INFLUENCE OF ALLUVIAL SEDIMENTATION RATE ON FLOODPLAIN SOIL DEVELOPMENT AND VEGETATION

By

JOHN PHILLIP KELLEY

Bachelor of Science

Oklahoma State University

Stillwater, Oklahoma

2003

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
MASTERS OF SCIENCE
December, 2006

INFLUENCE OF ALLUVIAL SEDIMENTATION

RATE ON FLOODPLAIN SOIL DEVELOPMENT

AND VEGETATION

Thesis Approved:

Dr. Brian J. Carter
Thesis Advisor

Dr. Karen R. Hickman

Dr. Jim Puckette

Dr. A. Gordon Emslie
Dean of the Graduate College

ACKNOWLEDGEMENTS

The author wishes to express sincere appreciation to Dr. Brian J. Carter, Professor of Soil Morphology for his advice, guidance and patience throughout this course of study. Grateful acknowledgements are also extended to Dr. Karen R. Hickman, Associate Professor of Grassland Ecology and Dr. Jim Puckette, Associate Professor of Sedimentary Geochemistry, Organic Geochemistry and Oceanography; for serving on the advisory committee and for their valuable counsel on the manuscript.

To Oklahoma State University and specifically to the Department of Plant and Soil Sciences, the author is grateful for the privilege to attend and for the facilities made possible for this study.

Sincere thanks go to my mother and father, Dorci and George, for their strong support and encouragement. Special thanks are also extended to Byron Sudbury and Clemn Turner for their helpful suggestions and technical support.

TABLE OF CONTENTS

PART I

PART II

Chapter Page

LIST OF TABLES

Table Page

LIST OF FIGURES

Figure Page

Part I

Formation of Late Holocene Buried Soils with Thick A Horizons

CHAPTER I

INTRODUCTION

Buried soils throughout the Southern Plains often contain a thick A horizon. Archaeologists, geoarchaeologists, and soil scientists often collaborate to describe and interpret archaeological sites associated with buried soils. Soil profile descriptions of buried soils include the specific physical appearance, but do not necessarily reflect the genesis of sites. The term "cumulic" is often used to describe these buried soils based on their appearance within alluvium. However, the terms "pachic" and "fluventic" could also be used to describe soils with thick A horizons in aggraded depositional environments.

The term "cumulic" is generally used to describe a soil with a thick A horizon (usually greater than 50 cm). Cumulic infers that the soil was formed by slow deposition of sediment concurrent with pedogenesis (Birkeland, 1999). Cumulic, in a taxonomic sense, can mean either slow deposition that is concurrent with pedogenesis, or a series of buried epipedons (Soil Survey Division Staff, 1999). "Pachic" is used by soil scientists to describe a thick A horizon that contains no visible evidence of sedimentation at the surface (i.e., formed by melanization) (Ferring, 1992). In addition, "fluventic" has been used to describe thick A horizons. Fluvents are multiple sedimentation units (flood events), each followed by relative periods of stability (soil formation) exhibiting irregular organic carbon content throughout the soil profile (i.e., a stacked series of thin A

horizons). Cumulic, pachic and fluventic soils acquire the same physical appearance, but differ in the formational process (i.e., the rate of sedimentation and accumulation of organic matter).

Differentiating between formational processes and associated sedimentary processes is essential to interpreting the spatial and temporal distributions of archaeological artifacts, as well as, in paleoenvironmental reconstruction. Soils mark a period of relative landscape stability which may represent hundreds if not thousands of years. If a paleosurface or sedimentary unit is overlooked, the paleoenvironment and distribution of artifacts (temporal and spatial) may be misinterpreted. The objectives of this study was to: 1) interpret the soil forming processes and associated sedimentary processes responsible for forming two key paleosols in the Southern Plains and 2) assign terms most suitable for the description of these buried soils. The two key paleosols investigated were the Caddo paleosol (Hall and Lintz, 1984) and the Copan paleosol (Hall, 1977). Regional correlation of these two sites validates the importance of the Caddo Soil and Copan soils (Waters, 1992). Identifying flood events and periods of relative stability within these paleosols will enhance present interpretation of paleoindian life and paleoenvironmental reconstruction.

CHAPTER II

LITERATURE REVIEW

Introduction

Waters (1992) describes three types of paleosols: relict, exhumed and buried. Relict paleosols are soils formed under past pedologic regimes and continue to be influenced by the present environmental conditions. Exhumed paleosols are soils that were at some point buried and later exposed by erosion, reintroducing them to active pedogenesis. Buried paleosols (buried soils) are soils that have, for the most part, been removed from the zone of active pedogenesis, retaining features formed under past pedologic regimes. Buried soils are key features within alluvial stratigraphic records of the Southern Plains. These stratigraphic records are crucial to understanding the Holocene environments and paleoindian patterns of the region. The long history of human occupation within the Southern Plains was affected by major climatic shifts during the Holocene (Holliday, 1995). Buried soils within stratigraphic sequences mark the passage of time and were originally used as stratigraphic markers (Holliday, 1990). Over the years, buried soils have enhanced spatial and temporal (seasonal to long term) patterning of artifact distributions, artifact density studies, and evaluation of artifact preservation (Ferring, 1986). In addition, the presence of buried soils greatly augments paleolandscape, paleoclimatic and paleoecological reconstruction (Schaetzl and Anderson, 2005).

The presence of buried soils within late Holocene alluvium is important to many archaeological and paleoenvironmental studies of the Southern Plains. The Southern Plains contain many of the best-known paleoindian sites in North America (Holliday, 2000). Many of these paleoindian sites are found in association with buried soils within Holocene alluvium. Common local paleosols are named the Caddo Soil in south-central Oklahoma (Hall and Lintz, 1984), the Copan Soil in northeastern Oklahoma (Reid and Artz, 1984) and the Delaware Creek Soil in south central Oklahoma (Ferring, 1986). Regional correlations between paleosols have been marginally applied (Hall, 1988, 1990; Waters and Nordt, 1995). Waters and Nordt (1995) document two prominent buried soils from east-central Texas (Brazos River floodplain) as formed from around 4200 to 2500 yr. B.P. (Buffalo Soil) and from around 1250 to 500 yr. B.P. (Asa Soil). Hall (1988, 1990) notes three associated buried soils present in north central Texas formed ca. 2000 to 1000 yr. B.P. (West Fork, Navarro and Hog Creek Soils). In addition, Ferring (1992) includes the Quitaque Soil (Central Rolling plains of Texas) as a correlation to the Caddo and Copan buried soils. The Asa, Buffalo, West Fork, Navarro, Hog Creek, Quitaque, Caddo and Copan buried soils correlate and represent periods of regional floodplain stability within Holocene alluvium (Hall, 1990; Waters and Nordt, 1995).

To fully investigate buried soils, the soil and sedimentary features must be distinguished. Sediments and soils, the contacts between them, the amount of time they represent, and the associated pedologic and sedimentary processes must be accurately evaluated and properly defined prior to archaeological interpretation or paleoenvironmental reconstruction (Bettis and Mandel, 2002; Waters, 1992, 2000). Sedimentary event duration and frequency are very important factors of artifact

distribution. Rapid sedimentation promotes dissociation of sequential artifacts, while slow deposition yields mixed assemblages on paleosurfaces or within stratigraphic units (Fig. 1) (Ferring, 1986; Waters, 2000).

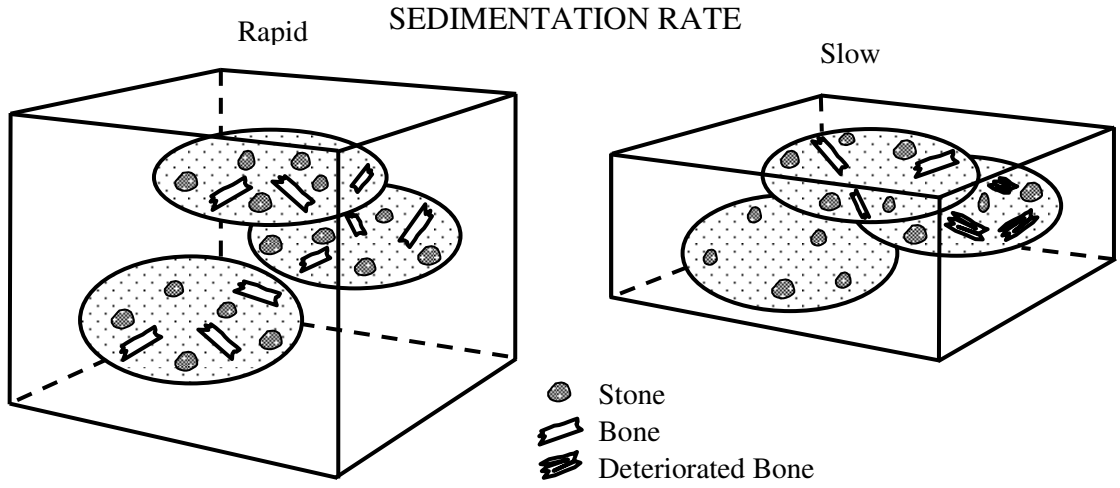

Figure 1. Schematic model of site formation. The same hypothetical occupation episodes are contrasted between settings with rapid and slow sedimentation rates. Note better superpositioning, spatial patterning resolution, and preservation in settings with rapid sedimentation. (From Ferring 1986)

For example, an artifact found near the top and bottom of a thick deposit (rapid deposition) may be nearly contemporaneous, whereas artifacts near the top of the unit (slow deposition) may be a mixture of artifacts from different time periods (Fig. 2) (Holliday, 1990).

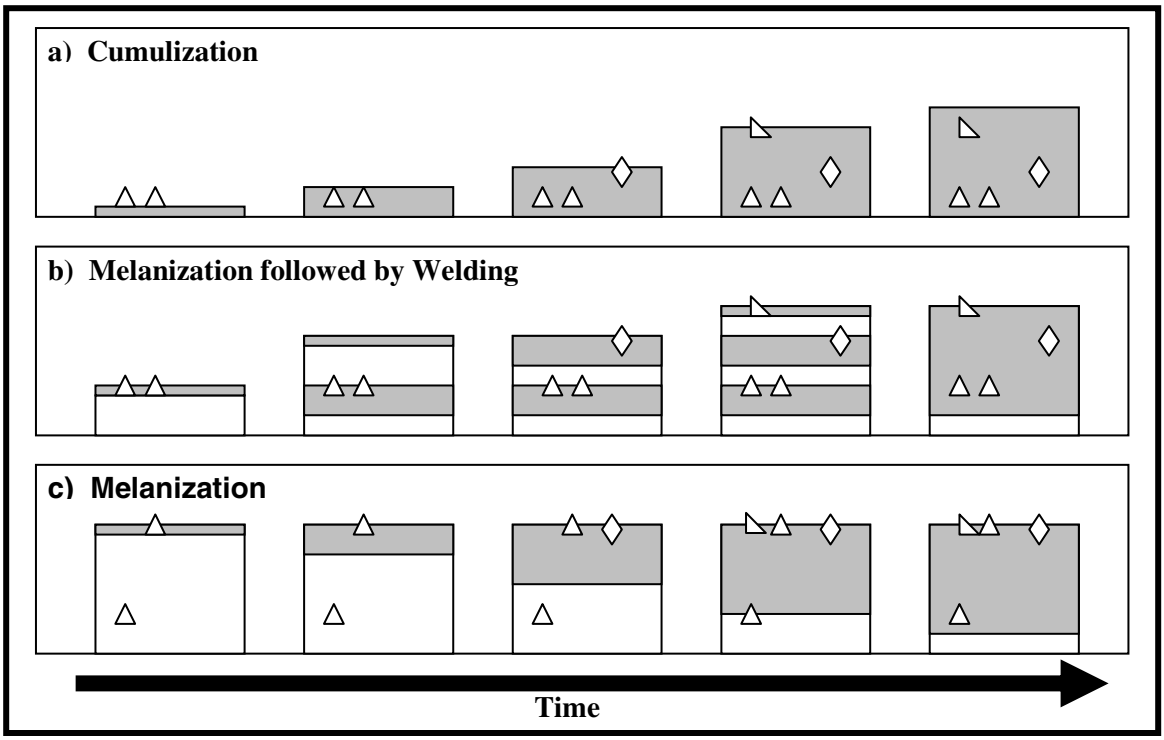

Figure 2. Schematic diagram of artifact distributions within three alluvial pedofacies common to floodplains. Three identical soils are shown to develop under different soil forming and sedimentary processes over time. (a) Cumulic soil formed under slow deposition. (b) Moderate sedimentation interrupted by periods of stability. Eventual welding of multiple buried soils masking discontinuities in sedimentation. (c) Rapid initial sedimentation followed by melanization.

Artifact assemblages from discrete occupations are more likely to become spatially separated during periods of frequent or long duration floods (Waters, 2000). In addition, smaller events will differentially bury areas on a floodplain producing the appearance of both continuous and non-continuous occupation of related material (Waters, 1992, 2000). Ferring (1986) demonstrated that sedimentary contacts may also be masked by pedogenesis; indirectly implicating that sedimentary sequences within A horizons may exist. However, no studies have directly addressed pedogenic alteration (melanization) of multiple sedimentary units within thick A horizons formed within Late Holocene alluvial buried soils. A similar study by Daniels (2003) recognizes the occurrence of

sheetflow and multiple buried soils within near surface alluvium. Although sedimentary structures within A horizons were pedogenically obscured, radiocarbon date analysis suggested a threshold rate of pedogenic assimilation was about 0.5 cm $year^{-1}$ (Daniels, 2003).

Other studies have attempted to quantify sedimentation rates of entire profiles. By utilizing a series of radiocarbon dates, Lintz and Hall (1983) addressed sedimentation rates of the Caddo Soil (0.80 cm/yr); but warned that "sedimentation rates of non-constant depositional environments, such as Carnegie Canyon (Caddo Soil) alluvium, are, at best, generalizations of the net annual sedimentation accumulation over many years." Many investigators assume that thick, stratified archaeological sites were formed by continuous sedimentation (Holliday, 1990). However, sedimentation is a result of random geologic processes: fluctuations in erosion, transport and base level. Calculated sedimentation rates attempt to conventionalize random events and should not be used to recreate detailed sedimentary history (Sadler, 1981). A better approach is to become aware of alternate hypotheses to facilitate enhanced site investigations. The randomness of overbank sedimentation gives rise to several alternative hypotheses of alluvial soil formation. Cumulization, as mentioned above, seems to be the most widely accepted model. A cumulic soil profile forms when sediments are deposited concurrent with pedogenesis. Another model, suggests that a relatively thick influx of sediment is deposited followed by a relative period of stability; forming perhaps a small A-C profile. Later, another package of sediment is deposited, followed by soil formation and melanization; eventually 'welding' the two profiles into one horizon. Soil 'welding' occurs when a soil horizon is buried but remains within the zone of active pedogenesis.

Essentially, melanization occurs downward through the overlying layer of soil; merging the present and past surface (Ruhe and Olson, 1980). This cycle could repeat any number of times forming a dark thick A horizon. Another hypothesis is the formation of a fluventic profile followed by melanization, welding separate horizons into a single A horizon. Still another hypothesis concludes that A horizons formed by melanization form pachic A horizons (Buol et al., 2003). Correctly determining site formational processes requires the separation of sedimentary and pedologic processes. Pedologic characteristics generally considered for the Southern Great Plains include particle size distribution analysis and organic carbon and calcium carbonate percent (Daniels, 2003).

Alluvial Sedimentology

Recognition of sedimentary structures is beneficial in understanding initial site formation processes. For the sake of archaeological investigation, it is assumed that most occupation took place on vertically accreting surfaces of floodplains. Although some artifacts are associated with lateral accretion deposits, they have likely been reworked (Waters, 1992). Thus for the purpose of this study a review of fluvial sedimentology is limited to vertically accreting floodplain deposits.

Vertically accreting floodplain deposits or overbank deposits consist of fine grained (fine sand to clay, 0.25mm - <0.002mm) sediments, deposited by slow moving sediment-laden floodwaters. Occasionally large flood events can create traction currents; resulting in relatively coarser floodplain sediment deposition (Bullinger-Weber and Gobat, 2006). Regardless, these sediments typically exhibit a laterally and vertically fining relationship of both texture and deposit thickness with increasing distance from the

stream channel (Kochel and Baker, 1988; Magilligan, 1992). Sediments having a vertically fining relationship of both texture and/or deposit thickness are generally referred to as a fining upward sequence (FUS) (Fichter and Poché, 2001). Occasionally floodplain deposits contain a coarsening upward sequence (CUS), and are interpreted as continued increase in flood magnitude and frequency; or a change in source material (Fichter and Poché, 2001; Magilligan, 1992). The spatial variation of sedimentary structure is related to hydraulic characteristics of flow and floodplain geometry (Kochel and Baker, 1988). Distal areas of floodplains may only receive a few millimeters of sediment while proximal channel areas may receive tens of centimeters of sediment (Reid and Frostick, 1994). Regardless of floodplain position and flood magnitude, sediments theoretically exhibit some form of structure or sedimentary facies.

Variations of overbank deposition include upper point bars, natural levees, crevasse splays and slackwater deposits (Prothero and Schwabb, 2004). Point bar sequences generally consist of channel lag (gravels and coarse sands) followed by high velocity planer laminations and trough cross beds (coarse sediment). Once abandoned, upper point bars are capped by low velocity sedimentation (very fine sands, silts and clays), typical of floodplains (Bullinger-Weber and Gobart, 2006). Natural levees are initially formed of near channel sandy sediments, creating a low sandy ridge topped by fine grained sediments (Prothero and Schwab, 2004). Often levees are breeched during flood events creating a crevasse splay. Crevasse splays are lobe shaped features extending out onto the floodplain away from the channel. These sediments are characterized by both sandy and muddy sediments, and show small scale cross beds and climbing ripple drifts (Prothero and Schwab, 2004). Crevasse splays fine laterally and

vertically, as the initial surge of floodwater dissipates. Crevasse splays eventually part to slackwater deposits. Slackwater deposits are generally found in areas void of high-velocity flows, and consist of intercalated planner laminations of medium to very fine sands, silts and clays (Benito et al., 2002).

Pedology

Particle Size Distribution - In young alluvial soils, particle size distribution (PSD) reflects sedimentological processes described above. As soils age, pedologic activity alters original PSD of the parent material and creates new structures making stratigraphic interpretation difficult (Birkeland, 1999; Waters, 1992). Knowledge of the soil forming processes is essential to differentiate sedimentary structures from pedologic structures. An important caveat of PSD analysis is that clay bands may form under sandy A-horizons and appear to represent sedimentary structure (Ferring, 1992; Holliday, 1990). Another caveat is that the physical properties of sediments may differ from information reflected by some laboratory analysis of PSD, because composite particles of both mineral and organic origin are common in suspended sediments (Nicholas and Walling, 1997). For example, pedogenic features (clay-humus aggregates and carbonate nodules) and sedimentary phenomenon (rip-up clasts and mud balls) may act as larger grains during transport and deposition. Because of this, lab methods and pretreatments must be carefully chosen and identified to suit site conditions.

Soil Organic Matter – Soil organic matter within alluvial soils is either incorporated during sedimentation or added by decomposing floral and faunal remains during periods of stability. Organic matter deposited during sedimentation may account for background levels of soil organic carbon within alluvial soils. It is also important to note that strata of

organic rich finer sediments may resemble buried A-horizons (Ferring, 1992). Post-depositional additions are controlled by and are indicative of climate, vegetation, soil texture and duration of surface stability (Stein, 1992). Organic carbon contents within stable soils decreases exponentially with depth (Bernoux et. al., 1998; Arrouays and Pelissier, 1994). Thus, organic carbon content (OCC) distributions within soils of alluvial fills can be used to discern stratigraphic layering, pinpoint paleosurfaces within soil horizons and give insight of the relative duration of surface stability. Once deposited, organic matter may be lost or removed by leaching, erosion and microbial decomposition (Brady and Weil, 2002).

Climate and Soil Organic Matter - Climate controls on organic matter include temperature and moisture (Brady and Weil, 2002). Soil organic matter decreases with increasing temperatures. In cool climates plant growth outpaces microbial decomposition, while microbial activity in warm climates is able to keep pace with vegetative growth (Jacobs and Mason, 2005). As a result, soil organic matter generally increases with decreasing mean annual temperature as one travels north (in the northern hemisphere) across similar mean annual precipitation regimes (Brady and Weil, 2002). Furthermore, soil organic matter generally increases with increasing moisture (Brady and Weil, 2002). Increasing moisture increases plant production, in turn adding large amounts of organic matter to the soil (Jacobs and Mason, 2002). Soil organic matter generally increases from west to east across the North American Great Plains; along similar mean annual temperatures regimes (Brady and Weil, 2002). However, extremes in moisture can have variable effects on soil organic matter. Excess moisture creates anaerobic conditions, reducing microbial decomposition of organic matter (Birkeland,

1999). Extremely dry conditions, on the other hand, can facilitate organic matter preservation in several ways: (1) low moisture levels can limit the depth of biological activity, (2) low precipitation prevents deep translocation and leaching of soil organic matter, and (3) high base saturation in arid climates facilitates Ca-humus bonds that protect soil organic matter from translocation and microbial decay (Schaetzl and Anderson, 2005).

Vegetation and Soil Organic Matter – Temperature and moisture are important factors of plant growth thus they are important factors of organic carbon assimilation and preservation. However, vegetation 'type' is also very important, when considering soil organic carbon assimilation and preservation. For example, in climate regions where vegetation includes both forests and grassland, forested sites generally contain less soil organic matter than prairies (Brady and Weil, 2002). In forested sites growth is slow and most growth occurs in the trunks and branches of trees, thus significant amounts of organic carbon is tied up in these enduring tissues (Kimmins, 1987). Grassland soils, on the other hand, generally contain greater amounts of soil organic matter, as a significant portion of grassland productivity is in the form of roots. Roots are very resistant to microbial decay and contribute more efficiently to soil humus than forest leaf litter (Brady and Weil, 2002). In addition, the aerial portion of most grasses, which are easily decomposed, die annually further adding to soil organic matter and reintroduce bases to the surface. By continually adding litter to the soil surface, grassland vegetation serves as an efficient base cycler; which impedes acid leaching by keeping soil pH close to neutral.

Soil Texture and Soil Organic Matter - In addition to climate and vegetation, soil texture plays a significant role in the accumulation of organic matter (Stein, 1992). Soils containing higher clay and silt contents generally contain higher amounts of organic carbon for three reasons. First, clays and silts naturally have higher fertility and a higher water holding capacity, which generally result in higher plant productivity (Brady and Weil, 2002). Second, clay stabilizes soil organic matter by forming clay-humus complexes or soil aggregates (Jacobs and Mason, 2005). Third, poor aeration in fine textured soils decreases organic matter decomposition (Brady and Weil, 2002).

Implications of Surface Stability - Organic carbon content distributions of soils vary with the duration of stability (no surface additions of sediment). With time (200 to 10,000 yrs), stable soils may reach a steady state of organic carbon, in which no additional organic carbon is retained (Birkeland, 1999). These soils typically exhibit a pachic A horizon greater than 50 cm thick. Organic carbon distribution, within Pachic soils is generally maximal at the surface, decreasing uniformly with depth; with an occasional secondary maximum values in the upper B horizon (Buol, et al., 2002; Schaetzl and Anderson, 2005). It is important to point out that the steady state of organic carbon may be retained despite climatic shifts, until buried or eroded (Stein, 1992). Conversely soils formed under unstable conditions seldom reach a steady state of organic carbon and have an irregular decrease in organic carbon with depth (Buol, et al., 2003). In addition, depth and pace of sedimentation is important, as mineralization of organic carbon should be less in rapidly aggraded soils as opposed to slowly aggraded soils (Blecker, et al., 1997).

Carbonates - Carbonate accumulation patterns and morphology of stages reflect regional mean annual precipitation, and are helpful in the correlation of various deposits and geomorphic surfaces (Schaetzl and Anderson, 2005). Soil carbonates are attributed to three possible sources: 1) the weathering of carbonate rich parent material, 2) capillary rise from a perched water table or 3) added by precipitation and dust from upwind sources (Birkeland, 1999; Schaetzl and Anderson, 2005). Most soil carbonates in arid and semi arid regions are attributed the latter (Machette, 1985). When ground water carbonates are present, it is important to be able to differentiate them from pedogenic carbonates (Birkeland, 1999). According to Birkeland (1999) "pedogenic carbonates should have features such as those of the six morphological stages with the correct depth distribution. In addition, in most cases there should be an overlying soil horizon, and their development ideally should bear some relationship to the carbonate stage attained."

Six stages of carbonate development in both gravely and non-gravely parent materials are recognized by Gile et al. (1966) and Machette (1985) (Table 1). Stages I – III represent development preceding complete cementation (plugging of pore spaces) and is typically designated as a Bk horizon. Stage IV – VI represent development at the point of cementation and later, and is typically designated as a Bkm or K horizon.

Stage	Gravelly Parent Material	Nongravelly Parent Material
I	Thin discontinuous clast coatings; some filaments; can be calcareous next to stones; about 4% $CaCO_3$	Few filaments or coatings on sand matrix grains; <10% $CaCO_3$
I+	Many or all clast coatings are thin and continuous	Filaments are common
II	Continuous clast coatings; local cementation of few to several clasts; matrix is loose and calcareous enough to give somewhat whitened appearance	Few to common nodules; matrix between nodules is slightly whitened by carbonate (15-50% by area), and the latter occurs in veinlets and as filaments; some matrix can be noncalcareous; about 10-15% $CaCO_3$ in whole sample, 15-75% in nodules
II+	Same as stage II, except carbonate in matrix is more pervasive	Common nodules; 50-90% of matrix is whitened; about 15% $CaCO_3$ in whole sample
Continuity of fabric high in carbonate		
III	Horizon has 50-90% K fabric with carbonate forming an essentially continuous medium; color mostly white; carbonate-rich layers more common in upper part; about 20-25% $CaCO_3$	Many nodules, and carbonate coats so many grains that over 90% of horizon is white; carbonate-rich layers more common in upper; about 20% $CaCO_3$
III+	Most clasts have thick carbonate coats; matrix particles continuously coated with carbonate or pores plugged by carbonate; cementation more or less continuous; >40% $CaCO_3$	Most grains coated with carbonate; most pores plugged; >40% $CaCO_3$
Partly or entirely cemented		
IV	Upper part of K horizon is nearly pure cemented carbonate (75-90% $CaCO_3$) and has a weak platy structure due to the weakly expressed laminar deposition layers of carbonate; the rest of the horizon is plugged with carbonate (50-75% $CaCO_3$)	
V	Laminar layer and platy structure are strongly expressed; incipient brecciation and pisolith (thin, multiple layers of carbonate surrounding particles) formation	
VI	Brecciation and recementation, as well as pisoliths, are common	

Table 1. Six stages of carbonate morphology.
Sources: Gile et al. (1966), Bachman (1977), Machette (1985), Birkeland (1999) and Schaetzl and Anderson (2005).

Climate During the Holocene

The Holocene marks the end of the last glacial period (~11,000 yrs. B.P. – present). The appearance of human occupations in the southern plains, the extinction of many megafaunal species and vegetation shifts during the Holocene heightens the significance of this period (Ferring, 1990; Knox, 1983). Generalized accounts of Southern Plains paleoclimate have been made by the analysis of pollen, phytoliths, carbon and oxygen isotopes, floral macrofossil assemblages, molluscan and vertebrate faunal records, soil characteristics and sedimentary structures (Arbogast and Johnson, 1994; Baker et al., 2000; Ferring, 1990; Hall, 1988, 1990; Meltzer, 1999; Nordt, 2004; Nordt et al., 1994). The climate of the Southern Plains during Holocene was characterized by a post-Pleistocene warming and drying trend that climaxed circa 7000-4500 yrs. B.P. , known as the Altithermal (Antevs, 1948), followed by a relatively cool moist climatic interval circa 2000-1000 yrs. B.P.. A drying trend returned circa 1,000 yrs. B.P., resulting in conditions similar to the present (Foreman et al., 2001; Hall, 1990; Holliday, 1990; Waters and Nordt, 1995). Climate changes during the Holocene were significant factors affecting Southern Plain fluvial morphology (Knox, 2000). Conflicting, alluvial records within the Southern Plains have primarily been associated with regional climate changes. Numerous interpretations of floodplain stability, floodplain aggradation, channel incision and channel aggradation have been made (Ferring, 1990; Forman et al., 2001; Hall, 1990; Holiday, 1988; Waters and Nordt, 1995). Often, channel incision is associated with warm dry periods. Theoretically less vegetation during warm dry periods resulted in increased runoff, thus greater stream flow

(Ferring, 1990; Hall, 1990). Other studies suggest channel incision ensued during cool moist periods when sediment concentration was lowest (increased sediment content during dry periods would result in increased alluvial aggradation) (Knox, 1983). Currently most investigators agree that climate change is not the only factor affecting fluvial morphology and that influence of global and regional climate change on local fluvial response remains unclear. Position in stream network, duration of climate trends, lag time in vegetation response, and changes in base level increase the complexity of the issue (Hall, 1990; Bogaart and van Balen, 2000; Martin, 1992; Nordt, 2004; Patton and Schumm, 1981; Waters and Nordt, 1995).

CHAPTER III

MATERIALS AND METHODS

Field Methods and Sampling

Two sites previously identified as type sections for the Caddo Soil (Lintz and Hall, 1983) and the Copan Soil (Reid and Artz, 1984) were located and verified along stream cutbanks (Fig. 3). Two soil profiles containing the Caddo Soil in Carnegie Canyon (CC) (sites #1 and #2; Fig. 4) and two soil profiles containing the Copan Soil on South Fork Cotton Creek (SFCC) (sites #1 and #2; Fig. 5) were selected for detailed soil description, sampling and analysis. To facilitate evaluation, the two profiles at Carnegie Canyon and the two profiles at South Fork Cotton Creek were excavated on similar stream terrace and floodplain landforms, respectively. Pedogenic features of alluvial fills were described and sampled using standard Soil Survey methods (Soil Survey Division Staff, 1993, 1996; Schoeneberger et al., 1998). Profiles were sampled (2 kg) at 10-15 cm intervals in conjunction with soil horizons. Soil nomenclature follows terminology as described by Holliday (2004). This method is useful where multiple buried soils are present, as buried soils are numbered from the top down; grouping and identifying individual buried soils (Holliday, 2004).

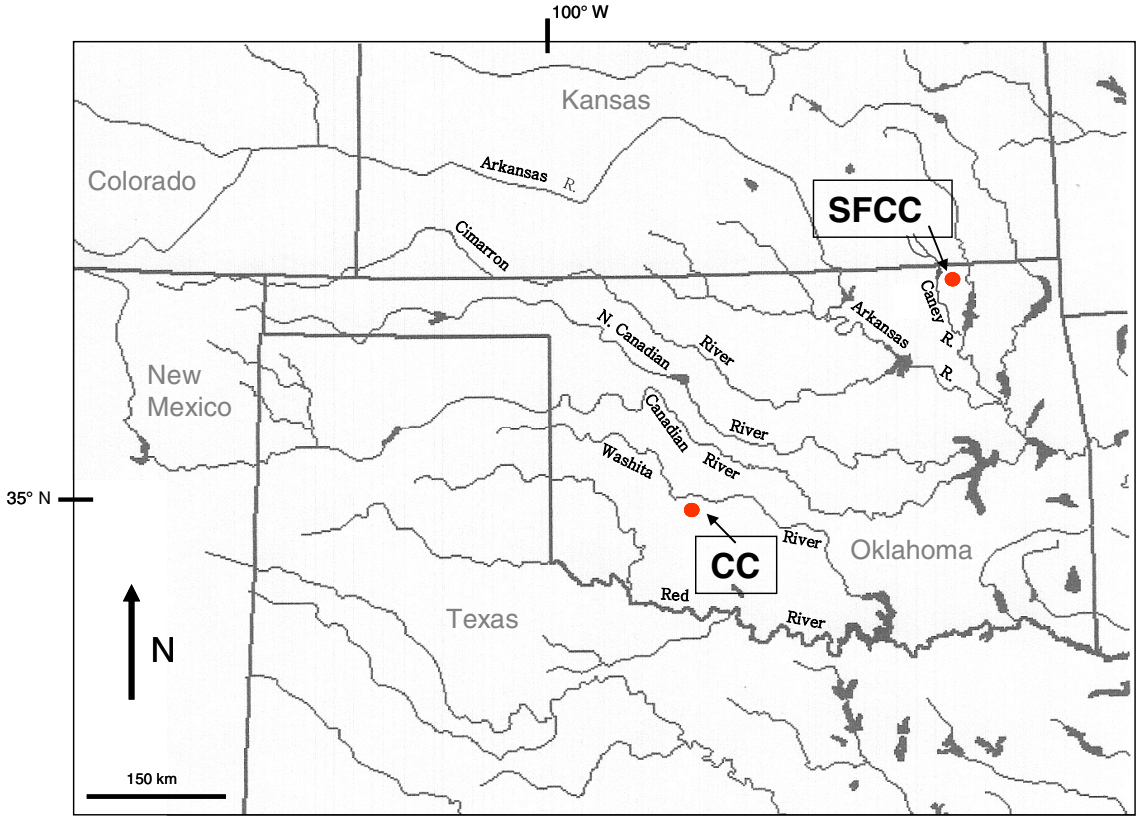

Figure3. Map showing site locations of Carnegie Canyon (CC) and South Fork Cotton Creek (SFCC) and rivers.

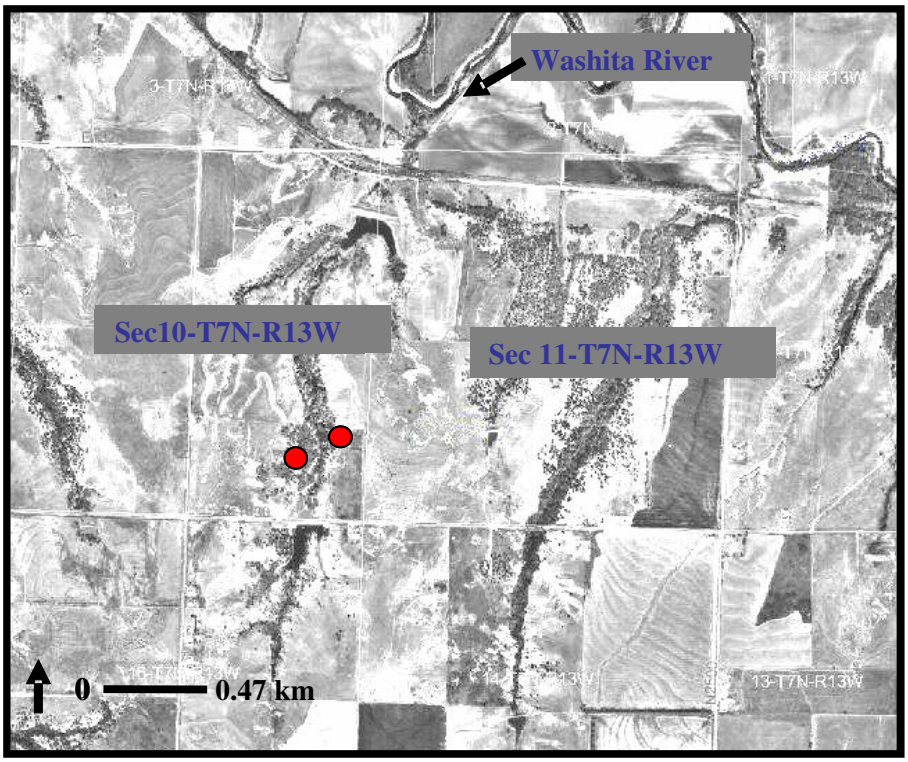

Figure 4. Aerial photo of Carnegie Canyon study area showing locations of CC #1 (east) and CC #2 (west). Cutbanks are located in the SE1/4 of the SE1/4 of Sec. 10 T7N R13W Caddo County, Oklahoma.

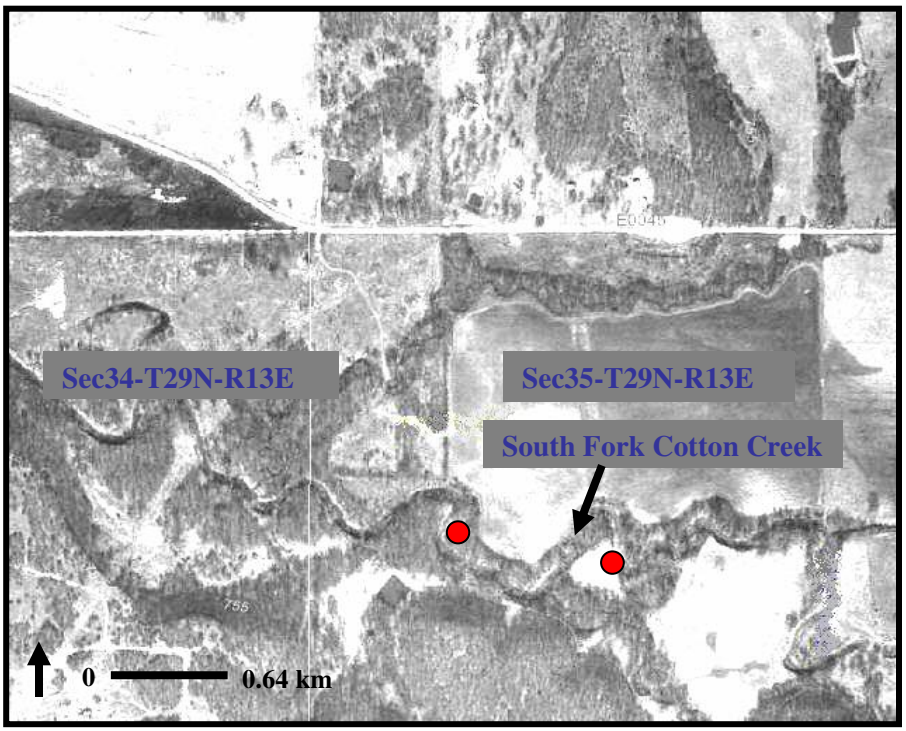

Figure 5. Aerial photo of South Fork Cotton Creek study area showing locations of SFCC #1 (east) and SFCC #2 (west). Cutbanks are located in the SW1/4 of Sec. 35 T29N R13E Washington County, Oklahoma

Soil and Sediment Analysis

Samples were air dried, manually ground, and passed through a 2 mm sieve. Particle size analysis was conducted by pipet method according to the Soil Survey Laboratory Methods Manual (Soil Survey Division Staff, 1996). Samples were pretreated with H_2O_2 to remove soil organic matter, dried, then dispersed with sodium hexametaphosphate. Particle size analysis included size fractions from 0.2 µm to 200 µm (clay – very coarse sand). Total organic carbon was determined by oxidation with $K_2Cr_2O_7$ in H_2SO_4 according to Yeomans and Bremner (1988). Calcium carbonate equivalence was determined by titrimetric method as in Soil Survey Division Staff (1996). Organic carbon content (OCC) distributions were compared with soil morphological descriptions and stratigraphy to pinpoint periods of stability following sedimentation; especially within thick dark A horizons of the Caddo and Copan Soils. Organic carbon content distributions of the modern soil profiles, including associated young buried soils varied systematically and are characterized by relative maximum values of OCC followed by rapidly decreasing OCC with depth. However, OCC distributions within the Caddo and Copan Soils are somewhat unique and will be discussed individually for each site in the following chapters.

Analysis and Interpretation

Stratigraphy was analyzed and discussed using clay-free sand (5-200 µm) to eliminate the influence of clay translocation during pedogenesis. Stratigraphy of the CC and SFCC stream cutbanks contained no visible original sedimentary structures. However, particle size analysis revealed systematic changes within all soil profiles, in the form of FUS's and CUS's. Within these general FUS's many small scale (< 100 years)

CUS's and FUS's were revealed. In most cases, a CUS topped by a FUS was interpreted as an increase and decrease in flood magnitude, respectfully (Magilligan, 1992). Thus, to simplify discussion of stratigraphy, a CUS followed by a FUS is generally assumed to be a flood event (FE). We assume small CUS's and FUS's within undeveloped C horizons represent changes in flood intensity during a large flood or a brief hiatus during rapid aggradation and are not isolated for discussion. Furthermore, portions of profiles where there are relatively no systematic changes (in grain size) within developed horizons are referred to as multiple units (MU). It is thought that these areas are the result of multiple small sedimentary events.

Radiocarbon Age Determinations

Bulk samples from the surfaces of the Caddo and Copan Soils were obtained from both sites at Carnegie Canyon and both sites at the South Fork Cotton Creek, respectively. Pretreatment and radiometric radiocarbon age determination was performed on bulk (or total) soil samples by Beta Analytical Inc. Sample pretreatment performed by Beta Analytical Inc. included: removal of roots under a binocular microscope and removal of carbonates by acid washes. Bulk fraction analysis was chosen to provide the most accurate time of burial, as the total fraction from the upper portion of a late Holocene buried soil provides the youngest age (Martin and Johnson, 1995). Radiometric radiocarbon ages were reported as conventional radiocarbon age.

CHAPTER IV

RESULTS AND DISCUSSION

Radiocarbon ages

Floodplain stability and soil formation of the Caddo and Copan Soils is thought to have occurred sometime between 1000 and 2000 Cal. yrs. B.P. (Ferring, 1992). Radiocarbon ages obtained for Caddo Soil 1 (CC#1) and Caddo Soil 2 (CC#2) are 950 ± 70 RCYBP and 1060 ± 50 RCYBP, respectively. However, following radiocarbon dating at SFCC, a discrepancy was revealed between the radiocarbon age we obtained from the top of the A horizon of the 'Copan Soil' (SFCC#1, 3980 ± 60 RCYBP and SFCC#2, 3310 ± 50) and the commonly cited time frame of 1000 – 2000 Cal. yrs. B.P. (Ferring, 1992). Initially, we chose a location proximal to the Lizard Site (34WN107) from Reid and Artz (1984), as containing a representative of the Copan Soil. Upon review, it was revealed, that a date had not been obtained from the A horizon of the 'Copan Soil' at the Lizard Site (34WN107), yet the soil was correlated as the Copan Soil. Reid and Artz (1984) however, reported dates obtained from the A horizon of the Copan Soil from four other sites in the area; which did correlate with the age range of the Copan Soil. Judging by proximity to the Lizard Site (34WN107), similar soil characteristics and A horizon thickness, it is likely that we identified the 'Copan Soil' that Reid and Artz (1984) identified. However, we feel this soil was formed much earlier, and is not truly the Copan Soil.

Thick A horizons at SFCC #1 and SFCC #2 starting at 195 cm (190-385 cm bgs) and 206 cm (134-340 cm bgs), respectfully, will be referred to as the Napoc Soil. The name Napoc is an arbitrary name we have assigned to this soil. No further attempts to correlate this soil with others from the region have been made. Despite this discrepancy, the Napoc Soil is still useful for the purpose of this research.

Defining Characteristics of Soil Profiles

Soil profile descriptions from four stream cutbank exposures (Table 2-5) revealed prominent buried soils with well defined upper surfaces. Buried soils with thick A horizons were identified starting at 154 cm, 234 cm, 190 cm and 134 cm below ground surface (bgs) for Caddo Soil 1 (CC #1, Akb3), Caddo Soil 2 (CC #2, Ab3), Napoc Soil 1 (SFCC #1, Ab) and Napoc Soil 2 (SFCC #2, Ab2) respectfully. Caddo Soil 1 contained an Ak-Abk-Bk-CB-C soil horizon sequence, which had a thickness of 180 cm (154-334 cm bgs) (Table 2). Similarly, Caddo Soil 2 contained an A-AB-Bk-C soil horizon sequence, which had a total thickness of 182 cm (234 to 416 cm bgs). However, Napoc Soils (1 and 2) had somewhat thicker (by 15 cm) A horizons, compared to the Caddo Soils (1 and 2). Both buried soils, Napoc Soil 1 and Napoc Soil 2 contained A-Bt-BC soil horizon sequences and obtained thicknesses of 195 cm (190-385 cm bgs) and 206 cm (134-340 cm bgs), respectfully.

Mollic colors (3/3 moist or darker, Table 2-5) for each buried soil punctuated the cutbanks and were 73 cm (154-227 cm bgs), 118 cm (234-352 cm bgs), 83 cm (190-273 cm bgs) and 97 cm (134-231 cm bgs) thick, for Caddo Soil 1 (Fig. 6), Caddo Soil 2

(Fig. 7), Napoc Soil 1 (Fig. 8) and Napoc Soil 2 (Fig. 9), respectfully. Mollic colors terminated at the bottom of the Akb3 and ABb3 horizons in Caddo Soil 1 and Caddo Soil 2, respectfully. While mollic colors extended into the upper Bt horizons in both Napoc Soil 1 and Napoc Soil 2.

Figure 6. Carnegie Canyon Site #1

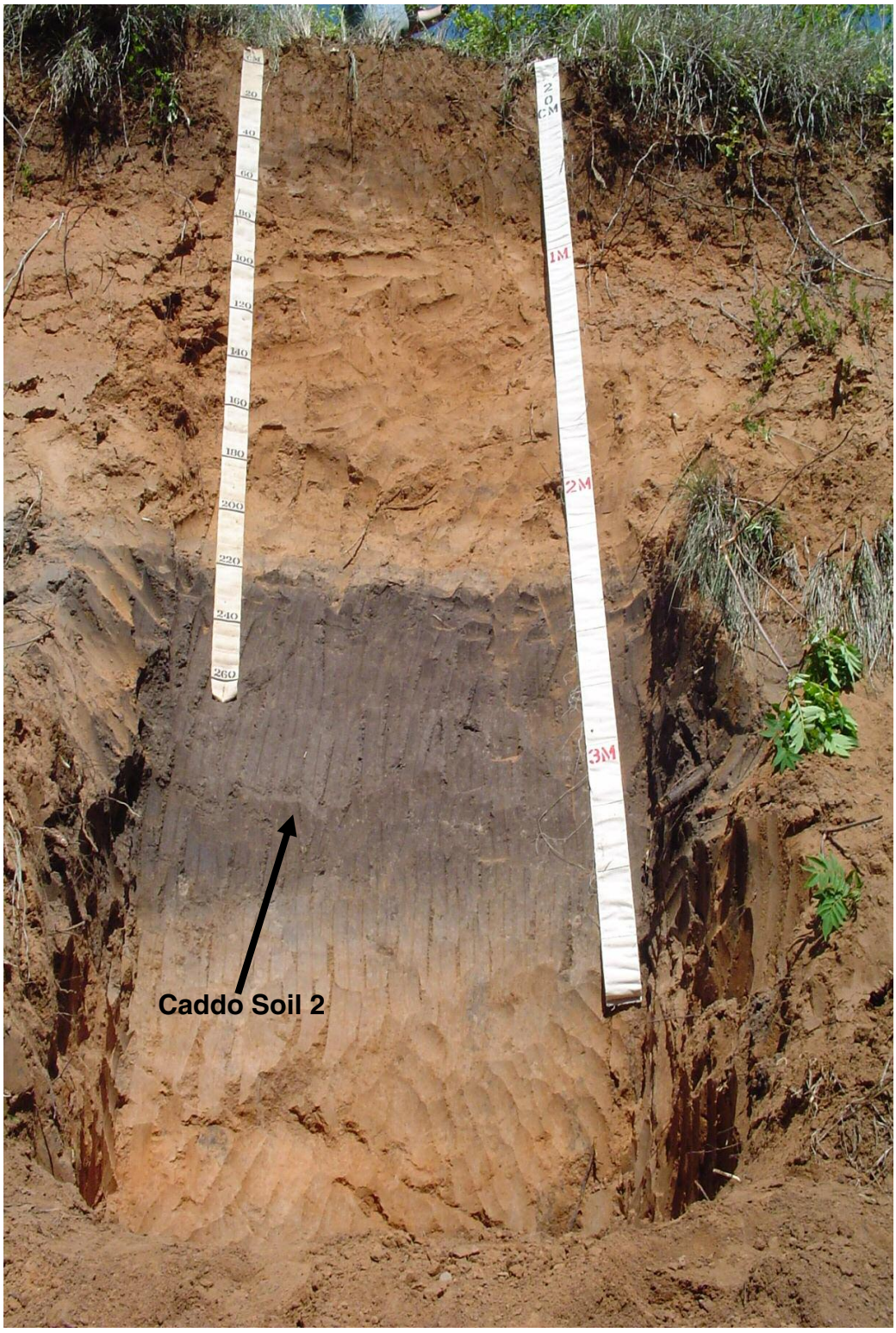

Figure 7. Carnegie Canyon Site #2

Figure 8. South Fork Cotton Creek #1

Figure 9. South Fork Cotton Creek Site #2

In addition to the thick buried soils, several less prominent buried soils were identified (in-field) in the modern soil profiles at CC #1, CC #2 and SFCC #2) (Tables 2, 3 and 5). Carnegie Canyon Site #1 had two buried soils starting at 42 cm (CC #1, A1b) and 78 cm bgs (CC #1 Ab2), with mollic colors of 22 cm (20-42 cm bgs) and 14 cm (42-56 cm bgs) thick (Table 2). Carnegie Canyon Site #2 had two buried soils starting at 28 cm (CC #2, Ab) and 64 cm bgs (CC #2, Ab2) with mollic colors of 25 cm (28-53 cm bgs) and 12 cm (64-76 cm bgs) thick (Table 3), respectfully. SFCC #2 had a field identified buried soil in the modern soil profile starting at 48 cm (SFCC #2, A1b) which contained mollic colors 35 cm (48-83 cm bgs) thick.

Table 2. Soil profile description for Carnegie Canyon Site # 1(east), 240 m north of road and dam (100 m north of Hall's reference section) and adjacent to "bison area" (Lintz and Hall, 1983) in SE¼ of SE¼ of Sec. 10, T7N, R13W, Caddo Co., Oklahoma.

Horizon	Depth (cm)	Color Moist (Dry)	Structure †	Texture‡	Consistence§	Boundary¶	Effervescence‖	Special Features
A1	0-8	5YR4/3(3/4)	1mGR	FS	vfr	gs	-	many fine and medium roots
A2	8-15	5YR4/3(3/4)	1mSBK	FS	vfr	gs	-	many fine and medium roots
AC1	20	5YR4/4(3/3)	1mSBK	FS	vfr	cs	-	many fine and medium roots
AC2	30	5YR4/4(3/3)	1mSBK	FS	vfr	cs	-	many fine and medium roots
A1b	42	5YR3/2(2.5/2)	2mSBK	LFS	vfr	gs	-	many fine and medium roots
A2b	48	5YR3/3(3/2)	1mSBK	FS	vfr	gs	-	many fine and medium roots
Cb	56	5YR4/3(3/3)	1mSBK	FS	vfr	cs	-	many fine and medium roots
Ab2	78	5YR3/2(3/3)	1mSBK	FS	vfr	gs	-	common fine and medium roots
ABkb2	94	5YR4/4(4/3)	1mSBK	FS	vfr	cw	ve	common fine and medium roots; few fine $CaCO_3$ soft masses
Bkb2	114	5YR4/6(5/3)	1cSBK	FS	vfr	gs	ve	few fine and medium roots; few fine $CaCO_3$ soft masse
C1b2	135	5YR5/6(5/4)	SG	FS	vfr	cs	ve	few fine roots; violent effervescence in spots; discontinuous coarse pockets of Bk-like material
C2b2	154	5YR4/6(5/6)	SG	FS	vfr	as	ve	few fine roots; violent effervescence in spots; common fine and medium lamellae; fine horizontal stratified sand-silt layers; zones of bioturbation (tubes filled with Ak1b3).
Ak1b3	163	5YR3/2(3/3)	1mSBK	FS	fr	gs	ve	few fine roots; common medium tubes of C2b2, many areas of bioturbation in upper 3 cm; few fine $CaCO_3$ soft bodies in pores.
Ak2b3	181	5YR3/2(3/3)	1mSBK	FS	fr	gs	ve	few fine roots; few fine $CaCO_3$ soft bodies in pores.
Ak3b3	201	5YR3/2(3/3)	1mSBK	FS	fr	gs	e	few fine roots; violent effervescence in spots; few fine $CaCO_3$ soft bodies in pores.

Table 2 Cont. - Soil profile description for Carnegie Canyon Site #1 (east), 240 m north of road and dam (100 m north of Hall's reference section) and adjacent to "bison area" (Lintz and Hall, 1983) in SE¼ of SE¼ of Sec. 10, T7N, R13W, Caddo Co., Oklahoma.

Horizon	Depth (cm)	Color Moist (Dry)	Structure[†]	Texture[‡]	Consistence[§]	Boundary[¶]	Effervescence[‖]	Special Features
Ak4b3	227	5YR3/3(3/4)	1mSBK	FS	fr	gs	e	few fine roots; few fine $CaCO_3$ soft bodies in pores.
ABk1b3	240	5YR4/3(4/4)	1mSBK	FS	fi	gs	e	few fine roots; effervescence in spots; common fine $CaCO_3$ soft bodies in pores.
ABk2b3	254	5YR4/3(4/4)	1mSBK	FS	fr	gs	-	few fine roots; common fine $CaCO_3$ soft bodies in pores.
Bkb3	274	5YR5/8(4/6)	1mSBK	LFS	fr	gs	-	few fine roots; common fine distinct redoximorphic depletions (5YR5/6); few fine $CaCO_3$ soft bodies in pores.
CBb3	312	5YR5/8(4/6)	1mSBK	FS	fr	gs	-	few fine roots; common fine distinct redoximorphic depletions (5YR5/6).
Cb3	334	5YR5/8(5/6)	MA	FS	fr	gs	-	few fine roots; common fine distinct redoximorphic depletions (5YR5/6); few coarse gravels and cobbles adjacent to hearth (one chert scaper from hearth area).

Structure[†]				Texture[‡]		Consistency[§]		Boundary[¶]		Effervescence[‖]	
1	weak	SBK	subangular blocky	FS	fine sand	vfr	very friable	a	abrupt	e	effervescent
2	moderate	PR	prismatic	S	sand	fr	friable	c	clear	ve	violently effervescent
f	fine	SG	single grain	L	loam(y)	fi	firm	g	gradual		
m	medium	MA	massive					s	smooth		
c	coarse							w	wavy		

Table 3 - Soil profile description for Carnegie Canyon Site #2 (west), 220 m north of road and dam (80 m north of Hall reference section) and 40 m south of site S 28-29 (Figure 14, Lintz and Hall, 1983) in SE¼ of SE¼ of Sec. 10, T7N, R13W, Caddo Co., Oklahoma.

Horizon	Depth (cm)	Color Moist (Dry)	Struc-ture	Tex-ture	Consis-tence	Boun-dary	Effer-vescence	Special Features
AC	0-21	5YR4/4(5/4)	2fSBK	FS	vfr	cs	-	many fine and medium roots.
Ab	28	5YR3/2(4/4)	2mSBK	FS	vfr	cs	-	many fine and medium roots.
Cb	53	5YR4/4(4/4)	2mSBK	FS	vfr	cs	-	many fine and medium roots.
Ab2	64	5YR3/2(3/3)	2mSBK	FS	vfr	gs	-	many fine and medium roots.
ACb2	76	5YR4/4(4/4)	1mSBK	FS	vfr	gs	-	common fine and medium roots.
C1b2	102	5YR5/6 (7.5YR5/6)	SG	VFS	vfr	gs	-	common fine and medium roots.
C2b2	128	5YR5/6 (7.5YR5/6)	SG	VFS	vfr	gs	-	common fine and medium roots.
C3b2	150	5YR5/6 (7.5YR5/6)	SG	VFS	vfr	gs	-	common fine and medium roots; common distinct redoximorphic accumulations (5YR3/3).
C4b2	162	5YR5/6 (7.5YR5/4)	SG	VFS	vfr	cs	-	few fine and medium roots; few fine lamellae (5YR4/6).
C5b2	184	5YR5/6 (7.5YR5/4)	SG	LVFS	fr/vfr	as	-	few fine and medium roots; coarsley stratified layers of sand over A horizon (5YR3/3).
C6b2	194	5YR5/6 (7.5YR5/4)	SG	VFS	vfr	as	-	few fine and medium roots; few faint redoximorphic accumulations (5YR5/8).
C7b2	212	7.5YR5/6(5/4)	SG	VFS	vfr	cw	-	few fine and medium roots; common distinct redoximorphic accumulations (7.5YR5/8).
C8b2	227	7.5YR5/4(5/4)	SG	FS	vfr	aw	-	few fine roots; stratified sand w/ A horizon material (7.5YR3/2); few distinct redoximorphic accumulations (7.5YR4/6).
C/Ab2	234	7.5YR6/2(4/2)	SG	FS	vfr	aw	-	few fine roots; 60% finely dispersed A horizon material (7.5YR3/1).

Table 3 Cont. - Soil profile description for Carnegie Canyon Site #2 (west), 220 m north of road and dam (80 m north of Hall reference section) and 40 m south of site S 28-29 (Figure 14, Lintz and Hall, 1983) in SE¼ of SE¼ of Sec. 10, T7N, R13W, Caddo Co., Oklahoma.

Horizon	Depth (cm)	Color Moist (Dry)	Struc-ture	Tex-ture	Consis-tence	Boun-dary	Effer-vescence	Special Features
A1b3	256	7.5YR2.5/1(3/1)	2mSBK	FSL	fr	gs	-	few fine roots; upper 3 cm bioturbated tubes & zones.
A2b3	274	7.5YR3/1(3/2)	2mSBK	VFSL	fr	cs	-	few fine roots; few fine siltans (or redoximorphic depletions) in roots & pores (7.5YR6/2).
A3b3	302	7.5YR3/1(4/2)	1cSBK	LVFS	fr	gs	-	many fine roots; common fine siltans (or redoximorphic depletions) in roots & pores (7.5YR6/2).
A4b3	338	7.5YR3/1(4/2)	1cSBK	LVFS	fr	gs	-	few fine roots; common fine siltans (or redoximorphic depletions) in roots & pores (7.5YR6/2)
ABb3	352	7.5YR3/1(4/3)	1cSBK/ 1cPR	LVFS	fi	gs	-	many fine roots; common fine siltans in roots & pores (7.5YR6/2); common distinct redoximorphic accumulations (5YR5/8).
Bk1b3	392	5YR5/6(5/4)	1cPR	LVFS	vfi	gs	e (spots)	few fine roots; common distinct redoximorphic accumulations (5YR5/8); few fine $CaCO_3$ soft bodies.
Bk2b3	405	5YR5/6(5/6)	SG	FS	fi	gs	e (spots)	few fine roots; common fine redoximorphic depletions (5YR6/4); few fine $CaCO_3$ soft bodies.
Cb3	416	5YR6/8(5/6)	SG	FS	fr	cs	-	few fine roots; few medium distinct redoximorphic depletions (5YR6/4).

Structure†			Texture‡		Consistency§		Boundary¶		Effervescence‖	
1	weak	SBK	subangular blocky	FS	fine sand	vfr	very friable	a	abrupt	e	effervescent
2	moderate	PR	prismatic	VFS	very fine sand	fr	friable	c	clear	ve	violently effervescent
f	fine	SG	single grain	L	loam(y)	fi	firm	g	gradual		
m	medium	MA	massive			vfi	very firm	s	smooth		
c	coarse							w	wavy		

Table 4 - Soil profile descriptions for South Fork Cotton Creek Site #1, 85 m south of archeological site 34WN107 (Lizard) (Reid and Artz, 1984) in SW1/4 of Sec 35 T29N R13E, Washington, Co., Oklahoma.

Horizon	Depth (cm)	Color Moist (Dry)	Struc-ture	Tex-ture	Consis-tence	Boun-dary	Effer-vescence	Special Features
A1	0-5	10YR3/1 (10YR3/2)	1mSBK	SiL	fr	cs	-	many fine and medium roots
A2	18	10YR3/1 (10YR3/2)	1mSBK	SiL	fr	cs	-	many fine and medium roots
A3	28	7.5YR3/1 (10YR3/2)	1mSBK	SiL	fr	cs	-	many fine and medium roots
A4	45	7.5YR3/1 (10YR4/2)	1mSBK	SiL	fr	cs	-	many fine and medium roots
Bt1	70	7.5YR3/2 (10YR4/2)	2mSBK	SiL	fr	cs	-	many fine and medium roots
Bt2	86	10YR3/2 (10YR4/3)	2mSBK	SiCL	fr	cs	-	many fine and medium roots
BC1	98	10YR4/2 (10YR4/3)	1mSBK	SiL	fr	cs	-	many fine and medium roots
BC2	115	10YR5/4 (10YR4/3)	1cPR	SiL	fr	cs	-	common fine and medium roots
BC3	145	10YR4/3 (10YR4/4)	1cPR	L	fr	cs	-	few fine roots; few fine faint redox. accumulations (7.5YR4/4)
BC4	190	10YR4/3 (10YR4/2)	1cPR	SiL	fr	as	-	few fine roots; few fine faint redox. accumulations (7.5YR4/4); few discont. siltans on ped faces
A1b	215	10YR3/2 (10YR3/3)	2mSBK/ 1mPR	SiCL	fi	gs	-	few fine roots; few fine faint redox. accumulations (7.5YR4/4); common discont. siltans on ped faces
A2b	246	10YR3/2 (10YR5/2)	1cPR/ 2mSBK	SiCL	fi	gs	-	few fine roots; common fine distint redox. accumulations (7.5YR4/4); few black (Fe-Mn oxide) softbodies and nodules

Table 4 Cont. - Soil profile descriptions for South Fork Cotton Creek Site #1, 85 m south of archeological site 34WN107 (Lizard) (Reid and Artz, 1984) in SW1/4 of Sec 35 T29N R13E, Washington, Co., Oklahoma.

Horizon	Depth (cm)	Color Moist (Dry)	Struc-ture	Tex-ture	Consis-tence	Boun-dary	Effer-vescence	Special Features
Bt1b.	273	10YR3/1 (10YR5/2)	1cPR/ 2mSBK	SiCL	fi	cs	-	few fine roots; common fine distinct redox. accumulation (7.5YR4/4); few black (Fe-Mn oxide) softbodies and nodules
Bt2b	289	10YR4/1 (10YR5/2)	1mSBK	SiCL	fi	cs	-	few fine roots; common fine distinct redox. accumulations (7.5YR4/4); few black (Fe-Mn oxide) softbodies and nodules
Bt3b	303	10YR4/1 (10YR5/3)	1cPR/ 1cSBK	SiC	fi	cs	-	few fine roots; common fine distinct redox accumulations (5YR4/4); few black (Fe-Mn oxide) soft bodies and nodules
BC1b	331	10YR5/1 (2.5YR6/4)	1cPR/ 1cSBK	CL	fi	cs	-	few fine roots; common fine prominent redox . accumulations (10YR5/6); common black (Fe-Mn oxide) softbodies and nodules
BC2b	357	10YR5/2 (2.5YR6/4)	1cPR/ 1cPR	SiCL	fr	cs	-	few fine roots; common fine prominent redox. accumulations (10YR5/8); common black (Fe-Mn oxide) soft bodies and nodules; few rounded sandstone gravels.
BC3b	385	10YR5/2 (2.5Y7/6)	1cPR	L	fr	-	-	few fine roots; common fine prominent redox. accumulations (10YR5/8); common black (Fe-Mn oxide) softbodies and nodules; few rounded sandstone gravels

Structure[†]		Texture[‡]	Consistency[§]	Boundary[¶]	Effervescence[‖]
1 weak	SBK subangular blocky	C clay	fr friable	a abrupt	
2 moderate	PR prismatic	Si silt(y)	fi firm	c clear	
m medium		L loam(y)		g gradual	
c coarse				s smooth	

Table 5 - Soil profile descriptions for South Fork Cotton Creek Site #2, 250 m southwest of archeological site 34WN107 (Lizard) (Reid and Artz, 1984) in SW1/4 of Sec 35 T29N R13E, Washington, Co., Oklahoma.

Horizon	Depth (cm)	Color Moist (Dry)	Struc-ture	Tex-ture	Consis-tence	Boun-dary	Effer-vescence	Special Features
A1	0-12	10YR3/1 (10YR4/2)	2mGR	SiL	fr	gs	-	Many fine and medium roots.
A2	24	10YR3/2 (10YR4/2)	2mGR	SiL	fr	gs	-	Many fine and medium roots.
AC	32	10YR4/3 (10YR5/2)	2mSBK	SiL	fr	cs	-	Many fine and medium roots.
A1b	48	10YR3/1 (10YR4/2)	2mSBK	SiL	fr	gs	-	Many fine and medium roots.
A2b	66	10YR3/1 (10YR4/2)	2mSBK	SiL	fr	cs	-	Many fine and medium roots.
Bw1b	83	10YR3/2 (10YR4/2)	2mSBK	SiL	fr	gs	-	Common fine and medium roots.
Bw2b	99	10YR4/3 (10YR5/3)	1mPR/ 1mSBK	SiL	fr	gs	-	Common fine and medium roots.
BCb	134	10YR4/3 (10YR5/3)	1mPR/ 1mSBK	SiL	fr	cs	-	Few fine roots.
A1b2	166	10YR3/1 (10YR4/2)	2mSBK	SiCL	fr	gs	-	Few fine roots.
A2b2	185	10YR3/1 (10YR4/2)	2mSBK	SiCL	fi	gs	-	Few fine roots; Few fine faint redox accumulations (10YR4/4).
Bt1b2	212	10YR3/1 (10YR5/2)	2mPR/ 2mSBK	SiC	fi	gs	-	Few fine roots; Common fine faint redox accumulations (10YR4/4); Many continuous intersecting slickensides; Common discontinuous clay films on ped faces.
Bt2b2	231	10YR3/1 (10YR5/2)	2mPR/ 2mSBK	SiC	fi	gs	-	Few fine roots; Many faint redox accumulations (10YR4/4); Many continuous intersecting slickensides; Common discontinuous clay films on ped faces.

Table 5 Cont. - Soil profile descriptions for South Fork Cotton Creek Site #2, 250 m southwest of archeological site 34WN107 (Lizard) (Reid and Artz, 1984) in SW1/4 of Sec 35 T29N R13E, Washington, Co., Oklahoma.

Horizon	Depth (cm)	Color Moist (Dry)	Struc-ture	Tex-ture	Consis-tence	Boun-dary	Effer-vescence	Special Features
Bt3b2	250	10YR4/1 (10YR5/2)	2cPR/ 2mSBK	SiC	fi	gs	-	Few fine roots; Many medium distinct redox accumulation (7.5YR4/4).
BC1b2	264	10YR4/1 (10YR5/3)	2cPR/ 2mSBK	SiCL	fi	gs	-	Few fine roots; Many medium distinct redox accumulations (7.5YR5/6).
BC2b2	285	10YR4/1 (10YR6/4)	2cPR/ 2mSBK	CL	fr	cs	-	Few fine roots; Many fine and medium distinct redox accumulations (7.5YR4/4 and 5YR4/4).
BC3b2	314	10YR5/6 (10YR6/4)	1cPR/ 1mSBK	L	fr	gs	-	Few fine roots; Many fine distinct redox depletions (10YR4/1).
BC4b2	340	10YR5/8 (10YR6/4)	1cPR/ 1mSBK	L	fr	gs	-	Very few fine roots; Common fine distict redox depletions (10YR4/1 and 5/2).

Structure†				Texture‡		Consistency§		Boundary¶		Effervescence‖
1	weak	SBK	subangular blocky	C	clay	fr	friable	c	clear	
2	moderate	PR	prismatic	Si	silt(y)	fi	firm	g	gradual	
m	medium	MA	massive	L	loam(y)			s	smooth	
c	coarse									

Carnegie Canyon #1

At Carnegie Canyon Site #1, relative maximum values of OCC occurred at the ground surface (A1 horizon; 0-8 cm) and upper portions of buried A horizons (A1b horizon, 30-42 cm bgs; Ab2 horizon, 56-78 cm bgs; and Ak1b3 horizons, 154-163 cm bgs) at depths 4 cm, 36 cm, 61 cm, and 158 cm bgs respectfully (Fig. 10). Following the relative maximum values at 4 cm, 36 cm, and 61 cm bgs, OCC decreased with increasing depth; indicative of a melanic processes. However, following the relative maximum value at 158 cm bgs (Ak1b3), OCC remained relatively constant with increasing depth, to 207 cm; suggesting cumulic processes. Below 207 cm, OCC again decreased with increasing depth suggesting melanic processes.

Subtle trends in clay-free particle size distribution with decreasing depth occurred throughout the CC #1 profile (Fig. 10). Fining upward sequences occurred from 4-17 cm, 36-45 cm, 61-119 cm, 129-139 cm and 207-293 cm bgs; and CUS's occur from 17-36 cm, 52-61 cm 119-129 cm and 139-158 cm bgs. Particle size is relatively uniform from 158-207 cm bgs. Three flood events were identified in the modern soil profile above the Caddo Soil 1 at 4-36 cm (FE 1), 36-61 cm (FE 2) and 61-158 cm bgs (FE 3) (Fig. 10). At the top of each flood event (FE 1, 2 and 3), field identified A and buried A horizons, as well as, relative maximum values of OCC occurred. Upper portions of all three flood events (FE 1, 2 and 3) corresponded with OCC relative maximum values and subsequent decreases in OCC with depth, indicating that melanic processes were responsible for the formation of all three soils.

Descending from 158 cm bgs, particle size remained relatively constant until 207 cm bgs (MU 1) (Fig. 10). This constant trend in clay-free particle size from 158-207 cm bgs correlated with the relatively constant levels of OCC from 158-207 cm bgs. Two possibilities exist to explain the formation of this portion of Caddo Soil 1: 1) the uniformly small particle size distribution suggests this portion of Caddo Soil 1 was likely formed by frequent small (<2cm) overbank deposits over many years (100+ years). In, addition a corresponding irregular OCC distribution indicate that the upper portion (158-207 cm bgs) of Caddo Soil 1 was formed by cumulization, or 2) an upper portion of Caddo Soil 1, formed by melanic processes, was truncated prior to aggradation of FE 3 (Fig. 10). However, corresponding soil surface dates of Caddo Soil 1 and 2 indicate that truncation is a less likely scenario, as the upper boundary of Caddo Soil 1 would have dated much older than Caddo Soil 2 if the younger upper portions were removed, prior to aggradation.

Flood Event 4 (207-334 cm bgs) is identifiable within the Caddo Soil 1 profile, the top of which correlated with the point at which OCC decreased with increasing depth within the Caddo Soil 1 Akb3 horizons (207 cm bgs) (Fig. 10). Using surface and buried soils sequences above Caddo Soil 1 as additional evidence, the decrease in OCC content and correlating FUS indicate that this portion of Caddo Soil 1 (~ 207 cm bgs and below) was formed by melanic processes during a period of relative stability; following rapid aggradation.

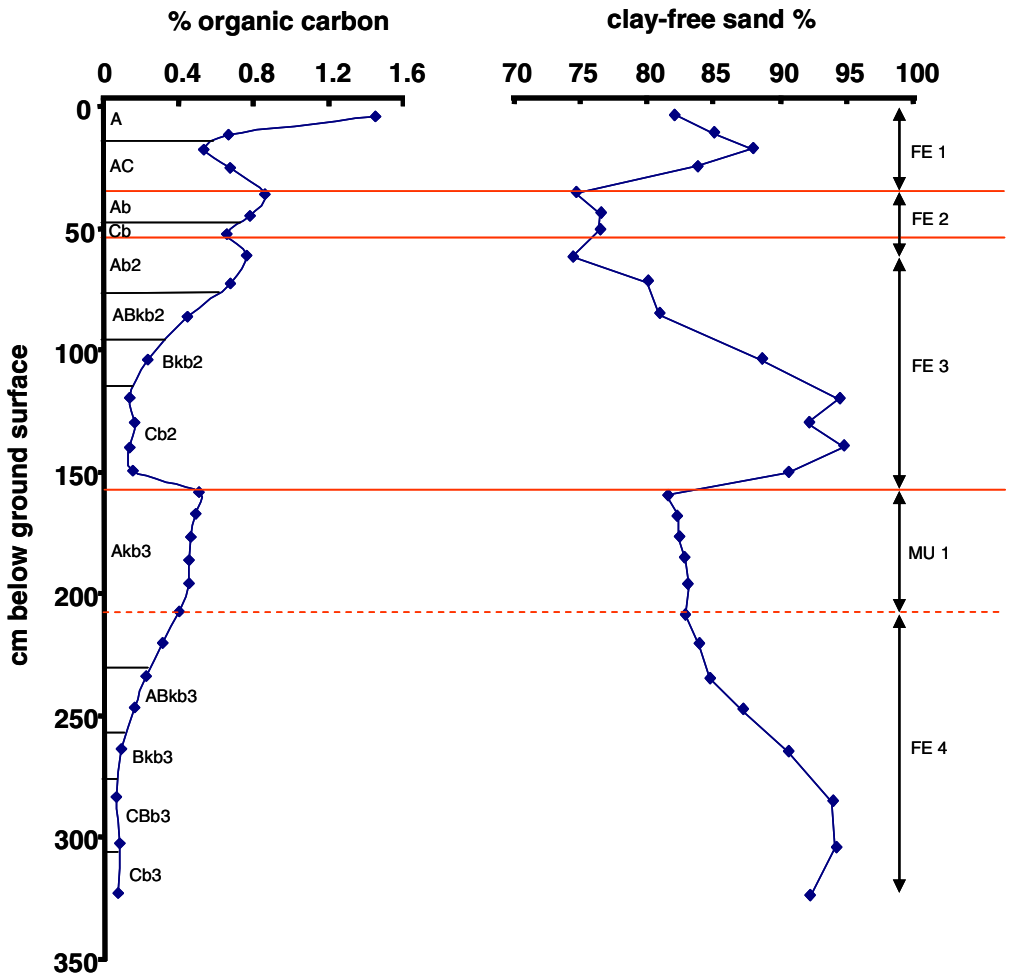

Figure 10. Sedimentary events, organic carbon and clay-free sand distribution at Carnegie Canyon Site #1. Solid horizontal lines highlight field identified A horizons, while the segmented horizontal line indicates a proposed paleosurface. Sedimentary events are indicated by FE (flood events) and MU (multiple units). Organic carbon values are plotted at the mean depth of the sampling interval.

Carnegie Canyon # 2

At CC #2, relative maximum values of OCC occurred at the ground surface (AC horizon; 0-21 cm bgs) and upper portions of buried A horizons (Ab horizon, 21-28 cm bgs; Ab2 horizon, 53-64 cm bgs; and A1b3 horizon, 234-256 cm bgs) at depths 5 cm, 24 cm, 58 cm, and 239 cm bgs respectfully (Fig. 11). Following relative maximum values at 5 cm, 24 cm, 58 cm, and 239 bgs, OCC decreased rapidly with increasing depth indicating melanization. From 295-329 cm bgs OCC remained relatively constant (cumulization); below 329 cm bgs OCC rapidly decreased with increasing depth indicating melanization.

Subtle trends in clay-free particle size occurred throughout the profile. Fining upward sequences occurred at 5-16 cm, 24-34 cm, 58-95 cm, 108-133 cm, 173-219 cm, 239-269 cm and 329-410 cm bgs, and CUS occurred at 16-24 cm, 34-58 cm, 95-108 cm, 133-173 cm, 219-239 cm and 269-295 cm bgs (Fig. 11). Three flood events were evident in the modern soil profile above the Caddo Soil 2 (0-24 cm, FE 1; 24-58 cm, FE 2; and 58-239 cm bgs, FE 3). The top of each flood event correlated with field identified A and buried A horizons, as well as, relative maximum values of OCC and subsequent decreasing OCC. As in CC #1 these soils above Caddo Soil 2 are interpreted as being formed by melanic processes

Two flood events were identifiable within Caddo Soil 2 at 239-295 cm (FE 4) and 329-410 cm bgs (FE 5) (Fig. 11). The top of FE 4 (239-295 cm bgs) correlated with the top of the field identified A1b3 horizon (Table 3), a relative maximum value of OCC (239 cm bgs) and subsequent decreasing downward curve in OCC; indicative of melanic

processes. The interval between 295 and 329 cm bgs contained both a uniform clay-free particle size distribution and a uniform distribution of OCC, indicating cumulic processes (MU 1). The top of FE 5 (329-410 cm bgs) correlated with the point at which OCC began to decrease with depth (329 cm bgs) suggesting melanic processes.

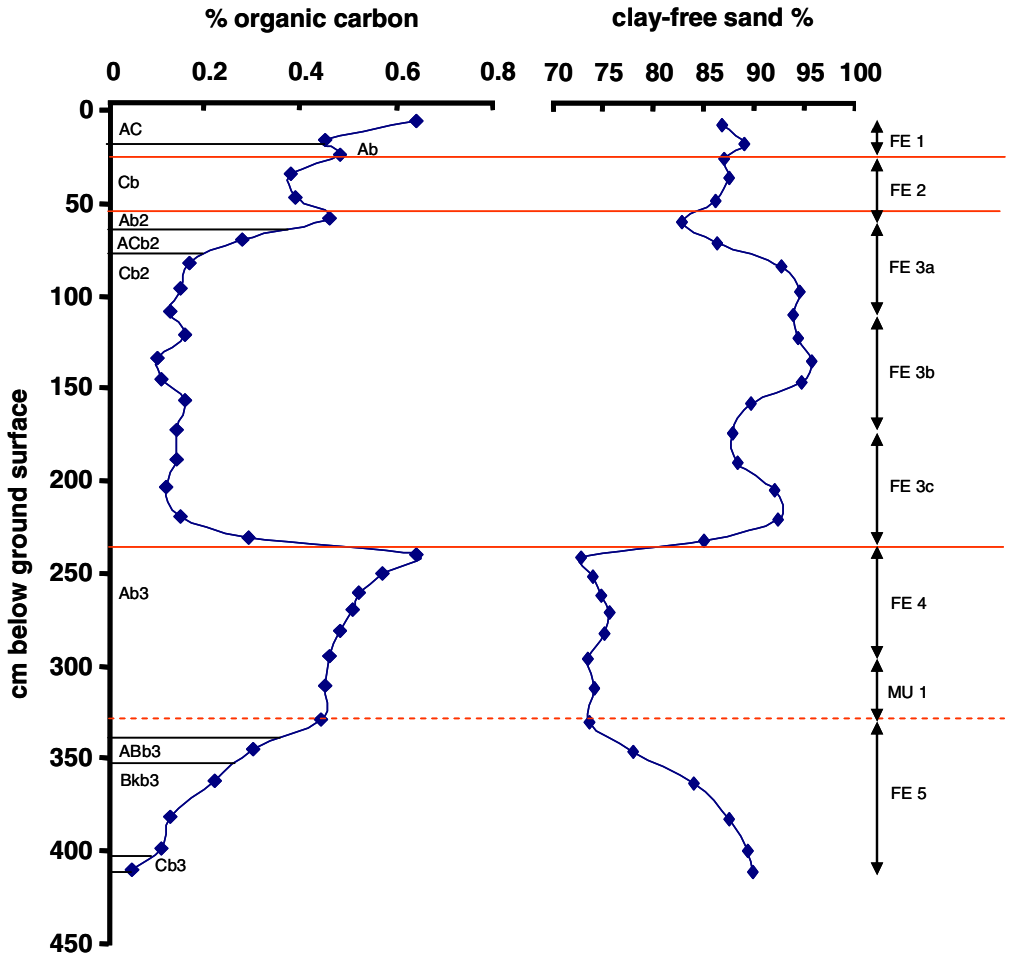

Figure 11. Sedimentary events, organic carbon and clay-free sand distribution at Carnegie Canyon Site #2. Solid horizontal lines highlight field identified A horizons, while the segmented horizontal line indicates a proposed paleosurface. Sedimentary events are indicated by FE (flood events) and MU (multiple units). Organic carbon values are plotted at the mean depth of the sampling interval.

Carnegie Canyon Site Synopsis

CC #1 and CC #2 had similar soil profile characteristics, which would be expected by their proximal locations. Clay-free particle size distribution matched the overall sandy condition of the Carnegie Canyon drainage system (ephemeral upper tributary reach). Both profiles (CC #1 and CC #2) contained melanic epipedons and two melanic buried soils in the modern soil profile, and showed evidence of soil stability and melanization. Both the Caddo Soil 1 and Caddo Soil 2 had corresponding radiocarbon ages of 950 ± 70 RCYBP and 1060 ± 50 RCYBP, respectfully. However, soil formational processes appeared to be different in the upper portions of the Caddo Soils. The upper portion of Caddo Soil 1 appeared to be formed by cumulic processes (Fig. 12), while the upper portion of Caddo Soil 2 appeared to have formed by melanization (Fig. 13).

Carbonate data from CC #1 and #2 was highly variable and yielded no systematic changes to aid interpretation of soil formation. According to Hall and Lintz (1984) carbonates within Carnegie Canyon have several possible origins: 1) calcareous eolian dust, 2) carbonates leached from upland Pleistocene soils, 3) dissolution of calcite cement from the Rush Springs Sandstone or 4) precipitated from carbonate rich ground water as it fluctuates seasonally in response to precipitation. However, slightly higher $CaCO_3$ levels within the Caddo Soils compared with the modern surface and associated younger buried soils supported the notion that the climate ~ 2000 B.P. was drier than modern times.

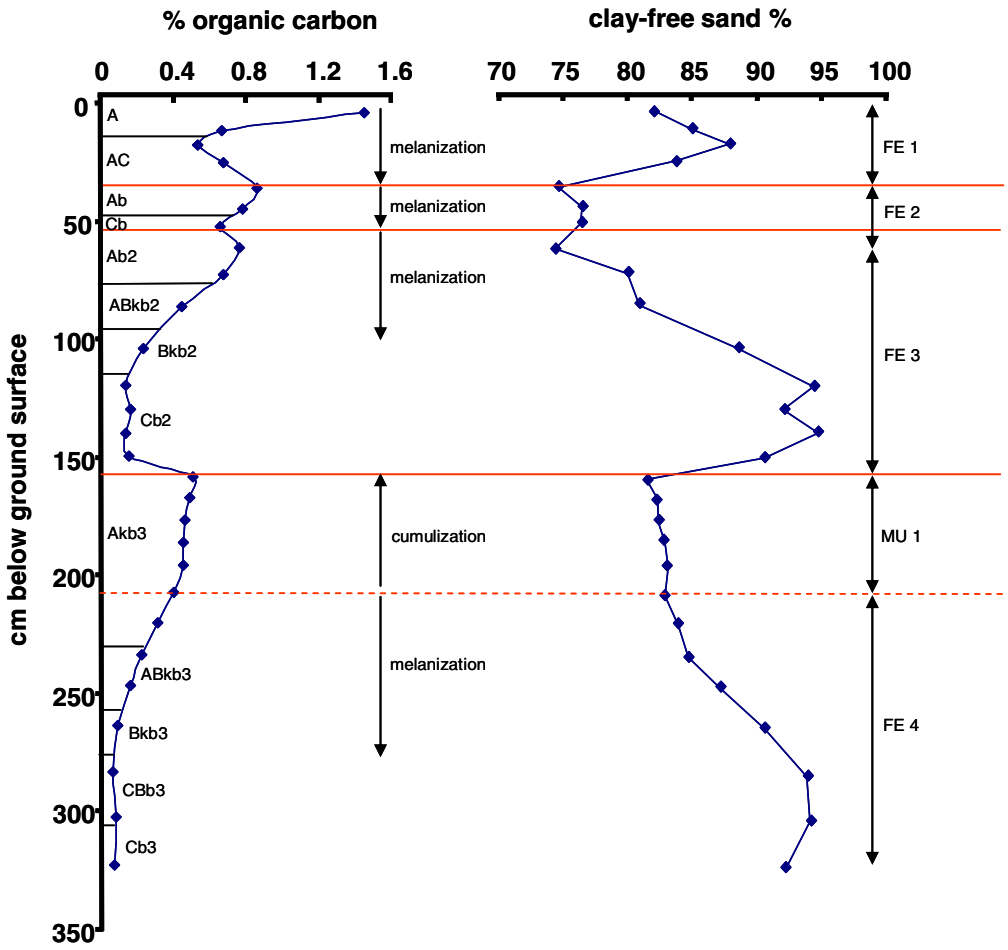

Figure 12. Soil development, sedimentary events, organic carbon and clay-free sand distribution Carnegie Canyon Site #1. Designation of melanic and cumulic portions of profile. Solid horizontal lines highlight field identified A horizons, while the segmented horizontal line indicates a proposed paleosurface. Sedimentary events are indicated by FE (flood events) and MU (multiple units). Organic carbon values are plotted at the mean depth of the sampling interval.

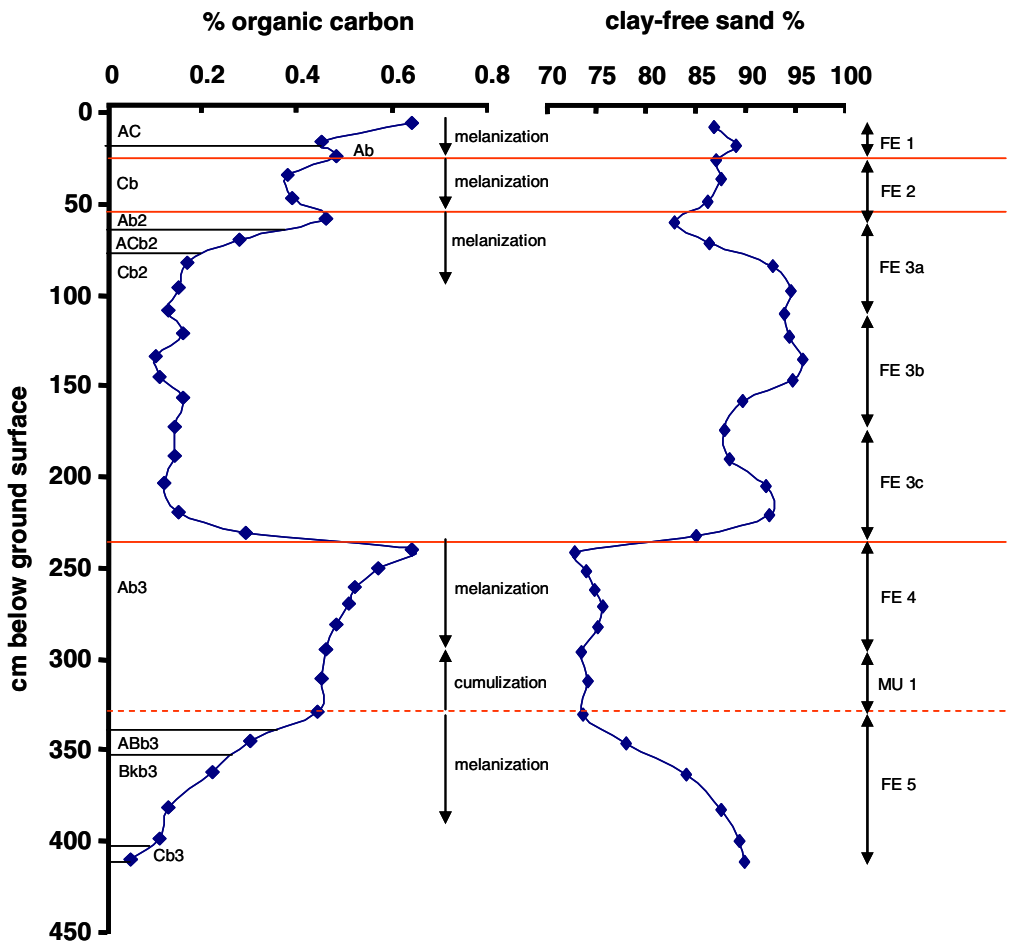

Figure 13. Soil development, sedimentary events, organic carbon and clay-free sand distribution at Carnegie Canyon Site #2. Designation of melanic and cumulic portions of profile. Solid horizontal lines highlight field identified A horizons, while the segmented horizontal line indicates a proposed paleosurface. Sedimentary events are indicated by FE (flood events) and MU (multiple units). Organic carbon values are plotted at the mean depth of the sampling interval.

South Fork Cotton Creek #1

At SFCC #1, relative maximum values of OCC occurred at the ground surface (A1 horizon; 0-5 cm bgs) and across a plateau within Napoc Soil 1 A2b horizon (215-246 cm bgs) (Fig. 14). Below the relative maximum value at 2 cm bgs OCC rapidly decreased with increasing depth until 92 cm bgs, at which point OCC began to slowly

increase with increasing depth until 215 cm bgs. Following the plateau (215-246 cm bgs) OCC rapidly decreased with increasing depth.

The clay-free particle size distribution revealed FUS's from 11-36 cm, 64-106 cm and 240-364 cm bgs; and CUS's from 0-11 cm, 51-64 cm, 106-196 cm and 364-378 cm bgs (Fig. 14). Clay-free particle size remained relatively constant from 196-240 cm bgs (MU 1), which correlated with the irregular OCC distribution from ~190-246 cm bgs. The OCC within the surface of Napoc Soil 1 increases with depth, which is a clear indication that the soil was not formed by melanic processes. This portion of Napoc Soil 2 seems to have formed by cumulic processes.

Three flood events were evident from 0-64 cm (FE 1), 64-196 cm (FE 2) and 246-358 cm bgs (FE 3) (Fig. 14). The upper flood event (FE 1) correlated with the modern surface and subsequent decrease in OCC with depth, indicative of a melanic soil. Flood event 2 (64-196 cm bgs) did not correlate with a relative maximum value of OCC or field described horizonation. However, OCC did decrease rapidly with depth as in a melanic profile. Here it is possible that a buried soil and a relative maximum value of OCC once existed, however the relative maximum value in OCC may have been masked by post-burial assimilation of organic carbon form the modern surface (soil welding). Flood event 3 (246-358 cm bgs) in the lower portion of Napoc Soil 1 correlated with the point at which OCC begins to decrease with depth below the plateau (246 cm bgs), and is interpreted as a melanic portion of Napoc Soil 1.

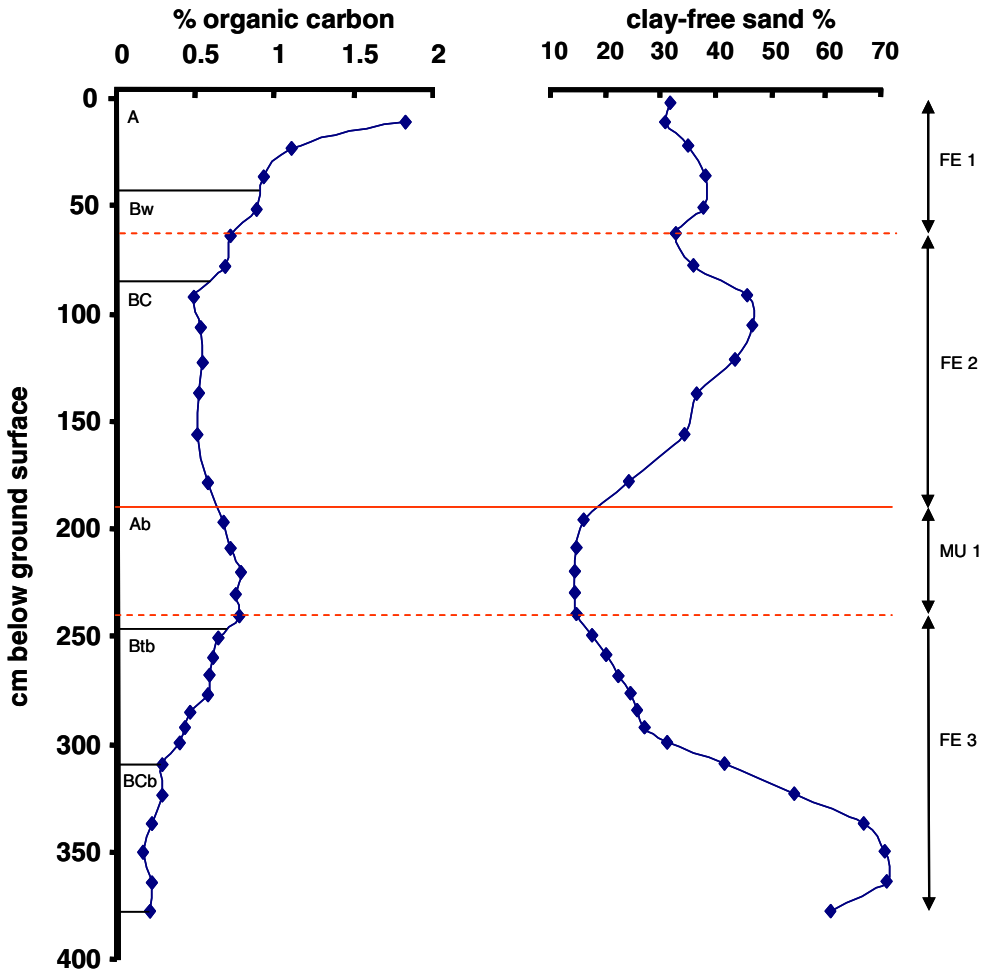

Figure 14. Sedimentary events, organic carbon and clay-free sand distribution at South Fork Cotton Creek Site #1. The solid horizontal line highlights a field identified A horizon, while segmented horizontal lines indicate proposed paleosurfaces. Sedimentary events are indicated by FE (flood events) and MU (multiple units). Organic carbon values are plotted at the mean depth of the sampling interval.

South Fork Cotton Creek # 2

At SFCC #2, relative maximum values of OCC occurred at the ground surface (A1 horizon; 0-12 cm bgs) and slightly below the surface of the A1b horizon (32-48 cm bgs) at 6 cm and 40 cm respectfully (Fig. 15). Below the relative maximum values at 6

cm and 40 cm bgs OCC rapidly decreased with increasing depth indicative of melanic processes. Further down profile (>108 cm bgs), OCC began to increase within the bottom of the BCb horizon (134-166 cm bgs). Mixing of the Napoc Soil 2 surface with sediments at the bottom of FE 2 (Fig. 15), explains the unusual OCC increase with depth, within the bottom of a BC horizon. Directly below within Napoc Soil 2, OCC continued to increase to 150 cm bgs then formed a plateau within A1b2 (134-166 cm bgs) and A2b2 (166-185 cm bgs) horizons from 150-180 cm bgs (Fig. 15). This potion of Napoc Soil 2 was very good evidence of cumulic soil formation, as a melanic soil would not decrease at the top. Following the plateau (150-180 cm bgs) OCC rapidly decreased with increasing depth indicative of melanic processes.

Trends in clay-free particle size revealed FUS's from 0-18 cm, 40-91 cm and 180-307 cm bgs, CUS's occur at 18-40 cm, 91-150 cm and 307-333 cm bgs (Fig. 15). Two flood events were evident in the modern soil profile above Napoc Soil 2 (0-40 cm, FE 1; and 40-125 cm bgs, FE 2). The top of each flood event correlated with field identified A and buried A horizons, as well as, relative maximum values and subsequent decreases with depth of OCC. These soils are representative of melanic soils.

Clay free particle size distribution as well as OCC distribution was relatively constant from 150-180 cm bgs (MU 1) (Fig. 15), suggesting that most of Napoc Soil 2 soil was formed by cumulic processes. One flood event was identifiable within the Napoc Soil 2 profile from 180-333 cm bgs (FE 3). The top of FE 3 (180-333 cm bgs) correlated with the point at which OCC began to decrease with increasing depth (180 cm bgs) suggesting that a thin soil was formed by melanic processes in the lower portions of

the Napoc Soil 2 prior to slow aggradation that formed the upper portions of Napoc Soil 2.

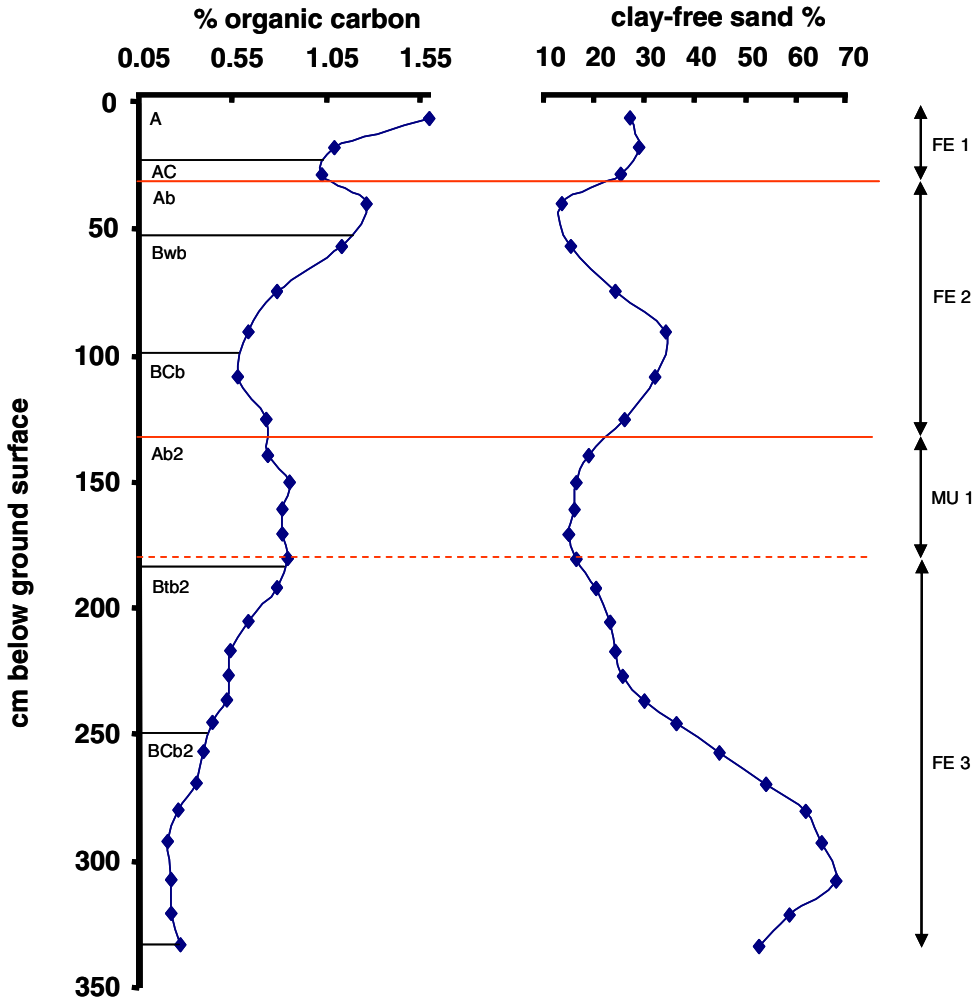

Figure 15. Sedimentary events, organic carbon and clay-free sand distribution at South Fork Cotton Creek Site #2. Solid horizontal lines highlight field identified A horizons, while the segmented horizontal line indicates a proposed paleosurface. Sedimentary events are indicated by FE (flood events) and MU (multiple units). Organic carbon values are plotted at the mean depth of the sampling interval.

South Fork Cotton Creek Site Synopsis

SFCC #1 and SFCC #2 have remarkably similar profiles. Clay-free particle size distribution matched the overall silty-clay condition of the South Fork Cotton Creek drainage system (perennial meandering upper/middle reach). The particle size distribution of SFCC #1 is almost mirrored by the particle size distribution of SFCC #2. In addition, OCC content of Napoc Soil 1 resembled the OCC of Napoc Soil 2, and both appeared to be formed by cumulization. Only two major differences existed between SFCC #1 and SFCC #2. One was the presence of a buried soil in the modern soil profile at SFCC #2 (Fig. 16); which may have been masked by pedogenesis in SFCC #1 (Fig. 17). The other was that the surface of Napoc Soil 1 is ~ 600 yrs older than the surface of Napoc Soil 2. Radiometric radiocarbon dates for Napoc Soil 1 and Napoc Soil 2 are 3980 ± 60 RCYBP and 3310 ± 50 RCYBP, respectfully.

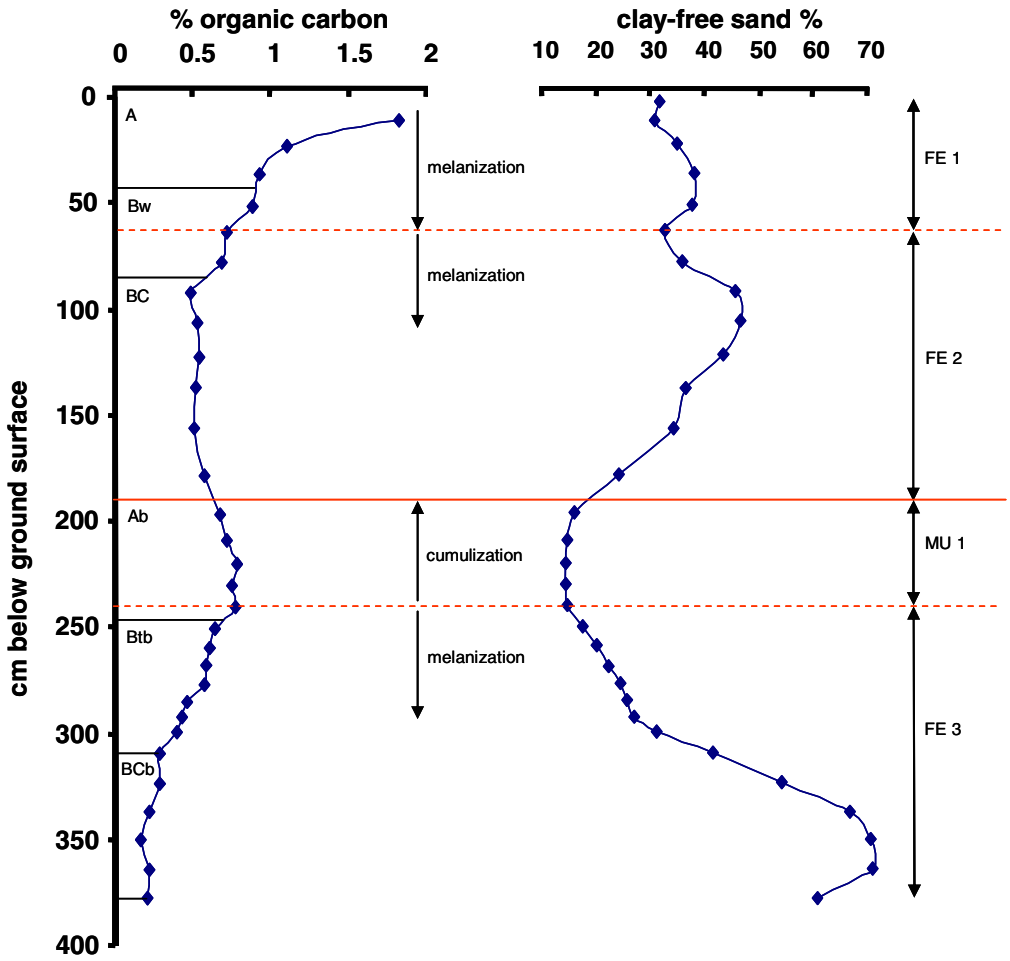

Figure 16. Soil development, sedimentary events, organic carbon and clay-free sand distribution at South Fork Cotton Creek Site #1. Designation of melanic and cumulic portions of profile. The solid horizontal line highlights a field identified A horizon, while segmented horizontal lines indicate proposed paleosurfaces. Sedimentary events are indicated by FE (flood events) and MU (multiple units). Organic carbon values are plotted at the mean depth of the sampling interval.

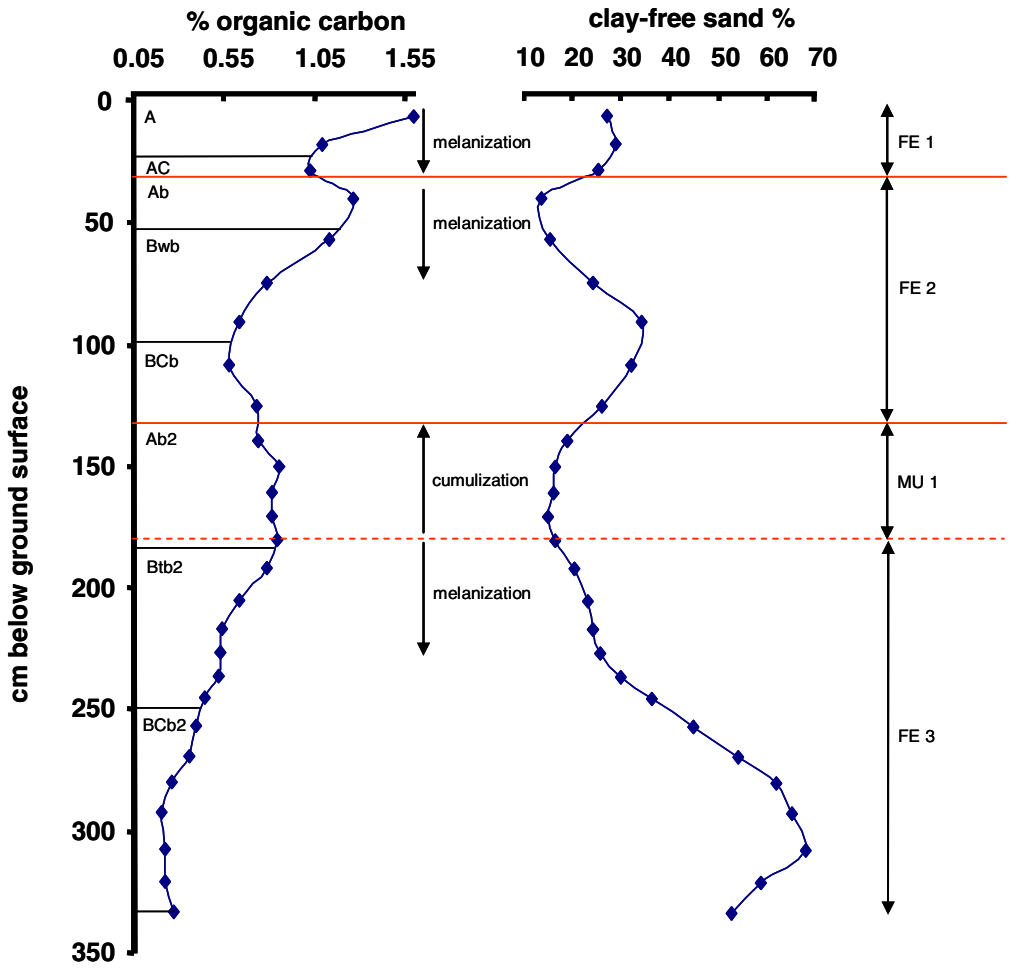

Figure 17. Soil development, sedimentary events, organic carbon and clay-free sand distribution at South Fork Cotton Creek Site #2. Designation of melanic and cumulic portions of profile. Solid horizontal lines highlight field identified A horizons, while the segmented horizontal line indicates a proposed paleosurface. Sedimentary events are indicated by FE (flood events) and MU (multiple units). Organic carbon values are plotted at the mean depth of the sampling interval.

CHAPTER V

CONCLUSIONS

Evaluation of several younger buried soils above Caddo Soil 1 and 2 and Napoc Soil 1 and 2 revealed preservation of sedimentary trends and well developed melanic OCC distributions within thick A horizons (>18 cm). These soils illustrated the importance of recognizing melanization and pachic soil development in alluvial settings.

The Caddo Soil at the Carnegie Canyon sites and the Napoc Soil at South Fork Cotton Creek sites formed by processes other than cumulization alone. The upper portions (239-295 cm bgs) of the Caddo Soil A horizon at CC # 2 formed a thick pachic horizon (melanization), eventually welding to the soil below. However, the lower portions of Caddo Soil 1 and Napoc Soils 1 and 2 were formed by melanic processes. While, the upper portions of the Caddo Soil 1 and Napoc Soils 1 and 2 were formed by cumulization or welding of fluvents (series of small stacked A horizons and changes in particle size).

The term 'cumulic' should not be used to describe soils with thick A horizons based on appearance alone, as it may lead to a false interpretation of the depositional setting. The use of this term implies that the floodplain continually and slowly built upward, without interruption by a major hiatus or major flood events. We have shown that these soils can be a result of several formational processes, leading to complex soils. Instead, soil morphological studies should be conducted on all archaeological sites to

evaluate depositional setting and soil forming processes, prior to excavation of the site. Soils found at these sites should then described by terms reflecting sedimentary and soil forming processes, as well as, appearance. Using terms that reflect depositional setting, soil morphology, and appearance would help clarify understanding and standardize nomenclature.

CHAPTER VI

LITERATURE CITED

Antevs, E. 1948. The great basin, with emphasis on glacial and postglacial time. University of Utah Bulletin 38, 168-191.

Arbogast, A.F., and W.C. Johnson. 1994. Climate implications of the late Quaternary alluvial record of a small drainage basin in the Central Great Plains. Quaternary Research 41:298-305.

Arrouays, D. and P. Pelissier. 1994. Modeling carbon storage profiles in temperate forest humic loamy soils of France. Soil Science 157(3):185-192.

Baker, R.G., G.G. Fredlund, R.D. Mandel, and E.A. Bettis III. 2000. Holocene environments of the central Great Plains: multi-proxy evidence from alluvial sequences, southeastern Nebraska. Quaternary International 67:75-88.

Benito, G., Y. Sánchez-Moya, and A. Sopeña. 2003. Sedimentology of high-stage flood deposits of the Tagus River, Central Spain. Sedimentary Geology 157:107-132.

Bernoux, M., D. Arrouays, C.C. Cerri, and H. Bourennane. 1998. Modeling vertical distribution of carbon in oxisols of the western Brazilian Amazon (Rondonia). Soil Science 163(12) 941-951.

Bettis III, E.A., and R.D. Mandel. 2002. The effects of temporal and spatial patterns of Holocene erosion and alleviation on the archaeological record of the Central and Eastern Great Plains, U.S.A. Geoarchaeology 17(2):141-154.

Birkeland, P.W. 1999. Soils and Geomorphology. 3rd ed. Oxford University Press, Oxford, NY.

Blecker, S.W., C.M. Yonker, C.G. Olson, and E.F. Kelly. 1997. Paleopedologic and geomorphic evidence for Holocene climate variation, shortgrass steppe, Colorado, USA. Geoderma 76:113-130

Bogaart, P.W., and R.T. van Balen. 2000. Numerical modeling of the response of alluvial rivers to Quaternary climate change. Global and Planetary Change 72:144-163.

Brady, N.C., and R.R. Weil. 2002. The nature and properties of soil. 3rd ed. Pearson Education, Inc., India.

Buol, S.W., R.J. Southard, R.C. Graham, and P.A. McDaniel. 2002. Soil genesis and classification. 5th Ed. Iowa State Press, IA.

Bullinger-Weber, G., and J.-M. Gobat. 2006. Identification of facies models in alluvial soil formation: The case of a Swiss alpine floodplain. Geomorphology 74:181-195.

Daniels, J.M. 2003. Floodplain aggregation and pedogenesis in a semiarid environment. Geomorphology 56:225-242.

Ferring, C.R. 1986. Rates of fluvial sedimentation: Implications for archaeological variability. Geoarchaeology 1(3):259-274.

Ferring, C.R. 1990. Archaeological geology of the Southern Plains, *In* Archaeological geology of North America. Centennial Special Volume. Vol. 4. N.P. Lasca and J. Donahue. (eds.). GSA, Boulder. CO, pp. 253-266.

Ferring, C.R. 1992. Alluvial pedology and geoarchaeology research. *In* Soils in Archaeology; Landscape Evolution and Human Occupation. V.T. Holliday. (ed.). Smithsonian Institution Press, WA, pp. 1-39

Fichter, L.S., and D.J. Poché. 2001. Ancient environments and the interpretation of geologic history 3rd Ed. Prentice-Hall, Upper Saddler River, NJ.

Forman, S.L., R. Oglesby, and R.S. Webb. 2001. Temporal and spatial patterns of Holocene dune activity on the Great Plains of North America: megadroughts and climate links. Global and Planetary Change 29(1):1-29.

Gile, L.H., F.F. Peterson, and R.B. Grossman. 1966. Morphological and genetic sequences of carbonate accumulation in desert soils. Soil Science 101:347-360.

Hall, S.A. 1977. Geology of the Holocene sediments and buried trees of Carnegie Canyon. *In* The Prehistory and Paleoenvironment of Birch Creek Valley, Oklahoma. Lab of Archaeology Contributions in Archaeology. No. 3. D.O. Henry. (ed.). University of Tulsa, OK, pp.11-31.

Hall, S.A. 1988. Environment and archaeology of the Central Osage Plains. Plains Anthropologist 33(120):203-218.

Hall, S.A. 1990. Channel trenching and climate change in the southern U.S. Great Plains. Geology 18:342-345.

Hall, S.A., and C. Lintz. 1984, Buried trees, water-table fluctuations, and 3,000 years of changing climate in west-central Oklahoma. Quaternary Research 22:129-133.

Holliday, V.T. 1988. Genesis of a late-Holocene soil chronosequence at the Lubbock Lake Archaeological Site, Texas. Annals of the Association of American Geographers 78(4):594-610.

Holliday, V.T. 1990. Pedology in archaeology. Geological Society of America Centennial Special 4:525-540.

Holliday, V.T. 1995. Stratigraphy and paleoenvironments of Late Quaternary Valley Fills on the Southern High Plains: Boulder, Colorado, Geologic Society of America Memoir 186.

Holliday, V.T. 2000. The evolution of paleoindian geochronology and typology on the Great Plains. Geoarchaeology 15(3):227-290.

Holliday, V.T. 2004. Soils in archaeological research. Oxford University Press, Oxford, New York. p. 338-342.

Jacobs, P.M., and J.A. Mason. 2005. Impact of Holocene dust aggradation on A horizon characteristics and carbon storage in loess-derived mollisols of the Great Plains, USA. Geoderma 125:95-106.

Kimmins, J.P. 1987. Forest Ecology: A foundation for sustainable management, 2nd Ed. Prentice Hall, Upper Saddle River, NJ.

Knox, J.C. 1983. Responses of river systems to Holocene climates. *In* Late Quaternary environments of the United States. Vol. 2. The Holocene. (ed.). H.E. Wright, Jr., (ed.). University of Minnesota Press, MN.

Knox, J.C. 2000. Sensitivity of modern and Holocene floods to climate change. Quaternary Science Reviews 19:439-457.

Kochel, R.C., and V.R. Baker. 1988. Paleoflood analysis using slackwater deposits. *In* Flood Geomorphology. V.R. Baker, R.C. Kochel, P.C. Patton. (eds.). Wiley, USA, pp.123-137.

Lintz, C. and S.A. Hall. 1983. The geomorphology and archaeology of Carnegie Canyon Fort Cobb Laterals Watershed, Caddo County, Oklahoma. Oklahoma Conservation Commission Archaeological Research Rep. 10. Oklahoma City, OK.

Machette, M.N. 1985. Calcic soils of the southwestern United States. Geological Society of America Special Paper 203:1-21.

Magilligan, F.J. 1992. Sedimentology of a fine-grained aggrading floodplain. Geomorphology 4:393-408.

Martin, C.W. 1992. Late Holocene alluvial chronology and climate change in the central great plains. Quaternary Research 37(3):315-322.

Martin, C.W., and W.C. Johnson. 1995. Variation in radiocarbon ages of soil organic matter fractions from late Quaternary buried soils. Quaternary Research 43:232-237.

Meltzer, D.J. 1999. Human response to middle Holocene (Altithermal) changes on the North American Great Plains. Quaternary Research 52(3):404-416.

Nicholas, A.P., and Walling, D.E. 1997. Modeling flood hydraulics and overbank deposition on river floodplains. Earth Surface Processes and Landforms 22:59-77.

Nordt, L. 2004. Late Quaternary alluvial stratigraphy of a low-order tributary in central Texas, USA and its response to climate and sediment supply. Quaternary Research 2:289-300.

Nordt, L.C., T.W. Boutton, C.T. Hallmark, and M.R. Waters. 1994. Late Quaternary vegetation and climatic changes in central Texas based on the isotopic composition of organic carbon. Quaternary Research 41:109-120.

Patton, C.P., and S.A. Schumm. 1981. Ephemeral-stream processes: Implications for studies of Quaternary Valley Fills. Quaternary Research 15:24-43.

Prothero, D.R., and F. Schwab. 2004. Sedimentary Geology: An Introduction To Sedimentary Rocks and Stratigraphy. Second Edition. W.H. Freeman and Company, New York, New York. pp. 139-149.

Reid, I., and L.E. Frostick. 1994. Fluvial sediment transport and deposition. *In* Sediment transport and depositional processes. K. Pye. (ed.). Blackwell Scientific Publications. Oxford. pp. 89-155.

Reid, K.C., and J.A. Artz. 1984. Hunters of the forest edge: Culture, time, and process in the Little Caney basin (1980, 1981, 1982 field seasons): University of Tulsa Contributions in Archaeology. 14. and Oklahoma Archeological Survey Studies in Oklahoma's Past. No. 13. Norman, OK.

Ruhe, R.V., and C.G. Olson. 1980. Soil welding. Soil Science 130:132-139.

Sadler, P.M. 1981. Sediment accumulation rates and the completeness of stratigraphic sections. Journal of Geology 89:569-584.

Schaetzl, R.J., and S. Anderson. 2005. Soils: Genesis and Geomorphology. Cambridge University Press, Cambridge, UK.

Schoenberger, P.J., D.A. Wysocki, E.C. Benham, and W.D. Broderson. 1998. Field book for describing and sampling soils. Natural Resource Conservation Service, USDA, National Soil Survey Center, Lincoln, NE.

Soil Survey Division Staff. 1993. Soil survey manual. Agriculture Handbook, vol. 18. U.S. Department of Agriculture, Washington, DC.

Soil Survey Division Staff. 1996. Soil survey laboratory methods manual. Soil Survey Investigations Rep. 42. version 3.0. U.S. Department of Agriculture, Natural Resource Conservation Service, Washington, DC.

Soil Survey Division Staff. 1999. Soil Taxonomy: A Basic System of Soil Classification for Making and Interpreting Soil Surveys. Agriculture Handbook No. 436. U.S. Department of Agriculture, Soil Conservation Service, Washington, DC.

Stein, J.K. 1992. Organic matter in archaeological contexts. *In* Soils in Archaeology; Landscape Evolution and Human Occupation. V.T. Holliday. (ed.). Smithsonian Institution Press, WA. pp. 1-39.

Waters, M.R. 1992. Principles of Geoarchaeology: a North American Perspective. The University of Arizona Press, Tucson, AZ.

Waters, M.R. 2000. Alluvial Stratigraphy and Geoarchaeology in the American Southwest. Geoarchaeology 15(6):537-557.

Waters, M.R., and L.C. Nordt. 1995. Late Quaternary floodplain history of the Brazos River in East-Central Texas. Quaternary Research 43:311-319.

Yeomans, J.C., and J.M. Bremner. 1989. A rapid and precise method for routine determination of organic carbon in soil. Communications in Soil Science and Plant Analysis 19:1467-1475.

PART II

The Impact of Sediment Burial Depth on Herbaceous Plants

CHAPTER VII

INTRODUCTION

Background

Alluvial sedimentation (aggradation) has a profound impact on plant communities and subsequent soil formation (Peterson and Baldwin, 2004, Johnson et. al., 1995). Many plant species are excluded from growing near streams and rivers because of intolerance to sedimentation, erosion, submergence, or physical damage (Johnson, et. al., 1995, Hupp, 1982). Sedimentation might alter vegetation composition depending on species, depth of aggradation, and sediment texture. Furthermore, sedimentation might alter plant population density and species richness and in turn affect soil formation.

This study focuses on the influence of sedimentation/soil cover on herbaceous plants. Understanding the relationships between alluvial aggradation, herbaceous vegetation and pedogenesis is essential to increasing the understanding of soil formational processes, interpretation of archaeological and paleoclimatologic data, prairie ecology, and predicting future effects on soil and vegetation due to anthropogenic changes (e.g. channel straightening, increased run-off, and dam removal/construction). In addition, documenting the response of herbaceous plants to sedimentation/soil cover is applicable to agricultural interests, as the need for non-chemical weed control, such as harrowing, increases (Baerveldt and Ascard, 1999).

Importance to Soil Genesis

Parent material (sediments), organisms (vegetation), and time are very important soil forming factors (Jenny, 1941). However, the interactions of sediments, vegetation, and time are complex. Occasionally floodplains are subjected to aggradation. If aggradation is rapid a soil may become buried marking the end of soil formation. However, depending on the thickness of aggradation, subsequent plant community and time, pedogenesis may occur at depths effectively joining a surface A horizon and an underlying buried A horizon. This process is known as 'soil welding' (Ruhe and Olson, 1980). If sedimentation is slow and vegetative growth and soil formation keep pace, the A horizons may continuously build-up or become cumulic (Birkeland, 1999). Cumulization implies that vegetative growth and cover is concurrent with floodplain accretion (i.e. sedimentation at a given time does not completely bury and destroy vegetation). Although cumulization is widely hypothesized as a significant soil formational process associated with alluvial settings, the amount of sediment limiting the soil formation and vegetative growth has not been established.

Importance to Archaeology and Paleoenvironmental Studies

Soils, sediments and vegetation reconstructions or interpretations are extremely important to further understanding of archaeological sites. Soils and sediments are important, as most archaeological sites are found within soils and sediments. Cumulization is often stated as the soil forming process responsible for many late Holocene alluvial soils associated with Southern Plains archaeological sites (Ferring, 1992; Waters, 1992).

By studying site vegetation, workers understand the environment of pre-historic times. Pollen and more recently phytolith records have helped workers shape and promote the understanding of many unanswered questions about pre-historic environments. Although pollen and phytolith studies tell us a great deal about plant species and compositions present at some point in history, they often give little indication of why a particular assemblage is present.

Prairie Ecology

Native prairie once covered large expanses of North America. Of the remaining native prairie, an even smaller fraction exists as floodplain prairie, because these sites have become woodland or cultivated for agricultural production (Johnson, 1994). As a result, grassland floodplains have received little attention from ecologists, compared to forested riparian zones (Mathews, 1988). Recently, prairie floodplains have gained more attention from ecologists as they represent a key interface between upland and downstream habitat and water quality (Dodds, et. al. 2004).

Problem Statement and Objectives

Alluvial sedimentation (aggradation) has a profound impact on plant communities and subsequent soil formation. However, the interactions between alluvial aggradation, herbaceous vegetation and pedogenesis is poorly understood. Sedimentation might alter species composition and in turn affect soil formation. The response of vegetation to alluvial sedimentation depends on several factors, for instance: plant species, depth of aggradation and sediment texture (Baerveldt and Ascard, 1999). Documentation of

relationships between sediments, vegetation and soils is especially beneficial for establishing conditions for A horizon (mollic) formation.

The short term objectives of this study were (1) to evaluate herbaceous plant community response to burial by alluvial sedimentation, and (2) to serve as pilot study to establish an effective experimental design for future studies of this kind.

Ecological studies measuring the response of vegetation to sedimentation has generally been associated with vegetation within streams, rivers, tidal flats and in riparian woodlands. Brooks (1986) and Peterson and Baldwin (2004) discussed the impact of sedimentation on aquatic vegetation of streams and tidal flats, which included: light reduction, abrasion, complete burial, growth suppression, reduced biodiversity and reduced germination from the seed the bank. Plants in general, either vary their rooting levels in response to sedimentation or they will suffocate (Brooks, 1986). Peterson and Baldwin (2004) reported reduced emergence of freshwater wetland plants as a result of 0.5 cm of sediment addition.

Ewing (1996) discussed riparian woodland community response to various hydrogeomorphic processes, including: sedimentation, erosion, submergence, fertility and salinity. Ewing (1996) reported a decrease in photosynthesis in red maple (*Acer rubra*) as a response to low oxygen at rooting depths caused by sedimentation. However symptoms gradually went away after adventurous roots developed within the sediments.

In agricultural soil is often pushed into intra-row spaces to physically smother weeds in a process called harrowing. Soil cover effectiveness as a means of weed control is dependent on depth of soil cover, seed size and plant seasonality. Small seeded plants

(most annual weeds) lack the reserves to emerge through thick layers of soil. However, if these small seeded plants do emerge they have the ability to reach or even surpass larger seeded plants, as small seeded plants have a higher relative growth rate, which declines less quickly than large seeded plants (Mohler, 1996).

Most studies have explored the effects of sedimentation on aquatic plants, trees, seeds or seedlings. However, no studies have examined the response of herbaceous vegetation, especially established vegetation; to burial. In addition no studies were found that evaluated soil A horizon formation under varying amounts of sedimentation. Based on previous research (Mohler, 1996; Baerveldt and Ascard, 1999), we hypothesize that grasses and forbs will be able to emerge through 8 cm of sediment while many plants will be smothered by 16 and 24 cm; decreasing species diversity (especially native grasses), plant cover; and bury the A horizon.

CHAPTER VIII

MATERIALS AND METHODS

Site Description

Field experiments were conducted in a stand of herbaceous plants south of Stillwater, OK (NE1/4 of the NW1/4 of Sec. 34 T18N R2E Payne County, Oklahoma; 35° 59' 56.221", -97° 4' 43.797"). Major plant species studied include: little bluestem (*Schizachyrium scoparium*), purpletop (*Tridens flavus*), silverleaf nightshade (*Solanum elaeagnifolium*), Sericea lespedeza (*Lespedeza cuneata*), Texas bull nettle (*Cnidoscolus texanus*), Virginia pepperweed (*Lepidium virginicum*), and western ragweed (*Ambrosia psilostachya*) (Table 6.) Mean annual precipitation and temperature at the site were 832 mm and 15.5°C, respectfully. The soil series at this site is a Teller fine sandy loam (fine-loamy, mixed, active, thermic, Udic Argiustoll) on 1-3% slopes. Teller soils are deep well drained soils formed on old loamy alluvial sediment that can average 3,250 kg/ha/yr in rangeland productivity (USDA, 1987). Experimental quadrats were established under natural growing conditions, no fertilizer or irrigation was applied.

Grasses	Season	Longevity	Photosynthetic Pathway
Little bluestem (*Schizachyrium scoparium*)	warm	perennial	C4
Purple top (*Tridens flavus*)	warm	perennial	C4
Indian grass (*Sorghastrum nutans*)	warm	perennial	C4
Scribner's panicum (*Dichanthelium oligosanthes*)	cool	perennial	C3
Big bluestem (*Andropogon gerardii*)	warm	perennial	C4
Bermudagrass (*Cynodon dactylon*)	warm	perennial	C4
Broomsedge bluestem (*Andropogon virginicus*)	warm	perennial	C4
Crabgrass (*Digitaria ciliaris*)	warm	perennial	C4
Japanese brome (*Bromus japonicus*)	cool	annual	C3
Forbs			
Western ragweed (*Ambrosia psilostachya*)	warm	perennial	C4
Silverleaf nightshade (*Solanum elaeagnifolium*)	warm	perennial	C4
Texas bull nettle (*Cnidoscolus texanus*)	warm	perennial	C4
Virginia pepperweed (*Lepidium virginicum*)	cool	ann./per.	C3
Sericea lespedeza (*Lespedeza cuneata*)	warm	perennial	C4
Slender lespedeza (*Lespedeza virginica*)	warm	perennial	C4
Sessile-leaved tickclover (*Desmodium sessilifolium*)	warm	perennial	C4
Kochia (*Eupatorium rugosum*)	warm	annual	C4
Yellow nutgrass (*Cyperus esculentus*)	warm	perennial	C4
White snakeroot (Eupatorium rugosum)	warm	perennial	C4
Lambsquarters (*Chenopodium album*)	warm	annual	C4
Prickly pear (*Opuntia spp.*)	cool	perennial	CAM
Daisy fleabane (*Erigeron annuus*)	cool	annual	C3
Common chickweed (*Stellaria media*)	cool	annual	C3
Showy partridge pea (*Cassia fasciculata*)	warm	annual	C4
Western yarrow (*Achillea millefolium*)	cool	perennial	C3
Yellow wood sorrel (*Oxalis stricta*)	warm	perennial	C4
Ashy sunflower (*Helianthus mollis*)	warm	perennial	C4

Table 6. List of plants found at study site showing seasonality, longevity and photosynthetic pathway.

Experimental Design

In March of 2005, a completely randomized design was used to determine the effects of sedimentation on in situ herbaceous vegetation. Effect of time, treatment, time and treatment, and replication (time*treatment) on herbaceous plant emergence were analyzed using repeated measures analysis of variance (SAS Institute, 2002). Twelve 2 m by 2 m quadrates, in a level area were staked off as permanent monitoring plots. Each plot was then subdivided into sixteen subplots for evaluation (Fig. 18).

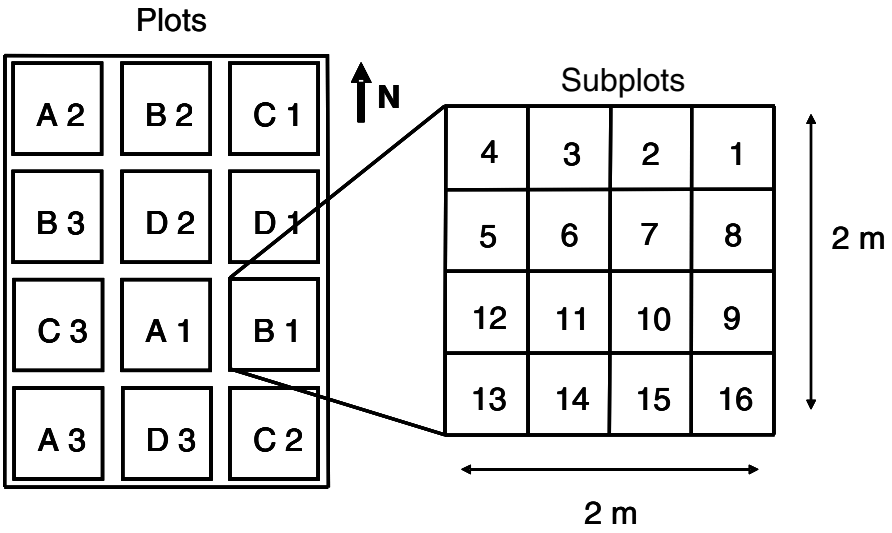

Figure 18. Layout of experimental plots and subplots within plots.

The vegetation (including previous year's identifiable standing dead or dormant) of each plot was then identified and foliar percent cover was estimated on 17 Mar. 2005 (Day 0), prior to treatments. The percent cover of all plots was estimated using a variation of the Daubenmire canopy coverage procedure (Daubenmire, 1959). Aerial plant cover by species was visually estimated and categorized into one of the following

cover classes: (0) 0%; (1) <1%; (2) 1 to 5%; (3) 5 to 25%; (4) 25 to 50%; (5) 50 to 75%; (6) 75 to 95%; and (7) 95 to 100%. Each cover class greater than 0 was then assigned a midpoint value of 0.5, 3, 15, 37.5, 62.5, 85 and 97.5 for cover classes 0 – 7, respectfully. Vegetation in the treatment plots was then flattened and pinned down using deer netting and sod staples, to help maintain an even application of the treatment and mimic flood waters. Treatment (Table 7) consisted of a fine sandy loam from a near-by Cimarron River sand pit, chosen to mimic alluvial sediment.

Sediment Characteristics

Color	5YR 5/6
Structure	massive, single grained
Consistence	friable
Effervescence	none
% Organic Carbon	0.067
Texture	Fine Sandy Loam

	Sand					Silt			Clay			Texture
Sample No.	2.0-1.0 (mm) (v.coarse)	1.0-0.5 (mm) (coarse)	0.5-0.25 (mm) (medium)	0.25-0.1 (mm) (fine)	0.1-0.05 (mm) (v.fine)	0.05-0.02 (mm) (coarse)	0.02-0.005 (mm) (medium)	0.005-0.002 (mm) (fine)	<0.0002 (mm)	Total Silt	Total Sand	
	%											
1	0.0668	0.8185	10.8189	32.5478	28.3540	18.9783	1.9817	0.4308	5.9020	21.3908	72.6060	FSL
2	0.0311	1.2593	15.6072	35.5083	24.4897	15.4898	1.8967	0.3731	4.4308	17.7596	76.8955	FSL
3	0.0131	0.7691	9.7949	30.7529	30.9191	19.8058	2.3288	0.4507	4.8641	22.5853	72.2491	FSL

Table 7. Characteristics of sediments used as treatment.

The treatment was applied at depths of 8 (plots B1, B2 and B3), 16 (plots C1, C2 and C3) and 24 cm (plots D1, D2, D3), on 17 Mar. 2005 (Day 0). Control plots, which received no treatment, were designated plot A1, A2 and A3. Following treatment, percent coverage of vegetation by species was visually estimated after 60 days (Day 60; 19 May 2005), 90 days (Day 90; 21 June 2005), 120 days (Day 120; 19 July 2005), 150

days (Day 150; 26 Aug. 2005) and 180 days (Day 180; 22 Sept. 2005) (Appendix A). Effect of treatment was first recorded on Day 60 (19 May 2005). All treatments for Day O completely covered vegetation.

To reduce error introduced by plants emerging from the sediment seed bank, seedlings germinating from the surface were removed. Plants emerging from depths were easily distinguishable, as these plants had thick stems and pushed a relatively large amount of soil up at the surface as they emerged. To confirm this pattern, several plants presumed to be emerging from depths were excavated and verified.

CHAPTER IX

RESULTS AND DISCUSSION

Grasses

Initial inventory (Day 0) of grasses revealed no differences between plots and complete sediment cover (Fig. 19). Of the grasses inventoried at Day 0 before burial (17 Mar. 2005) Japanese brome (*Bromus japonicus*) and Scribner's panicum (*Dichanthelium oligosanthes*) were the only grasses that had emerged (and the only cool season grasses observed). Japanese brome (*Bromus japonicus*) accounted for 35.31 %, 47.99 %, 52.08 % and 53.80 % of total grass coverage in treatments A (control), B (8 cm), C (16 cm) and D (24 cm) respectfully.

For the remainder of the experiment grasses in all treated plots (treatments B, C and D) remained below 10 % coverage, while grasses in the control plots (treatment A) flourished (Fig. 19). Grasses that did emerge in treatments B,C, and D were located in the periphery and were the result of an 'edge effect' (~ 40 cm from edge of plot) or erosion of sediment from the edges of the plot. However, the grasses in the control plots followed a normal growth pattern, reaching peak growth at Day 120 (19 July 2005), before the driest period of the summer. Unlike the study by Baerveldt and Ascard (1999), all cool season grass seedlings under 8, 16, and 24 cm of sediment were smothered.

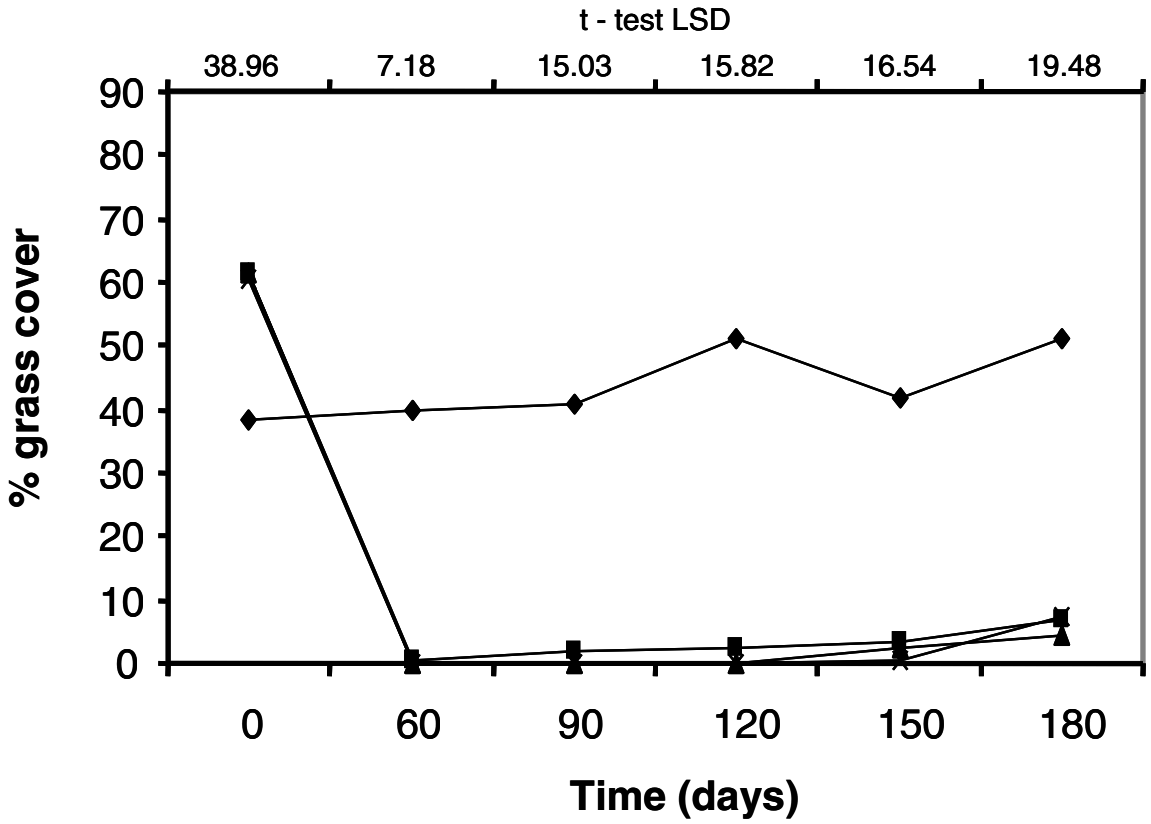

Figure 19. Effect of sedimentation on grasses (17 Mar. 2005 through 22 Sept. 2005). Treatments: A, control (--♦--); B, 8cm (--■--); C, 16 cm (--▲--); D (24 cm) (--x--).

Forbs

At Day 0 (17 Mar. 2005) a few forbs had emerged, and no dormant plants from the previous growing season accounted for totals (occasional stems were encountered but not unidentified).

Control plots produced more forb cover by Day 60 than plots that received 8, 16 or 24 cm of sediment (treatments B,C, and D). At Day 60 (19 May 2005) forbs had emerged from 8 and 16 cm (treatments B and C), while very few had emerged from 24 cm of sediment (treatment D) (Fig. 20). An explanation for this is that forbs in plots treated with 24 cm of sediment (treatment D) were either still making their way through

the thick cover or were retarded by a mulching effect of the soil cover. Mulch provides a physical barrier, but also could have kept soil temperatures lower in the root zone of the more deeply buried plants.

From Day 90 (21 June 2005) to Day 180 (22 Sept. 2005) forb cover in all treatments (A, B, C and D) was the same (Fig. 20). Burial at all depths had no effect on forb growth. The higher carbohydrate storage capacity of forbs roots, compared to grass roots, helps explain the similar forb growth observed within treated plots compared to the control plots. Although root carbohydrate storage capacity seems the most likely explanation for equal forb growth in treated plots compared to untreated plots, other environmental factors must be considered. Other environmental factors may include: 1) competition with by grasses that equaled suppression by burial, or 2) a mulching effect (this time in favor of the forbs) could have improved the growth of surviving forbs by reducing competition from grasses and/or by breaking capillary transport of water to the surface; effectively decreasing surface evaporation (thus increasing moisture content of the root zone) (Baerveldt and Ascard, 1999).

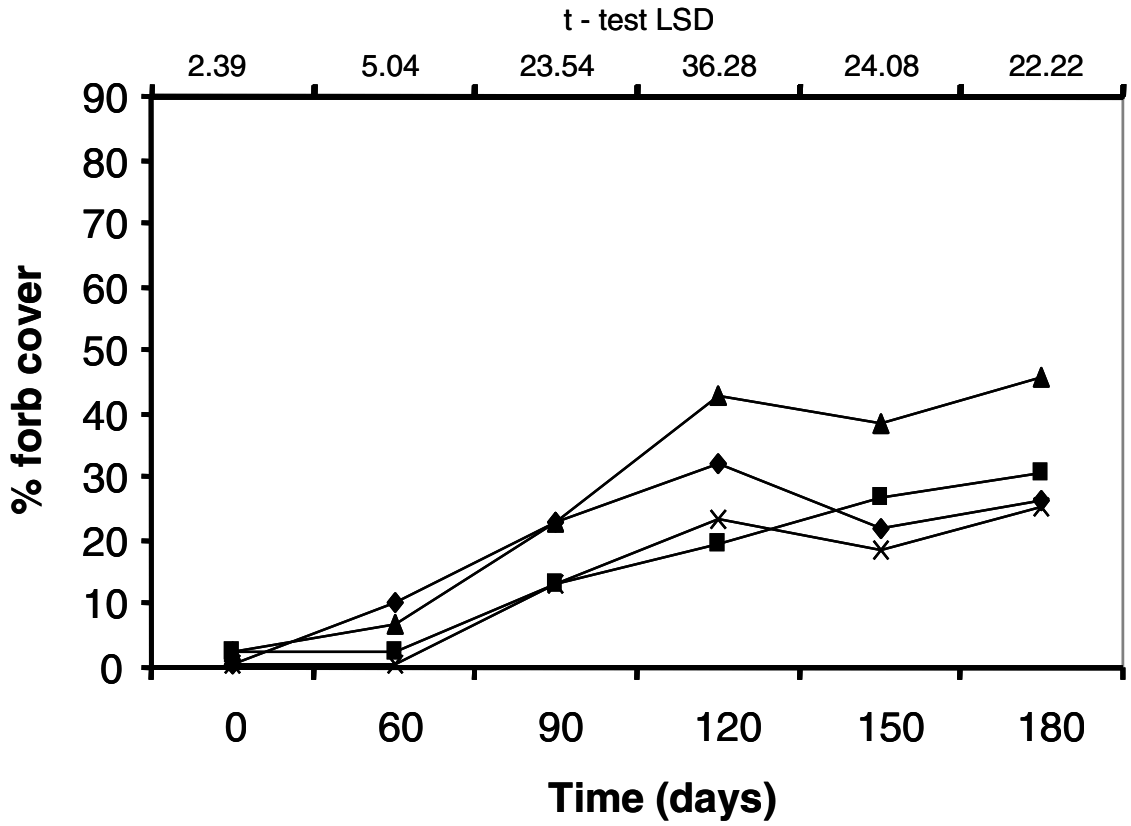

Figure. 20. Effect of sedimentation on forbs (17 Mar. 2005 through 22 Sept. 2005). Treatments: A, control (--♦--); B, 8cm (--■--); C, 16 cm (--▲--); D (24 cm) (--x--).

Figure 21. Plot C2 at Day 0 (17 Mar. 2005) prior to treatment.

Figure 22. Plot C2 at Day 0 (17 Mar. 2005) following treatment (16 cm of fine-loamy sand).

Figure 23. Plot C2 at Day 60 (19 May 2005).

Figure 24. Plot C2 at Day 90 (21 June 2005).

Figure 25. Plot C2 at Day 120 (19 July 2005).

Figure 26. Plot C2 at Day 150 (26 Aug. 2005).

Figure 27. Plot C2 at Day 180 (22 Sept. 2005).

Figure 28. Plot A1 at Day 180 (22 Sept. 2005).

CHAPTER X

CONCLUSIONS

Impact of Sedimentation on Herbaceous Plants

Sediments/soil cover (fine-loamy sand) of 8, 16, and 24 cm does have significant impact on herbaceous plant communities. Sediments/soil cover of 8, 16 and 24 cm effectively kills Japanese brome (*Bromus japonicus*) and Scribner's panicum (*Dichanthelium oligosanthes*) seedlings, and stops the emergence of little bluestem (*Schizachyrium scoparium*), and purpletop (*Tridens flavus*). Sediments/soil cover of 8, 16 and 24 cm may stop emergence of big bluestem (*Andropogon gerardii*) and broomsedge bluestem (*Andropogon virginicus*), however sampling size for these grasses was too small to ensure complete confidence.

Although sediment/soil cover dramatically reduced grass cover, sediment/soil cover of 8, 16 and 24 cm had little effect on warm season perennial herbaceous plants. Silverleaf nightshade (*Solanum elaeagnifolium*), Sericea lespedeza (*Lespedeza cuneata*), Texas bull nettle (*Cnidoscolus texanus*), Viginia pepperweed (*Lepidium virginicum*), and western ragweed (*Ambrosia psilostachya*) cover equaled forb cover in the control plots.

Soil Development

Sediments in treated plots (B, C, and D) showed no signs of soil development. Soil darkening indicates assimilation of soil organic matter. Based on Munsell soil colors there was no soil development in treated plots (B, C, and D). Another visual inspection

of color in July 2006 revealed that there was still relatively little organic matter build up on the surface. It may be several years before we begin to see changes in soil development.

Future studies

Studies are needed evaluating the effects of varying sediments/soil cover thickness on more species and at different developmental stage (different time of year) (Baerveldt and Ascard, 1999). Future studies should consider using shallower depths of sediments/soil covers, especially if the intention is to evaluate the response of grasses. Another idea is to apply sediments during the time of year when most flooding occurs. For example, a study in the Southern Plains should apply sediments in late spring or early summer to match the seasonality of flood events. In addition, plant response to sediments of different textural compositions should be evaluated, since particle size is related to flood intensity, duration, and sediment source.

CHAPTER XI

LITERATURE CITED

Baerveldt, S., and J. Ascard. 1999. Effect of soil cover on weeds. Biological Agriculture and Horticulture 17:101-111.

Birkeland, P.W. 1999. Soils and Geomorphology. 3rd ed. Oxford University Press, Oxford, NY.

Brooks, A. 1986. Response of aquatic vegetation to sedimentation downstream from river channelization works in England and Wales. Biological Conservation 38:351-367.

Daubenmire, R. 1959. A canopy-coverage method of vegetational analysis. Northwest Science 33:43-64.

Dodds, W.K., K. Gido, M.R. Whiles, K.M. Fritz, W.J. Mathews. 2004. Life on the edge: the ecology of Great Plains prairie streams. Bioscience 54(3):205-216

Ewing, K. 1996. Tolerance of four wetland plant species to flooding and sediment deposition. Environmental and Experimental Botany 63(2) 131-146.

Ferring, C.R. 1992. Alluvial pedology and geoarchaeology research. *In* Soils in Archaeology; Landscape Evolution and Human Occupation. V.T. Holliday. (ed.). Smithsonian Institution Press, WA, pp. 1-39

Hupp, C. R. 1982. Stream-grade variation and riparian forest ecology along Passage Creek, Virginia. Bulletin of the Torrey Botanical Club. 109:488-499.

Jenny, H. 1941. Factors of soil formation. McGraw-Hill, New York

Johnson, W.C. 1994. Woodland expansion in the Platte River, Nebraska: patterns and causes. Ecological Monographs. 64:45-84.

Johnson, W.C., M.D. Dixon, R. Simons, S. Jenson, K. Larson. 1995. Mapping the response of riparian vegetation to possible flow reductions in the Snake River, Idaho. Geomorphology 13:159-173.

Mathews, W.T. 1998. North American prairie streams for ecological study. Journal of the North American Benthological Society. 7:384-409.

Mohler, C.L. 1996. Ecological basis for the cultural control of annual weeds. Journal of Production Agriculture. 9(4):468-474.

Peterson, J.E. and A.H. Baldwin. 2004. Seedling emergence from seed banks of tidal freshwater wetlands: response to inundation and sedimentation. Aquatic Botany. 78(3) 243-254.

Ruhe, R.V. and C.G. Olson. 1980. Soil welding. Soil Science. 130:132-139.

SAS Institute. 2002. [Online] SAS OnlineDoc®, Version 9.1 http://www.okstate.edu/sas/v9.1/sashtml/main.htm. SAS Institute., Cary, NC.

Sadler, P.M. 1981. Sediment accumulation rates and the completeness of stratigraphic sections. Journal of Geology. 89:569-584.

United States Department of Agriculture. 1987. Soil Conservation Service. Soil Survey of Payne County, Oklahoma.

Waters, M.R. 1992. Principles of Geoarchaeology: a North American Perspective. The University of Arizona Press, Tucson, AZ.

APPENDIX A

Vegetation Data

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0
big bluestem (*Andropogon gerardii*)																	0
broomsedge bluestem (*Andropogon virginicus*)																	0
crabgrass (*Digitaria ciliaris*)																	0
Indian grass (*Sorghastrum nutans*)							37.5	15.0		15.0							4.21875
Japanese brome (*Bromus japonicus*)	85.5		15.0		62.5			37.5	37.5	37.5	62.5	62.5	62.5	62.5	15.0	37.5	36.125
little bluestem (*Schizachyrium scoparium*)			15.0	37.5	15.0	3.0	3.0		15.0	15.0	15.0	15.0	15.0	15.0	15.0		11.15625
purple top (*Tridens flavus*)		15.0	15.0			15.0			15.0		15.0		3.0		15.0	15.0	6.75
Scribner's panicum (*Dichanthelium oligosanthes*)	15.0					15.0						3.0					2.0625
Forbs																	
common chickweed (*Stellaria media*)																	0
daisy fleabane (*Erigeron annuus*)																	0
lambsquarters (*Chenopodium album*)																	0
kochia (*Kochia scoparia*)																	0
prickly pear (*Opuntia spp.*)																	0
sericea lespedeza (*Lespedeza cuneata*)																	0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0
showy partridge pea (*Cassia fasciculata*)	3.0	3.0															0.375
silverleaf nightshade (*Solanum elaeagnifolium*)																	0
slender lespedeza (*Lespedeza virginica*)																	0
Texas bull nettle (*Cnidoscolus texanus*)																	0
Virginia pepperweed (*Lepidium virginicum*)																	0
western ragweed (*Ambrosia psilostachya*)																	0
western yarrow (*Achillea millefolium*)																	0
white snakeroot (*Eupatorium rugosum*)																	0
yellow nutgrass (*Cyperus esculentus*)																	0
yellow wood sorrel (*Oxalis stricta*)																	0
ashy sunflower (*Helianthus mollis*)																	0
Grass Total																	60.3125
Forb Total																	0.4
Total Coverage																	60.6875

Table 8. Plot: A1, Day 0 (17 Mar. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)				15.0	15.0	15.0	3.0	3.0		3.0	15.0	15.0	15.0	3.0	15.0	3.0	7.5
Japanese brome (*Bromus japonicus*)			15.0	3.0									37.5			15.0	4.4
little bluestem (*Schizachyrium scoparium*)	15.0	15.0		15.0	15.0	3.0	15.0	15.0	37.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.7
purple top (*Tridens flavus*)		3.0		3.0		15.0				3.0							1.5
Scribner's panicum (*Dichanthelium oligosanthes*)	3.0		15.0		15.0		15.0	3.0	15.0	15.0	15.0	3.0	3.0	3.0	15.0	15.0	8.4
Forbs																	
common chickweed (*Stellaria media*)										3.0		3.0					0.4
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)																	0.0
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)																	0.0
western ragweed (*Ambrosia psilostachya*)						3.0			3.0	3.0		3.0		3.0	3.0		1.1
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	36.6
Forb Total																	1.5
Total Coverage																	38.1

Table 8. (Continued). Plot: A2, Day 0 (17 Mar. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)			15.0								3.0				3.0		1.3
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)				15.0		15.0		15.0	37.5	37.5	15.0	15.0	15.0	15.0	15.0	15.0	13.1
purple top (*Tridens flavus*)	3.0	3.0	3.0				3.0	3.0	3.0				3.0		15.0		2.3
Scribner's panicum (*Dichanthelium oligosanthes*)					15.0		3.0										1.1
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)																	0.0
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)																	0.0
western ragweed (*Ambrosia psilostachya*)											3.0						0.2
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	17.8
Forb Total																	0.2
Total Coverage																	18

Table 8. (Continued). Plot: A3, Day 0 (17 Mar. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)	15.0	15.0	3.0	3.0	37.5	15.0	15.0				3.0	3.0	15.0	3.0			8.0
Japanese brome (*Bromus japonicus*)	62.5	62.5	15.0	37.5		37.5	15.0	62.5	37.5	37.5	62.5	62.5		15.0	37.5	37.5	36.4
little bluestem (*Schizachyrium scoparium*)	3.0	15.0	15.0	37.5	15.0	3.0	3.0	15.0	15.0	3.0	3.0	3.0	15.0	37.5	15.0	15.0	13.3
purple top (*Tridens flavus*)	3.0		3.0				15.0	15.0	15.0	15.0	3.0	3.0	3.0		3.0	15.0	5.8
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																0.5	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)				0.5													0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)					0.5				0.5			0.5					0.1
silverleaf nightshade (*Solanum elaeagnifolium*)																	0.0
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)																	0.0
western ragweed (*Ambrosia psilostachya*)							0.5		3.0	15.0				3.0	15.0	15.0	3.2
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	63.5
Forb Total																	3.4
Total Coverage																	67

Table 8. (Continued). Plot: B1, Day 0 (17 Mar. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)	3.0	3.0		3.0	3.0	37.5	15.0	15.0	3.0		37.5	3.0	3.0			15.0	8.8
Japanese brome (*Bromus japonicus*)				3.0		15.0			3.0	15.0		15.0			15.0	15.0	5.1
little bluestem (*Schizachyrium scoparium*)	15.0	37.5	3.0	15.0	15.0	15.0	15.0	15.0	15.0	37.5	15.0	37.5	15.0	62.5	15.0	15.0	21.4
purple top (*Tridens flavus*)															3.0		0.2
Scribner's panicum (*Dichanthelium oligosanthes*)	37.5	3.0			15.0		3.0	15.0	15.0		3.0	15.0	3.0	15.0	3.0	15.0	8.9
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)	3.0					3.0											0.4
silverleaf nightshade (*Solanum elaeagnifolium*)																	0.0
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)																	0.0
western ragweed (*Ambrosia psilostachya*)		3.0	3.0					15.0	15.0				3.0		3.0		2.6
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	44.4
Forb Total																	3.0
Total Coverage																	47

Table 8. (Continued). Plot: B2, Day 0 (17 Mar. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)			3.0	3.0	3.0								3.0	62.5			4.7
Japanese brome (*Bromus japonicus*)	15.0	15.0	3.0		62.5	37.5	62.5	62.5	62.5	85.5	62.5	62.5	37.5	37.5	62.5	85.5	47.1
little bluestem (*Schizachyrium scoparium*)	15.0	15.0	15.0	37.5	15.0	15.0	15.0	37.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	17.8
purple top (*Tridens flavus*)			15.0			3.0	15.0					3.0	3.0		3.0	3.0	2.8
Scribner's panicum (*Dichanthelium oligosanthes*)	15.0	3.0	3.0							15.0	15.0		15.0		3.0		4.3
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)																	0.0
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)																	0.0
western ragweed (*Ambrosia psilostachya*)			3.0	3.0			3.0		3.0								0.8
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	76.7
Forb Total																	0.8
Total Coverage																	77

Table 8. (Continued). Plot: B3, Day 0 (17 Mar. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)	3.0	15.0		3.0						3.0	15.0		15.0	3.0			3.6
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)				3.0	15.0					15.0	3.0		15.0	3.0	85.5	62.5	12.6
Japanese brome (*Bromus japonicus*)	15.0					37.5	37.5	37.5	37.5	62.5							14.2
little bluestem (*Schizachyrium scoparium*)		3.0	15.0	15.0	15.0	15.0	15.0	3.0	3.0		15.0	15.0	15.0	3.0	3.0		8.4
purple top (*Tridens flavus*)						15.0				3.0				62.5		15.0	6.0
Scribner's panicum (*Dichanthelium oligosanthes*)	3.0	15.0	3.0	3.0	62.5	15.0	3.0				3.0	37.5	15.0				10.0
Forbs																	
common chickweed (*Stellaria media*)						15.0						0.5	0.5				1.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)	15.0			0.5					0.5		0.5	0.5					1.1
silverleaf nightshade (*Solanum elaeagnifolium*)																	0.0
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)																	0.0
western ragweed (*Ambrosia psilostachya*)	3.0	3.0								0.5							0.4
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)											0.5		0.5				0.1
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	54.8
Forb Total																	2.5
Total Coverage																	57

Table 8. (Continued). Plot: C1, Day 0 (17 Mar. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)	3.0																0.2
Japanese brome (*Bromus japonicus*)	62.5	37.5	62.5	62.5	37.5	37.5	37.5	62.5	62.5	37.5	15.0	97.5	62.5	37.5	15.0	15.0	46.4
little bluestem (*Schizachyrium scoparium*)			15.0	15.0	3.0	15.0	3.0				15.0			3.0	3.0		4.5
purple top (*Tridens flavus*)	3.0	15.0	3.0		3.0		15.0	3.0	15.0	15.0	3.0	15.0	15.0	15.0	15.0	15.0	9.4
Scribner's panicum (*Dichanthelium oligosanthes*)					3.0												0.2
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																0.5	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)																	0.0
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)																	0.0
western ragweed (*Ambrosia psilostachya*)	62.5							3.0									4.1
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	60.7
Forb Total																	4.1
Total Coverage																	65

Table 8. (Continued). Plot: C2, Day 0 (17 Mar. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)	37.5		3.0	3.0	15.0	3.0							3.0				4.0
Japanese brome (*Bromus japonicus*)		62.5	37.5		62.5	62.5	15.0	15.0	62.5	62.5	37.5	37.5	37.5		15.0	62.5	35.6
little bluestem (*Schizachyrium scoparium*)		15.0	37.5	62.5		15.0	37.5	3.0	37.5		15.0	15.0	15.0	37.5	62.5	15.0	23.0
purple top (*Tridens flavus*)					15.0	3.0	3.0	3.0	3.0	15.0		3.0				3.0	3.0
Scribner's panicum (*Dichanthelium oligosanthes*)			3.0	3.0		15.0				3.0	15.0				15.0	3.0	3.6
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)																	0.0
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)																	0.0
western ragweed (*Ambrosia psilostachya*)																	0.0
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	69.2
Forb Total																	0.0
Total Coverage																	69

Table 8. (Continued). Plot: C3, Day 0 (17 Mar. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)	37.5	15.0	15.0	3.0		15.0	37.5	97.5	97.5	62.5	62.5	3.0				15.0	28.8
Japanese brome (*Bromus japonicus*)		62.5									3.0	62.5		37.5		3.0	10.5
little bluestem (*Schizachyrium scoparium*)		3.0	15.0	15.0	3.0	15.0				15.0		3.0	3.0	15.0			5.4
purple top (*Tridens flavus*)	3.0		3.0	3.0								3.0	3.0			3.0	1.1
Scribner's panicum (*Dichanthelium oligosanthes*)		37.5		3.0	3.0		3.0				3.0	3.0	3.0				3.5
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)					0.5												0.0
silverleaf nightshade (*Solanum elaeagnifolium*)																	0.0
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)																	0.0
western ragweed (*Ambrosia psilostachya*)					3.0									15.0			1.1
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	49.4
Forb Total																	1.2
Total Coverage																	51

Table 8. (Continued). Plot: D1, Day 0 (17 Mar. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)	3.0	3.0			3.0			3.0		3.0						3.0	1.1
Japanese brome (*Bromus japonicus*)		15.0	3.0			15.0		15.0	37.5	3.0		37.5	15.0				8.8
little bluestem (*Schizachyrium scoparium*)	15.0	15.0	15.0	37.5	37.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	17.8
purple top (*Tridens flavus*)										3.0	15.0		15.0	15.0	3.0	3.0	3.4
Scribner's panicum (*Dichanthelium oligosanthes*)	15.0	15.0	15.0	15.0	3.0	3.0		3.0	15.0	3.0						3.0	5.6
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)																	0.0
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)																	0.0
western ragweed (*Ambrosia psilostachya*)																	0.0
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	36.8
Forb Total																	0.0
Total Coverage																	37

Table 8. (Continued). Plot: D2, Day 0 (17 Mar. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)	85.5	85.5	62.5	85.5	62.5	85.5	85.5	85.5	62.5	62.5	85.5	85.5	85.5	85.5	62.5	85.5	78.3
little bluestem (*Schizachyrium scoparium*)	3.0	15.0		3.0	3.0	3.0	15.0	15.0				3.0				15.0	4.7
purple top (*Tridens flavus*)	15.0		37.5	3.0	3.0			3.0	15.0	37.5	15.0		15.0	15.0	15.0	3.0	11.1
Scribner's panicum (*Dichanthelium oligosanthes*)		3.0		3.0		3.0						3.0	3.0		3.0		1.1
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)																	0.0
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)																	0.0
western ragweed (*Ambrosia psilostachya*)																	0.0
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	95.2
Forb Total																	0.0
Total Coverage																	95

Table 8. (Continued). Plot: D3, Day 0 (17 Mar. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)										3.0							0.2
Japanese brome (*Bromus japonicus*)	37.5	15.0	15.0	3.0	15.0	3.0	15.0	15.0	3.0		15.0	3.0	3.0	15.0	15.0	15.0	11.7
little bluestem (*Schizachyrium scoparium*)	3.0	3.0	15.0	37.5	15.0	3.0	3.0	3.0	37.5	15.0	15.0	3.0	3.0	15.0	37.5	0.5	13.1
purple top (*Tridens flavus*)	15.0	15.0	3.0	3.0	3.0	3.0	15.0	15.0	3.0	3.0	15.0	15.0	15.0	3.0	15.0	15.0	9.8
Scribner's panicum (*Dichanthelium oligosanthes*)					0.5	3.0				0.5		3.0	0.5	0.5	3.0		0.7
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)													0.5				0.0
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)		0.5	15.0											15.0			1.9
Virginia pepperweed (*Lepidium virginicum*)	15.0	15.0	15.0	15.0	15.0	3.0	3.0	15.0	15.0	15.0	0.5	0.5		0.5		0.5	8.0
western ragweed (*Ambrosia psilostachya*)	0.0		3.0	3.0		0.5											0.4
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	35.4
Forb Total																	10.3
Total Coverage																	46

Table 8. (Continued). Plot: A1, Day 60 (19 May 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)											3.0	15.0	0.5		15.0	3.0	2.3
Japanese brome (*Bromus japonicus*)			15.0			3.0		3.0	0.5		3.0	3.0	3.0	3.0			2.1
little bluestem (*Schizachyrium scoparium*)	62.5	37.5	15.0	37.5	15.0	37.5	37.5	62.5	85.5	62.5	3.0	3.0	37.5	62.5	15.0	85.5	41.2
purple top (*Tridens flavus*)		0.5	15.0		15.0	15.0	3.0	0.5	0.5	3.0	3.0	3.0	3.0	3.0			4.0
Scribner's panicum (*Dichanthelium oligosanthes*)	3.0	3.0	15.0	3.0	0.5	0.5	3.0	3.0	3.0	0.5	3.0	0.5	3.0	0.5	0.5	15.0	3.6
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)						3.0											0.2
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)	3.0		3.0		3.0			3.0						0.5	0.5		0.8
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																0.5	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)																	0.0
slender lespedeza (*Lespedeza virginica*)										0.5					0.5	3.0	0.3
Texas bull nettle (*Cnidoscolus texanus*)		3.0											3.0				0.4
Virginia pepperweed (*Lepidium virginicum*)	3.0	3.0	3.0	15.0	3.0	3.0	0.5		0.5		3.0	15.0		0.5		0.5	3.1
western ragweed (*Ambrosia psilostachya*)	3.0	3.0				3.0	3.0	3.0		3.0	0.5	15.0	3.0		0.5		2.3
western yarrow (*Achillea millefolium*)		0.5															0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)									0.5								0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	53.2
Forb Total																	7.2
Total Coverage																	60

Table 8. (Continued). Plot: A2, Day 60 (19 May 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)	15.0	62.5	15.0	15.0	15.0	37.5	15.0	62.5	15.0	15.0	15.0	15.0	3.0		15.0	15.0	20.7
little bluestem (*Schizachyrium scoparium*)	3.0			15.0		15.0	3.0	0.5	15.0	15.0	3.0		0.5	15.0	3.0	3.0	5.7
purple top (*Tridens flavus*)	3.0	0.5	15.0	15.0	0.5			0.5	0.5	3.0	3.0	0.5	0.5	3.0	15.0	3.0	3.9
Scribner's panicum (*Dichanthelium oligosanthes*)	0.5			3.0	3.0		0.5					0.5	0.5	0.5			0.5
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)	15.0	0.5					0.5	3.0		0.5	3.0	0.5				0.5	1.5
sessile-leaved tickclover (*Desmodium sessilifolium*)							3.0	3.0	0.5	3.0							0.6
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)	0.5	0.5					0.5									3.0	0.3
slender lespedeza (*Lespedeza virginica*)			0.5			0.5								15.0			1.0
Texas bull nettle (*Cnidoscolus texanus*)	0.5	15.0					15.0	15.0	0.5								2.9
Virginia pepperweed (*Lepidium virginicum*)	3.0		3.0	3.0	3.0	3.0			0.5	0.5	3.0	3.0	3.0	3.0	3.0	3.0	2.1
western ragweed (*Ambrosia psilostachya*)		0.5	3.0	3.0		3.0	3.0	3.0	15.0	15.0	0.5		3.0	15.0	15.0		4.9
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)					3.0		0.5										0.2
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	30.8
Forb Total																	13.5
Total Coverage																	44

Table 8. (Continued). Plot: A3, Day 60 (19 May 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)												3.0	3.0				0.4
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)							0.5	0.5									0.1
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)														0.5	0.5	0.5	0.1
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)		0.5	0.5		0.5				0.5	0.5							0.2
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)	0.5																0.0
western ragweed (*Ambrosia psilostachya*)	3.0	0.5	15.0	3.0	3.0				0.5						3.0	0.5	1.8
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	0.4
Forb Total																	2.1
Total Coverage																	3

Table 8. (Continued). Plot: B1, Day 60 (19 May 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)	0.5			15.0													1.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)	0.5				0.5			0.5	0.5								0.1
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)								3.0									0.2
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)	3.0				0.5		0.5					0.5				0.5	0.3
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)	0.5											0.5			0.5	3.0	0.3
western ragweed (*Ambrosia psilostachya*)		3.0	0.5														0.2
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	1.1
Forb Total																	1.0
Total Coverage																	2

Table 8. (Continued). Plot: B2, Day 60 (19 May 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)												3.0	0.5				0.2
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)			0.5												0.5		0.1
purple top (*Tridens flavus*)								0.5	0.5						0.5	3.0	0.3
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)												0.5					0.0
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)	0.5		0.5	15.0	0.5		0.5	3.0		15.0	0.5	3.0		0.5			2.4
western ragweed (*Ambrosia psilostachya*)			0.5	0.5					15.0		0.5	15.0					2.0
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	0.6
Forb Total																	4.4
Total Coverage																	5

Table 8. (Continued). Plot: B3, Day 60 (19 May 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)		0.5															0.0
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)															0.5		0.0
Virginia pepperweed (*Lepidium virginicum*)	0.5		0.5				15.0	3.0	15.0	15.0					15.0	15.0	4.9
western ragweed (*Ambrosia psilostachya*)	0.5	0.5		3.0			15.0	0.5	0.5						3.0	15.0	2.4
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	0.0
Forb Total																	7.4
Total Coverage																	7

Table 8. (Continued). Plot: C1, Day 60 (19 May 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)			0.5					0.5						0.5			0.1
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)					0.5						3.0	3.0	3.0				0.6
western ragweed (*Ambrosia psilostachya*)	0.5				0.5	0.5		15.0	15.0					0.5			2.0
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	0.0
Forb Total																	2.7
Total Coverage																	3

Table 8. (Continued). Plot: C2, Day 60 (19 May 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)		0.5		0.5	15.0		0.5		15.0					0.5			2.0
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)										0.5			3.0	85.5			5.6
Virginia pepperweed (*Lepidium virginicum*)	15.0	3.0	0.5		0.5			3.0	0.5		3.0	0.5	0.5		15.0	3.0	2.8
western ragweed (*Ambrosia psilostachya*)											3.0	0.5					0.2
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	0.0
Forb Total																	10.6
Total Coverage																	11

Table 8. (Continued). Plot: C3, Day 60 (19 May 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)																	0.0
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)								0.5	0.5								0.1
western ragweed (*Ambrosia psilostachya*)					0.5												0.0
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	0.0
Forb Total																	0.1
Total Coverage																	0

Table 8. (Continued). Plot: D1, Day 60 (19 May 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)				3.0													0.2
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)								0.5		0.5	0.5		0.5				0.1
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)																3.0	0.2
western ragweed (*Ambrosia psilostachya*)																	0.0
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	0.0
Forb Total																	0.5
Total Coverage																	1

Table 8. (Continued). Plot: D2, Day 60 (19 May 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)	0.5	0.5		3.0					0.5		0.5	0.5			0.5		0.4
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)			0.5	3.0													0.2
Virginia pepperweed (*Lepidium virginicum*)	0.5				3.0								0.5	0.5		0.5	0.3
western ragweed (*Ambrosia psilostachya*)																	0.0
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	0.0
Forb Total																	0.9
Total Coverage																	1

Table 8. (Continued). Plot: D3, Day 60 (19 May 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)	0.5	3.0		3.0	0.5	0.5	3.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	3.0	1.1
little bluestem (*Schizachyrium scoparium*)	3.0	3.0	15.0	62.5	37.5	3.0	15.0	3.0	62.5	37.5	37.5	3.0	3.0	37.5	37.5	3.0	22.7
purple top (*Tridens flavus*)	37.5	37.5	15.0	3.0	15.0	15.0	37.5	15.0	15.0	15.0	15.0	37.5	37.5	3.0	37.5	15.0	21.9
Scribner's panicum (*Dichanthelium oligosanthes*)					3.0	3.0			3.0	0.5		3.0	0.5	3.0	3.0	3.0	1.4
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)				3.0	0.5				3.0			3.0	0.5				0.6
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)		15.0	15.0														1.9
Virginia pepperweed (*Lepidium virginicum*)	15.0	3.0	15.0	15.0	15.0	15.0	3.0	15.0	15.0	15.0	3.0	3.0		3.0	3.0	0.5	8.7
western ragweed (*Ambrosia psilostachya*)			3.0	3.0		0.5											0.4
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	47.1
Forb Total																	11.6
Total Coverage																	59

Table 8. (Continued). Plot: A1, Day 90 (21 June 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)	0.5	0.5		0.5	0.5		0.5	0.5	0.5	3.0	3.0	15.0	3.0	0.5	3.0	3.0	2.1
Japanese brome (*Bromus japonicus*)				0.5	0.5								0.5	0.5			0.1
little bluestem (*Schizachyrium scoparium*)	85.5	37.5	37.5	37.5	15.0	37.5	62.5	62.5	85.5	85.5	3.0	3.0	37.5	62.5	37.5	85.5	48.5
purple top (*Tridens flavus*)		0.5	3.0	15.0	15.0	15.0	3.0				3.0	0.5	3.0	3.0	0.5		3.8
Scribner's panicum (*Dichanthelium oligosanthes*)		3.0	15.0	3.0	3.0	0.5	0.5	3.0	15.0	0.5	3.0	0.5	3.0	3.0	0.5	15.0	4.3
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)						3.0											0.2
lambsquarters (*Chenopodium album*)				0.5		0.5	0.5				3.0				0.5		0.3
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)	3.0		3.0		3.0				3.0					3.0	3.0		1.1
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)																	0.0
slender lespedeza (*Lespedeza virginica*)																15.0	0.9
Texas bull nettle (*Cnidoscolus texanus*)		37.5															2.3
Virginia pepperweed (*Lepidium virginicum*)		3.0	3.0	15.0	3.0	3.0	3.0	0.5	0.5			15.0	15.0	3.0	0.5	3.0	4.2
western ragweed (*Ambrosia psilostachya*)	15.0	3.0	0.5		0.5	3.0	15.0	3.0		0.5	3.0	3.0	3.0		0.5	0.5	3.2
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																0.5	0.0
yellow wood sorrel (*Oxalis stricta*)																0.5	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	58.8
Forb Total																	12.3
Total Coverage																	71

Table 8. (Continued). Plot: A2, Day 90 (21 June 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)		0.5						0.5				3.0			0.5		0.3
little bluestem (*Schizachyrium scoparium*)	3.0	0.5	0.5	15.0	3.0	0.5	0.5	3.0	15.0	15.0	3.0		3.0	15.0		3.0	5.0
purple top (*Tridens flavus*)	3.0	0.5	37.5	15.0	15.0	3.0		0.5	0.5	3.0	15.0	37.5	15.0	3.0	15.0	3.0	10.4
Scribner's panicum (*Dichanthelium oligosanthes*)				3.0	3.0							3.0		3.0			0.8
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)	15.0	3.0	3.0		15.0	37.5		3.0	3.0	3.0	15.0	3.0		3.0	3.0		6.7
sessile-leaved tickclover (*Desmodium sessilifolium*)		3.0				3.0	15.0	15.0	15.0	3.0						3.0	3.6
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)	3.0		3.0				0.5		15.0	3.0	3.0			3.0		37.5	4.3
slender lespedeza (*Lespedeza virginica*)			15.0			3.0								37.5			3.5
Texas bull nettle (*Cnidoscolus texanus*)	85.5	62.5					37.5	37.5	3.0	3.0							14.3
Virginia pepperweed (*Lepidium virginicum*)	3.0	0.5	3.0	15.0	15.0	15.0	3.0	0.5		3.0	15.0	3.0	15.0	15.0	3.0	15.0	7.8
western ragweed (*Ambrosia psilostachya*)		3.0	3.0	3.0		3.0	3.0	3.0	3.0	15.0	3.0	3.0	15.0	15.0	15.0		5.4
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	16.4
Forb Total																	45.4
Total Coverage																	62

Table 8. (Continued). Plot: A3, Day 90 (21 June 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)												3.0	3.0				0.4
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)												3.0	15.0				1.1
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)	3.0			3.0					0.5						3.0	3.0	0.8
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)		0.5															0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)		3.0					3.0		3.0		3.0				3.0	3.0	1.1
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)						0.5											0.0
Virginia pepperweed (*Lepidium virginicum*)	0.5	0.5	3.0	15.0	3.0	3.0	3.0	3.0	15.0		3.0	3.0		3.0	3.0		3.6
western ragweed (*Ambrosia psilostachya*)				3.0					15.0		3.0		3.0				1.5
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)				0.5													0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	2.3
Forb Total																	6.3
Total Coverage																	9

Table 8. (Continued). Plot: B1, Day 90 (21 June 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)									3.0								0.2
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)							3.0	3.0	3.0								0.6
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)									3.0	0.5		0.5		3.0	3.0	3.0	0.8
sessile-leaved tickclover (*Desmodium sessilifolium*)												3.0					0.2
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)		15.0	37.5		3.0		3.0		3.0	3.0	3.0		3.0				4.4
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)	3.0				3.0												0.4
western ragweed (*Ambrosia psilostachya*)	37.5	15.0	15.0	15.0	37.5			3.0	3.0			3.0		3.0	15.0	15.0	10.1
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	0.8
Forb Total																	15.9
Total Coverage																	17

Table 8. (Continued). Plot: B2, Day 90 (21 June 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)													0.5				0.0
purple top (*Tridens flavus*)	15.0		3.0	15.0	0.5			3.0	3.0							3.0	2.7
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)	37.5	3.0	37.5	0.5	15.0	15.0		15.0		15.0	15.0	15.0	0.5	37.5	15.0	15.0	14.8
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)												15.0	0.5	3.0	3.0	15.0	2.3
western ragweed (*Ambrosia psilostachya*)	15.0	3.0															1.1
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	2.7
Forb Total																	18.2
Total Coverage																	21

Table 8. (Continued). Plot: B3, Day 90 (21 June 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Section																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																0.5	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)		15.0			0.5				3.0								1.2
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)						0.5					37.5				3.0	0.5	2.6
Virginia pepperweed (*Lepidium virginicum*)			3.0				15.0	15.0	15.0	15.0					15.0	15.0	5.8
western ragweed (*Ambrosia psilostachya*)	15.0	15.0		37.5			37.5	15.0	15.0	3.0					3.0	3.0	9.0
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	0.0
Forb Total																	18.6
Total Coverage																	19

Table 8. (Continued). Plot: C1, Day 90 (21 June 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)	3.0		37.5			3.0		3.0					15.0				3.8
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)				37.5	37.5				3.0					0.5			4.9
Virginia pepperweed (*Lepidium virginicum*)					3.0							3.0	3.0		3.0		0.8
western ragweed (*Ambrosia psilostachya*)	15.0	3.0			3.0	3.0	15.0	15.0	15.0	0.5	15.0	3.0		3.0			5.7
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	0.0
Forb Total																	15.2
Total Coverage																	15

Table 8. (Continued). Plot: C2, Day 90 (21 June 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)	3.0							15.0					3.0	3.0	3.0		1.7
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)	0.5	15.0	15.0	37.5	15.0	15.0	0.5	15.0	37.5		3.0	15.0	15.0	3.0	3.0		11.9
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)	3.0	37.5			37.5	15.0				3.0	15.0	15.0	0.5	85.5	62.5		17.2
Virginia pepperweed (*Lepidium virginicum*)	15.0	15.0			3.0			3.0	0.5				3.0		3.0	3.0	2.8
western ragweed (*Ambrosia psilostachya*)										3.0		3.0					0.4
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)											15.0						0.9
Grass Total																	0.0
Forb Total																	34.9
Total Coverage																	35

Table 8. (Continued). Plot: C3, Day 90 (21 June 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)				3.0								0.5					0.2
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)										3.0							0.2
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)		3.0															0.2
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)	3.0	3.0						3.0									0.6
western ragweed (*Ambrosia psilostachya*)	0.5	0.5	3.0	15.0					0.5		3.0						1.4
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	0.0
Forb Total																	2.6
Total Coverage																	3

Table 8. (Continued). Plot: D1, Day 90 (21 June 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)					15.0							0.5					1.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)		0.5		3.0			3.0			0.5							0.4
sessile-leaved tickclover (*Desmodium sessilifolium*)															3.0		0.2
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)	15.0							3.0	15.0	3.0	15.0	3.0		3.0		3.0	3.8
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)	0.5								0.5								0.1
Virginia pepperweed (*Lepidium virginicum*)				3.0												3.0	0.4
western ragweed (*Ambrosia psilostachya*)			0.5									3.0		3.0			0.4
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	0.0
Forb Total																	6.2
Total Coverage																	6

Table 8. (Continued). Plot: D2, Day 90 (21 June 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)					3.0												0.2
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)	15.0	15.0		3.0	15.0	37.5	3.0	37.5	3.0	3.0	15.0	3.0			15.0	15.0	11.3
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)			62.5	85.5	62.5	37.5							0.5	0.5		0.5	15.6
Virginia pepperweed (*Lepidium virginicum*)	15.0								3.0				3.0	3.0	3.0	3.0	1.9
western ragweed (*Ambrosia psilostachya*)							3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	1.5
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	0.0
Forb Total																	30.4
Total Coverage																	30

Table 8. (Continued). Plot: D3, Day 90 (21 June 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)	3.0		15.0	37.5	37.5	3.0	3.0		62.5	37.5	37.5		3.0	37.5	37.5	3.0	19.8
purple top (*Tridens flavus*)	37.5	62.5	37.5	3.0	3.0	37.5	37.5	37.5	15.0	15.0	15.0	62.5	62.5	3.0	15.0	62.5	31.7
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)	15.0			15.0		3.0		3.0	3.0			3.0					2.6
slender lespedeza (*Lespedeza virginica*)													62.5				3.9
Texas bull nettle (*Cnidoscolus texanus*)		15.0	15.0														1.9
Virginia pepperweed (*Lepidium virginicum*)	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	3.0	3.0		3.0			3.0	3.0	8.4
western ragweed (*Ambrosia psilostachya*)				3.0													0.2
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	51.5
Forb Total																	17.0
Total Coverage																	69

Table 8. (Continued). Plot: A1, Day 120 (19 July 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)								3.0		3.0	3.0		3.0		15.0	3.0	1.9
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)	62.5	62.5	15.0	37.5	15.0	37.5	85.5	62.5	85.5	85.5	37.5	37.5	62.5	85.5	62.5	85.5	57.5
purple top (*Tridens flavus*)		3.0	15.0	15.0	37.5	15.0	3.0		3.0		15.0	3.0	3.0	3.0	3.0		7.4
Scribner's panicum (*Dichanthelium oligosanthes*)			3.0	3.0	3.0		3.0									3.0	0.9
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)						3.0											0.2
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)	3.0		3.0		3.0												0.6
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)			3.0	3.0							3.0				15.0	3.0	1.7
slender lespedeza (*Lespedeza virginica*)								3.0									0.2
Texas bull nettle (*Cnidoscolus texanus*)		15.0												0.5			1.0
Virginia pepperweed (*Lepidium virginicum*)			15.0	15.0		15.0	3.0				3.0	15.0	15.0			3.0	5.3
western ragweed (*Ambrosia psilostachya*)	15.0	3.0	3.0		3.0	3.0	3.0	3.0		3.0	3.0	3.0				3.0	2.8
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)						3.0											0.2
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	67.7
Forb Total																	11.8
Total Coverage																	80

Table 8. (Continued). Plot: A2, Day 120 (19 July 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)			37.5	37.5	15.0	15.0	3.0	15.0	62.5	37.5	15.0	15.0	15.0	15.0	37.5	3.0	20.2
purple top (*Tridens flavus*)	15.0	15.0	15.0	37.5	15.0	15.0	3.0	3.0	3.0	15.0	3.0	15.0	15.0	3.0	37.5	3.0	13.3
Scribner's panicum (*Dichanthelium oligosanthes*)				3.0	3.0												0.4
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)	15.0				15.0	37.5		15.0		15.0	37.5	3.0					8.6
sessile-leaved tickclover (*Desmodium sessilifolium*)		15.0				3.0	15.0	15.0	15.0	3.0						15.0	5.1
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)	15.0	3.0	3.0		3.0	15.0			15.0		15.0	15.0	15.0	15.0	3.0	62.5	11.2
slender lespedeza (*Lespedeza virginica*)			15.0			15.0							3.0	37.5			4.4
Texas bull nettle (*Cnidoscolus texanus*)	85.5	62.5					37.5	37.5	15.0	3.0							15.1
Virginia pepperweed (*Lepidium virginicum*)	15.0			15.0	15.0	15.0	15.0		15.0	3.0	15.0	37.5	15.0	3.0	15.0	15.0	12.1
western ragweed (*Ambrosia psilostachya*)		15.0	15.0	3.0		15.0	15.0		15.0	15.0	15.0	15.0	15.0	15.0	15.0		10.5
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)					15.0												0.9
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	33.9
Forb Total																	67.9
Total Coverage																	102

Table 8. (Continued). Plot: A3, Day 120 (19 July 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)												3.0	3.0				0.4
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)	3.0																0.2
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																0.5	0.0
purple top (*Tridens flavus*)				15.0											3.0		1.1
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)				3.0													0.2
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)		15.0					15.0		3.0		3.0					15.0	3.2
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)						0.5								0.5			0.1
Virginia pepperweed (*Lepidium virginicum*)		3.0	15.0	15.0	15.0	3.0	3.0	3.0	37.5	37.5	3.0	3.0	3.0	3.0			9.0
western ragweed (*Ambrosia psilostachya*)				15.0							3.0		15.0				2.1
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	1.7
Forb Total																	14.5
Total Coverage																	16

Table 8. (Continued). Plot: B1, Day 120 (19 July 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)								3.0	3.0								0.4
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)							3.0										0.2
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)				3.0						3.0				3.0	15.0		1.5
sessile-leaved tickclover (*Desmodium sessilifolium*)								3.0				3.0	15.0				1.3
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)	3.0	15.0	37.5	3.0					3.0	3.0	3.0		3.0				4.4
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)	15.0																0.9
western ragweed (*Ambrosia psilostachya*)	62.5	37.5	37.5	37.5	37.5	3.0		15.0	15.0			3.0		37.5	37.5	15.0	21.2
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	0.4
Forb Total																	29.5
Total Coverage																	30

Table 8. (Continued). Plot: B2, Day 120 (19 July 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)				3.0													0.2
purple top (*Tridens flavus*)	15.0		3.0	37.5				15.0									4.4
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)	3.0						3.0	15.0									1.3
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)	37.5		15.0		37.5	37.5	15.0										8.9
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)	3.0			3.0	3.0												0.6
western ragweed (*Ambrosia psilostachya*)	3.0	15.0	15.0	3.0				15.0									3.2
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	4.6
Forb Total																	14.0
Total Coverage																	19

Table 8. (Continued). Plot: B3, Day 120 (19 July 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)		15.0			3.0				3.0								1.3
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)		0.5									15.0				15.0	15.0	2.8
Virginia pepperweed (*Lepidium virginicum*)	15.0		3.0				15.0	15.0	15.0	37.5					15.0	15.0	8.2
western ragweed (*Ambrosia psilostachya*)	62.5	37.5		85.5	3.0	3.0	85.5	85.5	37.5	37.5					37.5		29.7
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)			15.0														0.9
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	0.0
Forb Total																	42.9
Total Coverage																	43

Table 8. (Continued). Plot: C1, Day 120 (19 July 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)	15.0		37.5				3.0		3.0					15.0			4.6
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)			3.0	85.5	85.5	3.0	.							0.5			11.1
Virginia pepperweed (*Lepidium virginicum*)												3.0	3.0	3.0			0.6
western ragweed (*Ambrosia psilostachya*)	15.0	15.0			3.0	15.0		62.5	62.5	3.0	15.0	3.0		3.0			12.3
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	0.0
Forb Total																	28.6
Total Coverage																	29

Table 8. (Continued). Plot: C2, Day 120 (19 July 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)						3.0	3.0			3.0	3.0						0.8
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)	15.0			3.0			3.0	37.5					15.0	3.0	15.0	3.0	5.9
sessile-leaved tickclover (*Desmodium sessilifolium*)											3.0						0.2
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)	15.0	15.0	15.0	15.0	3.0	37.5	15.0	15.0	62.5	3.0	15.0	15.0	15.0	15.0	15.0	3.0	17.1
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)		15.0	37.5	0.5		15.0				15.0	37.5	15.0	3.0	62.5	62.5		16.5
Virginia pepperweed (*Lepidium virginicum*)	15.0	15.0	3.0	3.0	3.0			15.0	3.0		3.0	3.0	3.0	3.0	15.0	15.0	6.2
western ragweed (*Ambrosia psilostachya*)					3.0					15.0	15.0	15.0		15.0			3.9
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	0.0
Forb Total																	50.6
Total Coverage																	51

Table 8. (Continued). Plot: C3, Day 120 (19 July 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)				3.0								3.0					0.4
prickly pear (*Opuntia spp.*)										3.0							0.2
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)	0.5	3.0															0.2
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																15.0	0.9
Virginia pepperweed (*Lepidium virginicum*)	3.0							3.0						0.5			0.4
western ragweed (*Ambrosia psilostachya*)		3.0		15.0	37.5			3.0	3.0		15.0					3.0	5.0
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	0.0
Forb Total																	7.1
Total Coverage																	7

Table 8. (Continued). Plot: D1, Day 120 (19 July 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)					37.5												2.3
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)		3.0	3.0	37.5	15.0	3.0	15.0			3.0							5.0
sessile-leaved tickclover (*Desmodium sessilifolium*)	3.0														3.0		0.4
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)	37.5							15.0	37.5	15.0	15.0	3.0		3.0		15.0	8.8
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)	0.5								0.5					0.5		0.5	0.1
Virginia pepperweed (*Lepidium virginicum*)				3.0												15.0	1.1
western ragweed (*Ambrosia psilostachya*)			3.0	15.0								3.0					1.3
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	0.0
Forb Total																	19.1
Total Coverage																	19

Table 8. (Continued). Plot: D2, Day 120 (19 July 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)						3.0											0.2
sessile-leaved tickclover (*Desmodium sessilifolium*)						3.0											0.2
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)	37.5	15.0		15.0	15.0	37.5	37.5	85.5	3.0		15.0	3.0	15.0		15.0	15.0	19.3
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)			85.5	85.5	62.5	37.5					3.0		0.5	0.5		0.5	17.2
Virginia pepperweed (*Lepidium virginicum*)	3.0				3.0				3.0				3.0	3.0		3.0	1.1
western ragweed (*Ambrosia psilostachya*)							15.0			15.0	3.0	3.0	15.0	3.0	3.0	37.5	5.9
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	0.0
Forb Total																	43.9
Total Coverage																	44

Table 8. (Continued). Plot: D3, Day 120 (19 July 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)	3.0	3.0		37.5	37.5	3.0	3.0	3.0	62.5	37.5	15.0	3.0	15.0	15.0	37.5	15.0	18.2
purple top (*Tridens flavus*)	37.5	62.5	37.5	15.0	15.0	37.5	15.0	37.5	15.0	15.0	3.0	62.5	37.5	3.0	15.0	37.5	27.9
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)	0.5			3.0					3.0		3.0						0.6
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)		3.0	3.0											37.5		0.5	2.8
Virginia pepperweed (*Lepidium virginicum*)	15.0	15.0	37.5	15.0	15.0	37.5	15.0	15.0	3.0	3.0		3.0				3.0	11.1
western ragweed (*Ambrosia psilostachya*)																	0.0
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	46.0
Forb Total																	14.4
Total Coverage																	60

Table 8. (Continued). Plot: A1, Day 150 (26 Aug. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)					3.0	3.0				0.5	3.0	3.0				3.0	1.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)	62.5	62.5	37.5	37.5	15.0	37.5	62.5	62.5	85.5	85.5	62.5	37.5	37.5	15.0	62.5	37.5	50.1
purple top (*Tridens flavus*)		3.0	15.0	3.0	15.0	3.0	3.0		3.0			3.0	15.0	15.0		3.0	5.1
Scribner's panicum (*Dichanthelium oligosanthes*)		3.0							3.0				3.0	0.5	3.0	3.0	1.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)			3.0	3.0	3.0			3.0			0.5						0.8
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)									3.0							3.0	0.4
silverleaf nightshade (*Solanum elaeagnifolium*)																	0.0
slender lespedeza (*Lespedeza virginica*)															3.0	15.0	1.1
Texas bull nettle (*Cnidoscolus texanus*)		3.0															0.2
Virginia pepperweed (*Lepidium virginicum*)	3.0		15.0	15.0	3.0	3.0					3.0	15.0	15.0	3.0	3.0	3.0	5.1
western ragweed (*Ambrosia psilostachya*)	37.5		3.0		3.0	3.0	3.0	3.0			3.0	3.0					3.7
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	57.1
Forb Total																	11.2
Total Coverage																	68

Table 8. (Continued). Plot: A2, Day 150 (26 Aug. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)		3.0	15.0	15.0	15.0	15.0	3.0	15.0	37.5	37.5	3.0		3.0	37.5	3.0	3.0	12.8
purple top (*Tridens flavus*)		3.0	37.5	3.0	15.0	3.0	3.0	15.0	0.5	3.0	3.0	15.0	15.0	3.0	15.0	15.0	9.3
Scribner's panicum (*Dichanthelium oligosanthes*)				3.0													0.2
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)	15.0				15.0	15.0					37.5	15.0	15.0	3.0			7.2
sessile-leaved tickclover (*Desmodium sessilifolium*)		3.0						15.0	15.0	3.0						15.0	3.2
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)	3.0					3.0			15.0	3.0		15.0		3.0		15.0	3.6
slender lespedeza (*Lespedeza virginica*)			15.0	15.0								3.0		15.0			3.0
Texas bull nettle (*Cnidoscolus texanus*)	62.5	62.5	0.5				37.5	37.5									12.5
Virginia pepperweed (*Lepidium virginicum*)	15.0		3.0	3.0	3.0						3.0	15.0	3.0		3.0	15.0	3.9
western ragweed (*Ambrosia psilostachya*)			3.0		15.0	15.0			3.0	3.0	3.0		15.0	15.0	37.5	3.0	7.0
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	22.3
Forb Total																	40.5
Total Coverage																	63

Table 8. (Continued). Plot: A3, Day 150 (26 Aug. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)							1.0										0.1
big bluestem (*Andropogon gerardii*)												3.0	3.0				0.4
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)		3.0											0.5				0.2
Indian grass (*Sorghastrum nutans*)	3.0										15.0	3.0					1.3
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)															3.0		0.2
purple top (*Tridens flavus*)			15.0	3.0							15.0						2.1
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)		3.0															0.2
prickly pear (*Opuntia spp.*)				3.0													0.2
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)		3.0						3.0	0.5						3.0	0.5	0.6
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)							0.5					0.5				0.5	0.1
Virginia pepperweed (*Lepidium virginicum*)			15.0	3.0		15.0	0.5	3.0	3.0		3.0	3.0	3.0				3.0
western ragweed (*Ambrosia psilostachya*)	37.5	15.0	15.0	37.5					15.0	15.0	3.0	15.0					9.6
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	4.2
Forb Total																	14
Total Coverage																	18

Table 8. (Continued). Plot: B1, Day 150 (26 Aug. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)					3.0					3.0	3.0			0.5			0.6
Indian grass (*Sorghastrum nutans*)								3.0	15.0								1.1
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																3.0	0.2
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)				15.0						15.0				3.0	3.0		2.3
sessile-leaved tickclover (*Desmodium sessilifolium*)								3.0			3.0	3.0					0.6
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)		3.0	15.0	3.0			3.0		3.0	3.0			3.0				2.1
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)					3.0												0.2
western ragweed (*Ambrosia psilostachya*)	85.5	62.5	37.5	62.5	62.5	15.0		37.5	37.5		15.0			85.5	85.5	37.5	39.0
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	1.9
Forb Total																	44.1
Total Coverage																	46

Table 8. (Continued). Plot: B2, Day 150 (26 Aug. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)	15.0			37.5	3.0			3.0	3.0						0.5		3.9
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)	3.0						3.0	15.0									1.3
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)	15.0		15.0		15.0	15.0				3.0	15.0	15.0		37.5	15.0	3.0	9.3
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)				0.5	15.0							15.0	3.0	3.0	15.0	15.0	4.2
western ragweed (*Ambrosia psilostachya*)	3.0	15.0	37.5	3.0				37.5				3.0	3.0	3.0		3.0	6.8
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	3.9
Forb Total																	21.5
Total Coverage																	25

Table 8. (Continued). Plot: B3, Day 150 (26 Aug. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)													1.0				0.1
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)		3.0		3.0			0.5			0.5			0.5				0.5
Indian grass (*Sorghastrum nutans*)																15.0	0.9
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																0.5	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)		15.0									3.0						1.1
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)		0.5									15.0	0.5			3.0		1.2
Virginia pepperweed (*Lepidium virginicum*)																	0.0
western ragweed (*Ambrosia psilostachya*)	62.5	37.5	0.5	85.5	37.5	15.0	85.5	85.5	85.5	37.5				3.0	62.5	37.5	39.7
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	1.5
Forb Total																	42.0
Total Coverage																	44

Table 8. (Continued). Plot: C1, Day 150 (26 Aug. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)		0.5	3.0								0.5	0.5	3.0	0.5		0.5	0.5
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)	15.0		15.0						3.0								2.1
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)			3.0	85.5	85.5	3.0											11.1
Virginia pepperweed (*Lepidium virginicum*)															3.0		0.2
western ragweed (*Ambrosia psilostachya*)	37.5	37.5			3.0	15.0	3.0	85.5	37.5	3.0	15.0	15.0		15.0			16.7
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)			15.0														0.9
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	0.5
Forb Total																	30.9
Total Coverage																	31

Table 8. (Continued). Plot: C2, Day 150 (26 Aug. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)	3.0	3.0		15.0	15.0							3.0	3.0	15.0	3.0	3.0	3.9
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)	37.5			3.0			15.0	15.0					15.0	3.0	15.0		6.5
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)	15.0		3.0	3.0	3.0	37.5			37.5						15.0	15.0	8.1
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)		3.0	37.5			15.0	3.0			15.0	37.5	37.5		37.5	37.5		14.0
Virginia pepperweed (*Lepidium virginicum*)	15.0	15.0		3.0	3.0			3.0	3.0	15.0					15.0	3.0	4.7
western ragweed (*Ambrosia psilostachya*)					15.0					37.5	15.0	15.0	15.0	3.0		3.0	6.5
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)						15.0	37.5										3.3
Grass Total																	3.9
Forb Total																	42.9
Total Coverage																	47

Table 8. (Continued). Plot: C3, Day 150 (26 Aug. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)		1.0	1.0									2.0		1.0		1.0	0.4
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)	0.5	0.5	0.5	0.5	0.5	0.5	0.5		0.5				0.5			3.0	0.5
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)										15.0							0.9
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)		3.0															0.2
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)	3.0	0.5						3.0				3.0		0.5			0.6
western ragweed (*Ambrosia psilostachya*)		3.0	0.5	15.0	85.5	0.5		3.0	15.0		15.0	0.5					8.6
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	0.8
Forb Total																	10.4
Total Coverage																	11

Table 8. (Continued). Plot: D1, Day 150 (26 Aug. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)	3.0		0.5		3.0					0.5		0.5	3.0	0.5	0.5	0.5	0.8
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)					15.0												0.9
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)		15.0	15.0	37.5	15.0	15.0	15.0			3.0							7.2
sessile-leaved tickclover (*Desmodium sessilifolium*)							3.0			3.0					0.5		0.4
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)	3.0							15.0	15.0	3.0	3.0	15.0		15.0		3.0	4.5
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)									3.0								0.2
Virginia pepperweed (*Lepidium virginicum*)																	0.0
western ragweed (*Ambrosia psilostachya*)		3.0	3.0	15.0			3.0					15.0					2.4
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	0.8
Forb Total																	15.7
Total Coverage																	16

Table 8. (Continued). Plot: D2, Day 150 (26 Aug. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)			3.0			3.0		0.5							0.5	0.5	0.5
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)		3.0				3.0	15.0										1.3
sessile-leaved tickclover (*Desmodium sessilifolium*)					3.0												0.2
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)	15.0	15.0			3.0	3.0	15.0	37.5	0.5		3.0	3.0	15.0		3.0	3.0	7.3
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)			62.5	62.5	62.5	37.5					3.0		0.5	0.5			14.3
Virginia pepperweed (*Lepidium virginicum*)	15.0	0.5			3.0								3.0	0.5			1.4
western ragweed (*Ambrosia psilostachya*)							15.0		3.0	15.0	3.0	15.0	37.5	15.0	3.0	37.5	9.0
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	0.5
Forb Total																	33.4
Total Coverage																	34

Table 8. (Continued). Plot: D3, Day 150 (26 Aug. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)	15.0	37.5					15.0		3.0						15.0	3.0	5.5
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)	15.0	3.0	15.0	37.5	37.5	3.0		15.0	85.5	62.5	15.0	37.5	37.5	37.5	62.5	3.0	29.2
purple top (*Tridens flavus*)	62.5	37.5	37.5	15.0	3.0	37.5	37.5	15.0		3.0	15.0	37.5	15.0		15.0	37.5	23.0
Scribner's panicum (*Dichanthelium oligosanthes*)					3.0		3.0								3.0		0.6
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)																	0.0
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)											37.5			37.5			4.7
Virginia pepperweed (*Lepidium virginicum*)	15.0	15.0	37.5	15.0	15.0	15.0	15.0	15.0	15.0			15.0				3.0	11.0
western ragweed (*Ambrosia psilostachya*)																	0.0
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	58.3
Forb Total																	15.7
Total Coverage																	74

Table 8. (Continued). Plot: A1, Day 180 (22 Sept. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)					15.0	15.0	3.0			15.0	15.0		15.0	3.0	15.0	3.0	6.2
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)	37.5	62.5	37.5	37.5	37.5	15.0	37.5	62.5	97.5	85.5	62.5	37.5	62.5	62.5	85.5	62.5	55.2
purple top (*Tridens flavus*)			15.0		15.0	15.0	3.0				3.0			3.0			3.4
Scribner's panicum (*Dichanthelium oligosanthes*)		15.0	3.0	3.0	3.0						3.0		15.0			15.0	3.6
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)								15.0									0.9
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																3.0	0.2
silverleaf nightshade (*Solanum elaeagnifolium*)																	0.0
slender lespedeza (*Lespedeza virginica*)															3.0	37.5	2.5
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)	3.0	15.0	15.0	15.0	3.0		3.0		3.0			15.0	3.0	3.0	3.0	3.0	5.3
western ragweed (*Ambrosia psilostachya*)	62.5	3.0			3.0	3.0	3.0	15.0			3.0	37.5				3.0	8.3
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	68.3
Forb Total																	17.2
Total Coverage																	86

Table 8. (Continued). Plot: A2, Day 180 (22 Sept. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)	3.0	15.0	15.0	15.0	15.0	37.5		15.0	62.5	37.5		3.0	15.0	37.5	15.0	15.0	18.8
purple top (*Tridens flavus*)	3.0		15.0	15.0	3.0	15.0		15.0		15.0	3.0	15.0	15.0	3.0	15.0	15.0	9.2
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)	15.0		15.0	15.0						3.0	15.0						3.9
sessile-leaved tickclover (*Desmodium sessilifolium*)								15.0	15.0	3.0	15.0						3.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)														15.0	15.0		1.9
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)	62.5	62.5	15.0			3.0	37.5	62.5	15.0								16.1
Virginia pepperweed (*Lepidium virginicum*)	15.0			15.0	15.0		3.0		15.0			37.5	15.0	15.0		15.0	9.1
western ragweed (*Ambrosia psilostachya*)		15.0	15.0		15.0	15.0	15.0	15.0		15.0	15.0		37.5	15.0	15.0		11.7
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	28.0
Forb Total																	45.8
Total Coverage																	74

Table 8. (Continued). Plot: A3, Day 180 (22 Sept. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)												3.0	3.0				0.4
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)		15.0					3.0	3.0						3.0			1.5
Indian grass (*Sorghastrum nutans*)	3.0																0.2
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)															3.0	3.0	0.4
purple top (*Tridens flavus*)			15.0					3.0							3.0		1.3
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)				15.0													0.9
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)		3.0															0.2
slender lespedeza (*Lespedeza virginica*)																0.5	0.0
Texas bull nettle (*Cnidoscolus texanus*)						3.0	15.0	3.0					3.0				1.5
Virginia pepperweed (*Lepidium virginicum*)			15.0	15.0	3.0	15.0			15.0			15.0		3.0		15.0	6.0
western ragweed (*Ambrosia psilostachya*)	37.5	15.0		62.5					15.0	15.0	37.5	15.0	62.5			15.0	17.2
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	3.8
Forb Total																	25.8
Total Coverage																	30

Table 8. (Continued). Plot: B1, Day 180 (22 Sept. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)			3.0			15.0					15.0	15.0			3.0	3.0	3.4
Indian grass (*Sorghastrum nutans*)								15.0	37.5							3.0	3.5
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)				15.0						15.0				15.0	15.0		3.8
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)			3.0		3.0												0.4
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)													3.0				0.2
western ragweed (*Ambrosia psilostachya*)	62.5	62.5	37.5	62.5	62.5	37.5	15.0	37.5	37.5			37.5		62.5	85.5	85.5	42.9
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	6.8
Forb Total																	47.2
Total Coverage																	54

Table 8. (Continued). Plot: B2, Day 180 (22 Sept. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)					15.0	3.0					3.0	15.0		3.0	3.0	3.0	2.8
Indian grass (*Sorghastrum nutans*)				37.5													2.3
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)									15.0							3.0	1.1
purple top (*Tridens flavus*)	15.0		15.0	3.0	3.0			15.0									3.2
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)		15.0					15.0	15.0									2.8
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)	3.0				3.0									3.0	3.0		0.8
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)				15.0	3.0							15.0	15.0	3.0	3.0	15.0	4.3
western ragweed (*Ambrosia psilostachya*)	15.0	15.0	37.5	37.5	15.0			15.0				15.0		15.0	3.0	15.0	11.4
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	9.5
Forb Total																	19.3
Total Coverage																	29

Table 8. (Continued). Plot: B3, Day 180 (22 Sept. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)																	0.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)				3.0													0.2
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)		3.0															0.2
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)												3.0				3.0	0.4
Virginia pepperweed (*Lepidium virginicum*)			3.0							15.0					37.5		3.5
western ragweed (*Ambrosia psilostachya*)	85.5	62.5	3.0	62.5	62.5	37.5	62.5	97.5	85.5	37.5	15.0				62.5	85.5	47.5
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	0.0
Forb Total																	51.7
Total Coverage																	52

Table 8. (Continued). Plot: C1, Day 180 (22 Sept. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)			3.0			3.0			15.0				15.0	3.0		15.0	3.4
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)																	0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)																	0.0
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)			3.0	85.5	62.5	15.0			3.0								10.6
Virginia pepperweed (*Lepidium virginicum*)											15.0			37.5			3.3
western ragweed (*Ambrosia psilostachya*)	37.5	15.0		3.0	3.0	15.0	15.0	85.5	62.5	62.5	37.5				15.0		22.0
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)		15.0															0.9
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	3.4
Forb Total																	36.8
Total Coverage																	40

Table 8. (Continued). Plot: C2, Day 180 (22 Sept. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)	3.0	3.0	15.0	15.0	15.0		3.0	15.0	3.0				3.0	37.5	15.0		8.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)												37.5					2.3
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)	37.5			15.0			15.0	15.0			15.0		15.0			15.0	8.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)														3.0			0.2
silverleaf nightshade (*Solanum elaeagnifolium*)						3.0											0.2
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)		15.0	37.5			15.0	15.0			37.5	37.5	15.0		15.0	62.5		15.6
Virginia pepperweed (*Lepidium virginicum*)	15.0	15.0	3.0		15.0			15.0	3.0		15.0	15.0			15.0	15.0	7.9
western ragweed (*Ambrosia psilostachya*)				3.0	37.5	15.0	15.0			37.5		15.0	37.5	15.0		15.0	11.9
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)		15.0	3.0			15.0	37.5										4.4
Grass Total																	10.3
Forb Total																	48.2
Total Coverage																	58

Table 8. (Continued). Plot: C3, Day 180 (22 Sept. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)		2.0										3.0		2.0	1.0	2.0	0.6
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)			3.0	15.0	15.0	0.5	0.5		3.0			3.0	3.0		37.5	15.0	6.0
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)							0.5										0.0
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)																	0.0
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)																	0.0
Virginia pepperweed (*Lepidium virginicum*)		3.0						37.5						3.0			2.7
western ragweed (*Ambrosia psilostachya*)	37.5	15.0	3.0	37.5	85.5			37.5	37.5		37.5					15.0	19.1
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	6.6
Forb Total																	21.9
Total Coverage																	28

Table 8. (Continued). Plot: D1, Day 180 (22 Sept. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)	37.5	3.0	3.0	37.5				3.0	3.0	15.0	37.5	15.0			3.0	15.0	10.8
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)				3.0	15.0	3.0				3.0							1.5
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)	15.0	15.0	37.5	15.0		37.5	15.0										8.4
sessile-leaved tickclover (*Desmodium sessilifolium*)													15.0				0.9
showy partridge pea (*Cassia fasciculata*)													3.0				0.2
silverleaf nightshade (*Solanum elaeagnifolium*)	15.0							3.0	15.0	3.0							2.3
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)	3.0								3.0				3.0			3.0	0.8
Virginia pepperweed (*Lepidium virginicum*)				3.0					3.0			37.5				15.0	3.7
western ragweed (*Ambrosia psilostachya*)	15.0	15.0	3.0	37.5													4.4
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	10.8
Forb Total																	22.1
Total Coverage																	33

Table 8. (Continued). Plot: D2, Day 180 (22 Sept. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot.

	Subplot																
Grasses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**AVG**
bermudagrass (*Cynodon dactylon*)																	0.0
big bluestem (*Andropogon gerardii*)																	0.0
broomsedge bluestem (*Andropogon virginicus*)																	0.0
crabgrass (*Digitaria ciliaris*)	3.0	3.0	3.0			15.0		15.0			3.0		3.0		3.0	15.0	3.9
Indian grass (*Sorghastrum nutans*)																	0.0
Japanese brome (*Bromus japonicus*)																	0.0
little bluestem (*Schizachyrium scoparium*)																	0.0
purple top (*Tridens flavus*)																	0.0
Scribner's panicum (*Dichanthelium oligosanthes*)																	0.0
Forbs																	
common chickweed (*Stellaria media*)																	0.0
daisy fleabane (*Erigeron annuus*)																	0.0
lambsquarters (*Chenopodium album*)																	0.0
kochia (*Kochia scoparia*)																	0.0
prickly pear (*Opuntia spp.*)																	0.0
sericea lespedeza (*Lespedeza cuneata*)	3.0						15.0										1.1
sessile-leaved tickclover (*Desmodium sessilifolium*)																	0.0
showy partridge pea (*Cassia fasciculata*)																	0.0
silverleaf nightshade (*Solanum elaeagnifolium*)						3.0				3.0			15.0				1.3
slender lespedeza (*Lespedeza virginica*)																	0.0
Texas bull nettle (*Cnidoscolus texanus*)			15.0	62.5	62.5	37.5			3.0		15.0			3.0		3.0	12.6
Virginia pepperweed (*Lepidium virginicum*)	15.0				3.0									3.0			1.3
western ragweed (*Ambrosia psilostachya*)					3.0		3.0	15.0	37.5	37.5	15.0	37.5	37.5	15.0	15.0	37.5	15.8
western yarrow (*Achillea millefolium*)																	0.0
white snakeroot (*Eupatorium rugosum*)																	0.0
yellow nutgrass (*Cyperus esculentus*)																	0.0
yellow wood sorrel (*Oxalis stricta*)																	0.0
ashy sunflower (*Helianthus mollis*)																	0.0
Grass Total																	3.9
Forb Total																	32.2
Total Coverage																	36

Table 8. (Continued). Plot: D3, Day 180 (22 Sept. 2005)
Percent cover of each species per subplot, average cover of each species (AVG) in plot, total grass cover in plot, total forb cover in plot and total plant cover in plot

VITA

John Phillip Kelley

Candidate for the Degree of

Masters of Science

Thesis: INFLUENCE OF ALLUVIAL SEDIMENTATION RATE ON FLOODPLAIN SOIL DEVELOPMENT AND VEGETATION

Major Field: Environmental Science

Personal Data: Born in Tulsa, Oklahoma, On April 9, 1980, the son of George and Dorci Kelley

Education: Graduated from Muskogee High School, Muskogee, Oklahoma in May 1994; received a Bachelor of Science degree in Horticulture from Oklahoma State University, Stillwater, Oklahoma, May 2003. Completed the requirements for the Masters of Science degree in Environmental Science at Oklahoma State University, in December 2006.

Experience: Graduate Research Assistant, Department of Plant and Soil Sciences, Oklahoma State University, Stillwater, Oklahoma, January 2004 to September 2006

Professional Organizations: Soil Science Society of America; Professional Soil Science Association of Oklahoma

Name: John Phillip Kelley Date of Degree: December, 2006

Institution: Oklahoma State University Location: Stillwater, Oklahoma

Title of Study: INFLUENCE OF ALLUVIAL SEDIMENTATION RATE ON FLOODPLAIN SOIL DEVELOPMENT AND VEGETATION

Pages in Study: 126 Candidate for the Degree of Master of Science

Major Field: Environmental Science

Part I:

Scope and Method of Study:

The purpose of this study was to evaluate soil forming and sedimentary processes responsible for the formation of two key paleosols in the Southern Plains (the Caddo and Copan Soil). Vertical trends in organic carbon content and clay-free particle size distribution were used to delineate sedimentary events and evaluate subsequent soil forming processes.

Findings and Conclusions:

Systematic changes in clay-free particle size and organic carbon content distribution with depth revealed sedimentary sequences throughout profiles, as well as, cumulic and pachic soil formation within thick mollic A horizons of buried soils.

Part II:

Scope and Method of Study:

The purpose of this study was to evaluate established herbaceous plant community response to burial by sedimentation and to serve as a pilot study for future studies of this kind. Sediment burial depths of 8, 16 and 24 cm were applied to established herbaceous plant plots in the spring. Percent plant coverage by species was then evaluated during the following growing season.

Findings and Conclusions:

Sediment burial depths of 8, 16 and 24 cm had no effect on percent coverage of pre-existing forb species. While, burial depths of 8, 16 and 24 cm killed almost all pre-existing grass species.

ADVISORS'S APPROVAL: Dr. Brian J. Carter