nashii*
Elbert	front terr	10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		11.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		12.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		15.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		17.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		20.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		22.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		25.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		27.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		30.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		32.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		35.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		37.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		40.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		42.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		45.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	back terr	47.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		50.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		52.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		55.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		57.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		60.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		62.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		65.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		67.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		70.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		72.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		75.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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Creek	Zone	Distance (m)	*S. alterniflora* Height (cm)	Total % Cover	% Cover *S. alterniflora*	% Cover *S. patens*	% Cover *D. spicata*	% Cover *Salicornia* spp.	% Cover *J. roemerianus*	% Cover *P. australis*	% Cover *I. frutescens*	% Cover *B. frutescens*	% Cover *S. robustus*	% Cover *A. tenuifolius*	% Cover *L. nashii*
		Vegetation Data													
Elbert	back terr	77.50	22.0	35.0	20.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		80.00	21.0	50.0	49.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		82.50	25.0	45.0	45.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		85.00	25.0	50.0	40.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		87.50	25.0	55.0	50.0	0.0	4.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		90.00	34.0	65.0	10.0	0.0	54.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		92.50	47.0	50.0	25.0	0.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		95.00	47.0	90.0	30.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		97.50	46.0	100.0	10.0	40.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	boundary	100.00	0.0	100.0	0.0	50.0	45.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0
Gray's	basin	0.25	0.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		1.00	90.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		2.00	89.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	transition	3.00	76.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		4.00	72.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		5.00	64.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		6.00	57.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	front terr	7.00	41.0	45.0	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		8.00	34.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		9.00	33.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		10.00	36.0	50.0	49.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		11.00	35.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		12.00	31.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		15.00	24.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		20.00	20.0	25.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		25.00	34.0	50.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	back terr	30.00	39.0	25.0	10.0	0.0	14.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		35.00	31.0	35.0	9.0	0.0	25.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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		Vegetation Data													
Creek	Zone	Distance (m)	*S. alterniflora* Height (cm)	Total % Cover	% Cover *S. alterniflora*	% Cover *S. patens*	% Cover *D. spicata*	% Cover *Salicornia* spp.	% Cover *J. roemerianus*	% Cover *P. australis*	% Cover *I. frutescens*	% Cover *B. frutescens*	% Cover *S. robustus*	% Cover *A. tenuifolius*	% Cover *L. nashii*
Gray's	back terr	40.00	0.0	5.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		42.50	0.0	15.0	0.0	0.0	10.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		45.00	0.0	30.0	0.0	0.0	19.0	10.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
		47.50	0.0	20.0	0.0	0.0	13.0	1.0	5.0	0.0	0.0	0.0	0.0	0.0	1.0
		50.00	0.0	40.0	0.0	0.0	5.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		55.00	0.0	40.0	0.0	0.0	35.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		57.50	0.0	30.0	0.0	1.0	24.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0
		60.00	0.0	95.0	0.0	10.0	50.0	0.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0
		62.50	0.0	100.0	0.0	1.0	4.0	0.0	95.0	0.0	0.0	0.0	0.0	0.0	0.0
	boundary	65.00	0.0	100.0	0.0	45.0	45.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	5.0
Huron	basin	0.25	86.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		1.00	79.0	60.0	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		2.00	88.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		3.00	90.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		4.00	82.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		5.00	75.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	transition	6.00	72.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	front terr	7.00	79.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		8.00	81.0	45.0	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		9.00	87.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		10.00	90.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		15.00	70.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		20.00	62.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		25.00	82.0	70.0	70.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		30.00	102.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		32.50	68.0	75.0	75.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	back terr	35.00	82.0	20.0	5.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	boundary	36.00	0.0	100.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0

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Creek	Zone	Vegetation Data													
		Distance (m)	*S. alterniflora* Height (cm)	Total % Cover	% Cover *S. alterniflora*	% Cover *S. patens*	% Cover *D. spicata*	% Cover *Salicornia* spp.	% Cover *J. roemerianus*	% Cover *P. australis*	% Cover *I. frutescens*	% Cover *B. frutescens*	% Cover *S. robustus*	% Cover *A. tenuifolius*	% Cover *L. nashii*
Kit Carson	basin	0.25	63.0	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	transition	1.00	48.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	front terr	2.00	46.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		3.00	40.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		4.00	39.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		5.00	37.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		6.00	37.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		7.00	36.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		8.00	36.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		9.00	42.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		10.00	46.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		15.00	46.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		20.00	45.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	back terr	22.50	36.0	20.0	10.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		25.00	29.0	10.0	5.0	0.0	1.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		27.50	0.0	30.0	5.0	0.0	5.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		30.00	0.0	40.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	35.0	0.0	0.0	0.0
		32.50	0.0	55.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0
	boundary	35.00	0.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0	0.0	0.0	0.0
		36.00	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0
La Plata	basin	0.25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	transition	2.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		3.00	26.0	5.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	front terr	4.00	35.0	15.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		5.00	30.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		6.00	34.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		7.00	35.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

		Vegetation Data													
Creek	Zone	Distance (m)	*S. alterniflora* Height (cm)	Total % Cover	% Cover *S. alterniflora*	% Cover *S. patens*	% Cover *D. spicata*	% Cover *Salicornia* spp.	% Cover *J. roemerianus*	% Cover *P. australis*	% Cover *I. frutescens*	% Cover *B. frutescens*	% Cover *S. robustus*	% Cover *A. tenuifolius*	% Cover *L. nashii*
La Plata	front terr	8.00	35.0	45.0	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		10.00	32.0	55.0	55.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		15.00	43.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		20.00	55.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		25.00	52.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		30.00	55.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		35.00	52.0	45.0	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		40.00	67.0	45.0	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		45.00	48.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	back terr	50.00	27.0	40.0	20.0	0.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		55.00	31.0	35.0	5.0	0.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		57.50	41.0	45.0	5.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		60.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
La Plata	boundary	62.50	0.0	100.0	0.0	10.0	0.0	0.0	0.0	0.0	90.0	0.0	0.0	0.0	0.0
Lincoln	basin	0.25	69.0	15.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		1.00	82.0	15.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		2.00	61.0	5.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		3.00	45.0	5.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		4.00	36.0	5.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	transition	5.00	38.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		6.00	27.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		7.00	29.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	front terr	8.00	35.0	15.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		9.00	37.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		10.00	45.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		15.00	36.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		20.00	38.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		25.00	47.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Creek	Zone	Vegetation Data													
		Distance (m)	*S. alterniflora* Height (cm)	Total % Cover	% Cover *S. alterniflora*	% Cover *S. patens*	% Cover *D. spicata*	% Cover *Salicornia* spp.	% Cover *J. roemerianus*	% Cover *P. australis*	% Cover *I. frutescens*	% Cover *B. frutescens*	% Cover *S. robustus*	% Cover *A. tenuifolius*	% Cover *L. nashii*
Lincoln	front terr	30.00	29.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		35.00	31.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	back terr	40.00	27.0	25.0	24.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		45.00	31.0	30.0	15.0	0.0	14.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		50.00	25.0	20.0	10.0	0.0	9.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		55.00	22.0	20.0	10.0	0.0	9.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		60.00	24.0	20.0	5.0	0.0	0.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		65.00	19.0	20.0	5.0	0.0	0.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		70.00	32.0	20.0	9.0	0.0	10.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		75.00	45.0	25.0	9.0	0.0	15.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		80.00	14.0	10.0	1.0	0.0	4.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		85.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		87.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	boundary	90.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		92.50	0.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		93.00	0.0	75.0	0.0	5.0	50.0	0.0	0.0	0.0	0.0	20.0	0.0	0.0	0.0
Little Bear	transition	0.25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	front terr	2.00	46.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		3.00	35.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		4.00	35.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		5.00	29.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		6.00	25.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		7.00	24.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	back terr	10.00	23.0	30.0	20.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		15.00	20.0	15.0	5.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		20.00	23.0	15.0	5.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		22.50	0.0	10.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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Creek	Zone	Vegetation Data													
		Distance (m)	*S. alterniflora* Height (cm)	Total % Cover	% Cover *S. alterniflora*	% Cover *S. patens*	% Cover *D. spicata*	% Cover *Salicornia* spp.	% Cover *J. roemerianus*	% Cover *P. australis*	% Cover *I. frutescens*	% Cover *B. frutescens*	% Cover *S. robustus*	% Cover *A. tenuifolius*	% Cover *L. nashii*
Little Bear	boundary	25.00	0.0	20.0	0.0	0.0	0.0	19.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
		27.50	0.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.0	0.0	0.0	0.0
		30.00	0.0	80.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	79.0	0.0	0.0	0.0
		32.50	0.0	60.0	0.0	30.0	0.0	0.0	0.0	0.0	0.0	30.0	0.0	0.0	0.0
		34.00	0.0	90.0	0.0	60.0	0.0	0.0	0.0	0.0	0.0	30.0	0.0	0.0	0.0
Missouri	basin	0.25	60.0	15.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	transition	1.00	60.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	front terr	2.00	49.0	15.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		3.00	31.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		4.00	28.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		5.00	29.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		6.00	29.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		7.00	32.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		8.00	30.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		10.00	37.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		15.00	33.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		20.00	33.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		25.00	30.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		30.00	37.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		35.00	29.0	5.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		37.50	32.0	45.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		40.00	69.0	70.0	70.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	boundary	42.50	0.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0	0.0	0.0	0.0	0.0
		45.00	0.0	20.0	0.0	5.0	10.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0
Pikes	basin	0.25	61.0	15.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	transition	1.00	21.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	front terr	2.00	23.0	55.0	55.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		3.00	19.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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Creek	Zone	Vegetation Data													
		Distance (m)	*S. alterniflora* Height (cm)	Total % Cover	% Cover *S. alterniflora*	% Cover *S. patens*	% Cover *D. spicata*	% Cover *Salicornia* spp.	% Cover *J. roemerianus*	% Cover *P. australis*	% Cover *I. frutescens*	% Cover *B. frutescens*	% Cover *S. robustus*	% Cover *A. tenuifolius*	% Cover *L. nashii*
Pikes	front terr	4.00	20.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		5.00	19.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		10.00	21.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		15.00	19.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		17.50	19.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	back terr	20.00	31.0	55.0	15.0	0.0	35.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		22.50	32.0	60.0	10.0	0.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		25.00	36.0	50.0	10.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		27.50	0.0	100.0	0.0	2.0	98.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	boundary	30.00	0.0	100.0	0.0	30.0	70.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		32.50	0.0	100.0	0.0	25.0	5.0	0.0	0.0	0.0	20.0	0.0	0.0	0.0	0.0
Quandry	basin	0.25	91.0	85.0	85.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		1.00	78.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	transition	2.00	39.0	85.0	85.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	front terr	3.00	34.0	90.0	90.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		4.00	39.0	85.0	85.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		5.00	42.0	90.0	90.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		10.00	51.0	90.0	90.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	back terr	15.00	52.0	80.0	20.0	10.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		20.00	0.0	70.0	0.0	0.0	0.0	0.0	70.0	0.0	0.0	0.0	0.0	0.0	0.0
		25.00	0.0	80.0	10.0	0.0	0.0	0.0	70.0	0.0	0.0	0.0	0.0	0.0	0.0
		30.00	34.0	80.0	80.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		35.00	38.0	80.0	80.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		40.00	43.0	75.0	45.0	0.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		45.00	37.0	55.0	9.0	0.0	45.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		47.50	47.0	100.0	0.0	49.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
		50.00	37.0	90.0	0.0	10.0	65.0	0.0	0.0	0.0	0.0	0.0	0.0	15.0	0.0
	boundary	52.50	65.0	75.0	0.0	35.0	39.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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Creek	Zone	Vegetation Data													
		Distance (m)	*S. alterniflora* Height (cm)	Total % Cover	% Cover *S. alterniflora*	% Cover *S. patens*	% Cover *D. spicata*	% Cover *Salicornia* spp.	% Cover *J. roemerianus*	% Cover *P. australis*	% Cover *I. frutescens*	% Cover *B. frutescens*	% Cover *S. robustus*	% Cover *A. tenuifolius*	% Cover *L. nashii*
Quandry	boundary	53.00	63.0	100.0	0.0	10.0	79.0	0.0	0.0	0.0	0.0	5.0	0.0	1.0	0.0
Red Cloud	basin	0.25	76.0	15.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		1.00	75.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		2.00	79.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	transition	3.00	71.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	front terr	4.00	78.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		5.00	76.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		6.00	63.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		7.00	52.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		8.00	47.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		9.00	44.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		10.00	38.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		11.00	38.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		15.00	38.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		20.00	42.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		25.00	32.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		30.00	35.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		35.00	37.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		40.00	35.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	back terr	45.00	38.0	30.0	29.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		50.00	26.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		52.50	32.0	30.0	10.0	0.0	0.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		55.00	24.0	30.0	5.0	0.0	10.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		57.50	0.0	100.0	0.0	30.0	50.0	5.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0
	boundary	60.00	0.0	80.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	70.0	0.0	0.0	5.0
		61.00	0.0	100.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0
Shavano	basin	0.25	57.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		1.00	53.0	45.0	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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Creek	Zone	Vegetation Data													
		Distance (m)	*S. alterniflora* Height (cm)	Total % Cover	% Cover *S. alterniflora*	% Cover *S. patens*	% Cover *D. spicata*	% Cover *Salicornia* spp.	% Cover *J. roemerianus*	% Cover *P. australis*	% Cover *I. frutescens*	% Cover *B. frutescens*	% Cover *S. robustus*	% Cover *A. tenuifolius*	% Cover *L. nashii*
Shavano	basin	2.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	transition	3.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		4.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	front terr	5.00	37.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		6.00	37.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		7.00	35.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		8.00	34.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		9.00	32.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		10.00	33.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		11.00	32.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		12.00	33.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		15.00	31.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	back terr	20.00	40.0	45.0	5.0	0.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		22.50	25.0	20.0	5.0	0.0	0.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	boundary	25.00	37.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		27.50	54.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		30.00	.	50.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0	0.0
		31.00	0.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.0	0.0	0.0	0.0
Sunlight	basin	0.25	74.0	80.0	80.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		1.00	74.0	70.0	70.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	transition	2.00	54.0	60.0	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		3.00	46.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	front terr	4.00	39.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		5.00	35.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		10.00	58.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		15.00	38.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		20.00	28.0	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		25.00	46.0	60.0	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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Creek	Zone	Vegetation Data													
		Distance (m)	*S. alterniflora* Height (cm)	Total % Cover	% Cover *S. alterniflora*	% Cover *S. patens*	% Cover *D. spicata*	% Cover *Salicornia* spp.	% Cover *J. roemerianus*	% Cover *P. australis*	% Cover *I. frutescens*	% Cover *B. frutescens*	% Cover *S. robustus*	% Cover *A. tenuifolius*	% Cover *L. nashii*
Sunlight	front terr	30.00	40.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		35.00	33.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	back terr	40.00	41.0	40.0	39.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		45.00	32.0	45.0	30.0	0.0	10.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		50.00	41.0	50.0	20.0	0.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		55.00	44.0	30.0	29.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		60.00	42.0	60.0	39.0	0.0	20.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		65.00	43.0	70.0	45.0	0.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		70.00	39.0	80.0	30.0	0.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		75.00	45.0	90.0	69.0	0.0	20.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		80.00	42.0	55.0	24.0	0.0	30.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		85.00	45.0	70.0	40.0	0.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		90.00	34.0	35.0	19.0	0.0	15.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		95.00	40.0	50.0	40.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		100.00	39.0	55.0	40.0	0.0	14.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		105.00	33.0	40.0	19.0	0.0	20.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		110.00	37.0	60.0	24.0	0.0	35.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		115.00	46.0	45.0	10.0	0.0	34.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		120.00	36.0	45.0	20.0	0.0	24.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		125.00	33.0	40.0	20.0	0.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		130.00	20.0	14.0	15.0	10.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0
		135.00	20.0	6.0	5.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	boundary	140.00	0.0	90.0	0.0	70.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		145.00	63.0	100.0	0.0	90.0	20.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0
Tabeguache	transition	0.25	70.0	5.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		1.00	71.0	5.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	front terr	2.00	85.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		3.00	72.0	70.0	70.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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		Vegetation Data													
Creek	Zone	Distance (m)	*S. alterniflora* Height (cm)	Total % Cover	% Cover *S. alterniflora*	% Cover *S. patens*	% Cover *D. spicata*	% Cover *Salicornia* spp.	% Cover *J. roemerianus*	% Cover *P. australis*	% Cover *I. frutescens*	% Cover *B. frutescens*	% Cover *S. robustus*	% Cover *A. tenuifolius*	% Cover *L. nashii*
Tabeguache	front terr	4.00	61.0	5.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		5.00	50.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		6.00	57.0	15.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		7.00	77.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		10.00	71.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		15.00	75.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		20.00	73.0	15.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		25.00	58.0	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	back terr	30.00	90.0	55.0	30.0	0.0	20.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0
		35.00	56.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		40.00	68.0	95.0	90.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		42.50	84.0	95.0	50.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	boundary	45.00	63.0	100.0	0.0	15.0	80.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0
		46.00	0.0	100.0	0.0	10.0	40.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0	0.0
Torries	basin	0.25	98.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		1.00	93.0	15.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		2.00	94.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		3.00	89.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	transition	4.00	85.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		5.00	71.0	15.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	front terr	6.00	34.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		7.00	25.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		8.00	29.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		9.00	30.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		10.00	29.0	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		15.00	26.0	35.0	34.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		20.00	27.0	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	back terr	25.00	29.0	35.0	35.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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Creek	Zone	Vegetation Data Distance (m)	*S. alterniflora* Height (cm)	Total % Cover	% Cover *S. alterniflora*	% Cover *S. patens*	% Cover *D. spicata*	% Cover *Salicornia* spp.	% Cover *J. roemerianus*	% Cover *P. australis*	% Cover *I. frutescens*	% Cover *B. frutescens*	% Cover *S. robustus*	% Cover *A. tenuifolius*	% Cover *L. nashii*
Torries	back terr	30.00	25.0	30.0	20.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		35.00	24.0	25.0	20.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		40.00	19.0	25.0	20.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		45.00	25.0	25.0	5.0	0.0	0.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		50.00	31.0	50.0	5.0	0.0	0.0	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		55.00	33.0	55.0	5.0	0.0	10.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		60.00	0.0	10.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		62.50	0.0	30.0	0.0	0.0	10.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		65.00	0.0	90.0	0.0	0.0	80.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
	boundary	67.50	0.0	45.0	0.0	0.0	10.0	0.0	0.0	0.0	35.0	0.0	0.0	0.0	0.0
		70.00	0.0	75.0	0.0	0.0	74.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0

APPENDIX G. Soil Data.

Creek	Zone	Soil Data			
		Distance (m)	%MOM	%SOM	Bulk Density [a]
Cameron	transition	0.40	2.82	6.45	0.44
	front terr	1.30	2.98	7.59	0.41
		1.70	3.09	9.61	0.34
		3.60	3.33	8.14	0.36
		3.90	3.58	9.56	0.33
		4.20	3.38	9.44	0.34
		9.00	3.94	9.39	0.39
		25.00	3.35	8.26	0.41
		40.00	2.35	5.19	0.57
	back terr	65.00	0.91	4.21	0.70
		68.00	1.33	3.32	0.80
		71.00	0.58	3.43	0.55
Columbia	basin	5.40	5.43	15.41	0.20
		10.70	11.68	20.76	0.23
		17.20	9.11	22.60	0.19
	transition	20.40	10.88	22.79	0.16
		21.20	8.70	17.80	0.19
		21.50	21.96	34.36	0.15
	front terr	27.00	19.71	34.93	0.12
		46.00	20.65	41.32	0.12
		64.00	4.72	8.88	0.43
	back terr	78.00	1.35	3.57	0.70
		89.00	6.20	22.62	0.22
		94.00	7.75	24.34	0.27
Culebra	basin	0.30	15.03	29.83	0.12
		0.60	10.44	25.37	0.16
		1.80	13.36	28.96	0.14
	transition	2.00	11.02	25.99	0.16
		2.40	22.41	39.01	0.12
		2.90	12.73	38.95	0.14
	back terr	3.00	21.29	44.56	0.14
		5.00	22.71	40.78	0.10
		8.00	21.68	42.36	0.10
Democrat	basin	0.50	1.39	6.19	0.41
	transition	1.20	3.92	7.38	0.37
		1.80	3.87	7.74	0.36
		2.10	3.84	7.37	0.40
		3.20	4.11	9.24	0.32
	front terr	4.10	4.13	7.67	0.36
		7.00	2.27	9.04	0.40
		26.00	4.69	8.91	0.40
	back terr	37.00	0.74	2.66	0.78
		42.00	0.63	2.01	0.86
		51.00	1.96	5.15	0.64
	boundary	59.00	1.30	4.79	0.60
El Diente	basin	0.25	6.59	20.46	0.21

Creek	Zone	Soil Data			
		Distance (m)	%MOM	%SOM	Bulk Density [a]
El Diente	basin	0.30	15.54	21.02	0.17
		0.50	6.56	16.93	0.21
	transition	0.80	12.20	21.29	0.20
		1.00	8.52	18.88	0.23
		1.20	7.43	17.59	0.25
	front terr	11.00	12.10	24.57	0.20
		24.00	9.96	19.72	0.22
	back terr	38.00	4.07	9.29	0.42
		42.00	2.28	4.25	0.66
		44.00	0.83	3.20	0.70
		45.00	0.43	2.96	0.73
Elbert	basin	0.30	7.11	15.09	0.21
		0.40	6.77	13.30	0.26
		0.90	5.12	13.67	0.24
	transition	1.70	7.87	16.98	0.27
		2.30	7.62	13.13	0.31
		3.00	6.39	14.39	0.27
	front terr	14.00	9.49	16.24	0.28
		33.00	9.75	20.37	0.26
	back terr	69.00	18.19	33.11	0.14
		89.00	11.37	22.53	0.23
		94.00	22.69	41.05	0.13
		98.00	17.15	30.98	0.18
Kit Carson	basin	0.25	1.35	6.07	0.38
		0.40	2.49	6.96	0.35
		0.60	2.61	7.03	0.37
	transition	1.00	2.14	6.57	0.37
		0.90	2.71	7.54	0.39
		1.00	4.41	7.92	0.37
	front terr	7.00	2.84	7.02	0.37
		14.00	3.62	5.64	0.55
		17.00	3.73	4.94	0.59
	back terr	21.00	1.51	2.76	0.68
		28.00	0.57	2.34	0.73
		34.00	0.24	2.74	0.75
Little Bear	transition	0.25	0.43	4.73	0.57
		0.40	1.24	6.35	0.50
		0.50	1.92	5.93	0.53
		0.70	2.20	6.21	0.40
		1.00	1.53	5.86	0.43
		1.60	3.07	7.63	0.43
	front terr	4.00	5.06	8.69	0.39
	back terr	12.00	2.82	5.49	0.56
		15.00	0.53	1.86	0.88
		20.00	0.47	1.99	0.87
	boundary	28.00	0.49	2.89	0.69
		33.00	0.85	7.59	0.52
Quandry	basin	0.20	10.16	13.20	0.23

Creek	Zone	Soil Data			
		Distance (m)	%MOM	%SOM	Bulk Density [a]
Quandry	basin	0.70	9.95	14.23	0.24
		1.00	9.17	12.35	0.25
	transition	1.20	12.53	17.68	0.18
		1.40	8.89	17.45	0.21
		1.90	16.61	34.82	0.15
		12.00	19.22	36.37	0.13
	back terr	30.00	35.88	45.82	0.09
		36.00	11.71	20.44	0.24
		45.00	1.79	5.18	0.66
		48.00	7.39	14.60	0.39
		52.00	1.31	5.50	0.57
Shavano	basin	0.25	1.61	5.95	0.36
		1.30	3.90	6.83	0.40
		2.80	1.53	7.83	0.36
	transition	3.60	1.82	8.62	0.34
		3.80	1.98	12.68	0.27
		4.50	5.99	14.40	0.31
	front terr	7.00	5.60	11.17	0.38
		11.00	5.88	12.29	0.36
	back terr	22.00	0.81	2.46	0.77
	boundary	26.00	2.63	3.54	0.57
		29.00	0.81	3.70	0.57
		31.00	1.11	20.46	0.21

a. Bulk density was measured in g/m^2.