# VEGETATION AND FERTILIZATION EFFECTS ON WATER SOLUBLE ORGANIC CARBON AT THREE NORTH DAKOTA SITES

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**Title**

Vegetation and Fertilization Effects on Water Soluble Organic Carbon

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The Supervisory Committee certifies that this ***disquisition*** complies with North Dakota State University's regulations and meets the accepted standards for the degree of

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## ABSTRACT

The role of water soluble organic carbon (WSOC) in carbon sequestration is not well understood. This study was initiated to evaluate WSOC's role in sequestering carbon at three previously established mixed-species grassland plot sites in ND compared to cropland, as affected by species, species richness, fertility management, and harvest management. Soils were extracted with a 1:2 (w/v) soil:deionized water solution to determine WSOC. Analysis of variance and Tukey-Kramer HSD were used to determine if treatments affected WSOC. In general, WSOC decreased with increasing soil depth. Individual species showed greater WSOC compared to cropland checks, with no difference among species. Species richness and harvest frequency had no effect on WSOC, while WSOC was affected by phosphorus near the soil surface and nitrogen in the subsoil. Knowledge of treatment effects on WSOC can be used to maximize soil carbon sequestration, thus increasing productivity and profitability in agriculture.

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# INTRODUCTION

The role of water soluble organic carbon (WSOC) in soil organic carbon (SOC) sequestration is poorly understood and is often overlooked when C sequestration studies are conducted. This study was initiated to better understand the role that WSOC plays in the process of sequestering SOC in grassland and cropland systems. This study examined how individual grasses and forbs, mixtures of species, fertilizers, and harvesting frequency affected the concentration and distribution of WSOC in grassland/permanently vegetated research plots and adjacent cropland soils. This will help bring a clearer understanding of the small, short-term changes that are occurring within the soil so that we can better manage our grasslands, not only for forage and potential biofuels production, but also for soil quality so that optimum production can be maintained. Determining which individual species as well as mixtures of species can be useful in creating mixed grasslands on marginal agricultural lands for the purpose of sequestering carbon to improve soil quality and for biofuel production. This information can also help improve the management of our natural resources.

## Literature Review

### Soil Organic Carbon

Most soils contain carbon (C) in at least one of two forms: inorganic carbon (IC) and/or organic carbon (OC). Collectively, they make up the total carbon (TC) of the soil. The IC pool is made up of predominantly carbonate minerals such as calcite and dolomite. Inorganic carbonates are formed when byproducts of primary mineral weathering, such as $Ca^{+2}$ and $Mg^{+2}$ cations, are bound with $CO_2$ (Nelson and Sommers, 1996; Lal, 2008). Numerous review articles have shown that the SOC pool originates from plant, animal, and microbial residues at various stages of decomposition. Soil OC also includes exudates from active roots as well as active soil microfauna and -flora. The chemical components of these structures are made up of highly oxidizable carbohydrates, proteins, and lipids as well as more resilient lignin type compounds. Multiple oxidation events transform fresh organic residues through the humification process into humus. The degree of decomposition ranges anywhere from unaltered, recognizable tissues to highly decomposed, unidentifiable organic substances called humus (Nelson and Sommers, 1996; Sikora and Stott, 1996; Baldock and Skjemstad, 2000; Weil and Magdoff, 2004; Baldock, 2007; Rice et al., 2007; Lal, 2008; Silveira et al., 2008).

Soil organic matter (SOM) constitutes a large percentage of the total SOC pool. Soil OM, unlike SOC, consists of only non-living organic substances at varying stages of decay (Swift, 1996; SSSA, 2008). Within SOM, there are humic and non-humic substances. Humic material comprises approximately two-thirds of SOM and exists as humic acids (HA), fulvic acids (FA), and humin. Non-humic materials have undergone little decomposition in the soil and are identifiable as carbohydrates, proteins, amino acids, and other easily oxidizable fresh materials (Schnitzer, 1982). Fulvic acids have simple chemical structures, low molecular weights, and contain a large proportion of plant essential nutrients that are easily available for microbial oxidation. Conversely, HA's are high molecular weight substances that have formed complexes with other byproducts of decomposition making them more resilient to microbial oxidation, enabling them to remain protected in the soil much longer than FA's (Anderson and Coleman, 1985). Humin substances make up roughly half of the total SOM and are the most stabile of the humic substances and therefore have the longest residency time in soil (Weil and Magdoff, 2004).

Most agricultural soils contain anywhere from less than 1% up to 10% SOM. The chemical composition of SOM varies throughout the growing season, but is normally made up of approximately 50% C, 40% O, 5% H, 4% N, and 1% S. (Dick and Gregorich, 2004). Soil OM is highly variable in composition due to its various stages of decomposition. Therefore, SOM is broken down, or fractionated into different groupings based on its decomposability, particle size and density, and/or solubility (Baldock and Skjemstad, 2000). Separating SOM by solubility is a common method that uses an alkaline solution to separate the FA and HA from the more recalcitrant humin by solubilizing the FA and HA into solution. That solution is then acidified causing the HA to precipitate due to its insolubility in acid and leaving the acid soluble FA in solution (Schnitzer, 1982; Anderson and Coleman, 1985; Swift, 1996; Post et al., 2001; Wander, 2004). Fractionating SOM by availability for decomposition has been conducted by numerous researchers who have used 3 fractions, one of which included living organisms. Following the SSSA definition of OM, living organisms are excluded leaving 2 fractions: "labile/active and stabile/passive" (Weil and Magdoff, 2004; Haynes, 2005). Organic matter can also be partitioned by means of density and particle size yielding various labels for these fractions: "light and heavy fractions" (Post et al., 2001) and "particulate organic matter and macro organic matter" (Sikora and Stott, 1996). Of the three fractionation methods, the chemical solubility method is the most commonly used.

Organic Carbon by Depth

Numerous studies have shown that the overall trend of SOC distribution in mineral soils decreases with increasing depth (Haynes and Knight, 1989; Collins et al., 2000; Cihacek and Meyer, 2002). A global study of 2721 soil carbon profiles to a 1 meter depth across biomes and vegetation types found that SOC decreased with increasing depth (Jobbagy and Jackson, 2000). Overall, the uppermost 20 centimeters of soil contained 41% of the total SOC and two-thirds of the total root biomass. Root biomass was vertically distributed shallower in the profile than SOC. The SOC found deeper in the soil profile was due to leaching, diminished microbial oxidation with increasing depth from the surface, and fewer OM sources, such as roots (Jobbagy and Jackson, 2000).

Carbon Sequestration

The transformation and long-term storage of atmospheric $CO^2$ into SOC via photosynthesis and subsequently humification is known as C sequestration. In order for C to be sequestrated, the humic materials should be stored at depths of at least 0.5 to 1.0 m from the soil surface to ensure increased residence time (Lal, 2008). In a review article by Paustian et al. (1997), C sequestration has different definitions depending on the reason for C storage. For purposes of mitigating atmospheric greenhouse gases such as $CO^2$, C sequestration refers to the net yield of OC additions to the soil minus the losses. However, in an agricultural setting with various cultivation and management techniques, C sequestration could be defined as any increase in average OC content over the duration of a management regime (Paustian et al., 1997). Management plans for increasing C sequestration require that the rate of soil C inputs outpace the losses, or rate of OC decomposition (Paustian et al., 1997; Mishra et al., 2010).

Soil Organic Carbon Additions

Soil OC is added to the soil from OM in the form of plant, animal, and soil organism detritus residues (Anderson and Coleman, 1985) as well as organic amendments such as animal manure (Paustian et al., 1997). Active plant roots supplement SOC through the release of exudates, growth and senescence of roots, and through microbial oxidation of active roots, all of which define C rhizodeposition (Shamoot et al., 1968). The amount, or degree of rhizodeposition is directly correlated to root biomass production (van der Krift et al., 2001). The fresh OC supplied through rhizodeposition creates what is known as a priming effect, where microbial populations boom due to the presence of easily oxidizable OC. Elevated microbial populaces feed on the fresh root derived C until it is depleted and then turn to the less energy-rich, condensed and stabilized SOC (Cheng et al., 2003). The once stabilized humic material undergoes further humification and once again becomes labile with the ability to move deeper into the soil profile due to microorganisms (Kalbitz et al., 2005). The labile SOC is likely to become adsorbed onto mineral surfaces at deeper depths, reducing its rate of decomposition, thus increasing its residence time (Baldock and Skjemstad, 2000). As fresh, energy rich, C from aboveground litter and rhizodeposition become depleted, the microbial community decreases. Microbial communities downsize due to a lack of energy-rich, fresh OC sources because the decomposition of older, more humified C requires more energy than is provided through its oxidation (Fontaine et al., 2007).

Factors Influencing SOC Storage/Decomposition

Soil OC decomposition rates are influenced by natural and anthropogenic factors. The natural factors that form SOC are similar to those that form soil: climate, living organisms, topography, parent material, and time. The human induced factors involve disturbance and are management driven within agroecosystems. Numerous review articles agree that climate has the biggest impact on formation and decomposition of SOC, mainly through the influence of temperature and moisture (Stevenson, 1994; Johnson, 1995; Paustian et al., 1997; Dick and Gregorich, 2004; Weil and Magdoff, 2004). Soils in warm and wet climes such as the tropics typically have less SOC (Stevenson, 1994) than those in higher latitudes with cool moist conditions (Johnson, 1995). Soil OM decomposition increases when soil water filled pore space increases from 30 to 60%, but above 70% water filled pore space, decomposition is slowed, or inhibited due to a lack of oxygen for microbial activity (Doran et al., 1990). Microorganisms are responsible for the oxidation, or decomposition of OM in soil. It has been found that decomposition decreases with increasing soil depth and is thought to be due to a combination of decreased oxygen at depth, SOC absorption to Fe and Al oxides and oxyhydroxides, as well as a lack of adequate fresh carbon sources to support microbial populations (Fontaine et al., 2007). The topography or slope of a landscape can determine the temperature and amount of moisture in a soil, affecting SOC decomposition rates. Soils that receive less sunlight such as those on steep north facing slopes in the northern hemisphere experience lower rates of SOC decomposition due to cool and wet soil conditions that are less than optimal for microbial growth (Weil and Magdoff, 2004). Steep slopes generally have less SOC as a result of high decomposition rates due to reduced moisture, which is caused by surface runoff and gravitational forces within the soil water column (Stevenson, 1994). Soil OC can also be translocated to depressional areas through leaching and runoff. Depressional zones have lower decomposition rates due to their anaerobic conditions caused by soil saturation (Stevenson, 1994). Soil parent material as well as plant material influences SOM decay rates. Soil textures such as fine silts and clays have reduced rates of decomposition compared to coarse-textured soils (Ladd et al., 1985). The larger soil surface area in fine textured soils allows for greater formation of organo-mineral complexes that protect SOC from microorganisms (Stevenson, 1994). Among the fine textured clays, 2:1 layered phyllosilicate clay minerals such as smectite are better able to protect SOC from microbial oxidation longer than 1:1 clays due to their ability to physically trap SOC between their layers (Wattel-Koekkoek et al., 2003). Plant derived OM high in lignins and waxes tend to have slower decomposition rates than plant material high in carbohydrates (Oades, 1988). Soils lose large reserves of SOC due to disturbances such as natural erosion events as well as erosion due to agriculture. Implementing new management techniques to increase SOC will initially see rapid increases in SOC followed by a slower rate of increase until the rate of SOC additions and rate of decomposition are in equilibrium. The soil will remain in this steady state or equilibrium until management or another SOC forming factor are altered (Johnson, 1995; Weil and Magdoff, 2004).

Managing Soil Organic Carbon

Numerous review articles make it clear that the conversion of virgin forest and prairie into cropland greatly reduced their SOC content (Paustian et al., 1997; Dumanski et al., 1998; Paustian and Cole, 1998; Bruce et al., 1999; Lal et al., 1999; Follett, 2001). Continued cultivation increased mineralization of stabilized SOC as well as increasing erosion, which also quickly exhausted SOC. Maintaining crop residues on the soil surface increases SOC additions and can be achieved through the implementation of conservation tillage systems, which reduces soil disturbance (Follett, 2001). Managing cropland in the following ways will increase C storage through the addition of above and belowground litter and reduced erosion: (a) reduction/discontinued use of summer-fallow (Cihacek and Ulmer, 1995; Dumanski et al., 1998; Paustian and Cole, 1998; Lal et al., 1999), (b) return of crop residues to field instead of baling or burning (Haynes, 2005), (c) implementation of cover crops and perennial forage crops into crop rotations (Paustian et al., 1997; Paustian and Cole, 1998), (d) increased fertilizer additions (Bruce et al., 1999; Lal et al., 1999; Miles et al., 2008), and, (e) reestablishment of perennial grasslands via grassed waterways, buffer strips, and the Conservation Reserve Program (Lal et al., 1999; Follett, 2001). Most agricultural techniques that increase net primary productivity also increase SOC as long as crop residues are returned to the soil.

Influence and Benefits of SOC/SOM on Soil Properties

Soil OC positively influences soil physical, chemical, and biological properties. Soil OC benefits soil physical properties by acting like a glue to hold soil particles together. The aggregation of soil particles strengthens soil structure, which reduces erosion, increasing pore space leading to an increase in water holding capacity and a decrease in bulk density (Baldock and Skjemstad, 2000; Chen et al., 2004; Dick and Gregorich, 2004; Weil and Magdoff, 2004; Haynes, 2005). Mollification, or the darkening of soil by the accumulation of humic substances acts to warm soil faster in spring as well as keeping it wetter and subsequently cooler in summer heat (Weil and Magdoff, 2004; Haynes, 2005). Soil chemical properties such as cation exchange capacity (CEC) and buffering capacity are enhanced with the aid of SOC additions. Plant essential nutrients are held in close proximity to the rhizosphere due to a high cation and anion exchange capacity. Soil CEC is increased due to the high surface area and large number of variable charge exchange sites, or functional groups on SOM (Dick and Gregorich, 2004; Weil and Magdoff, 2004; Haynes, 2005). The variable charge sites of SOM are useful for adsorbing heavy metals and toxic substances such as herbicides and pesticides and stabilizing them within the soil (Sikora and Stott, 1996). Soil buffering capacity is increased by OM's ability to reduce the concentration of $H^+$ in solution by attracting $H^+$ to its negative charge sites, thus reducing the acidity in soil solution. Soil OM also decreases Al toxicity by forming complexes with $Al^{3+}$, taking it out of soil solution (Weil and Magdoff, 2004). Biological soil properties such as microbial growth and nutrient cycling are influenced by the presence of SOM. Soil OM provides microorganisms with an energy source that allows their populations to grow. The growth and size of microbial communities mostly determines the rate at which SOM is oxidized. Essentially, microorganisms recycle non-living tissues and release the nutrients that were stored in those tissues as plant available nutrients, which is known as the mineralization process (Dick and Gregorich, 2004; Haynes, 2005). The fertility and productivity of a soil is positively correlated to the amount of SOM in a soil, thus making SOM content an indicator of soil health (Sikora and Stott, 1996).

Water Soluble Organic Carbon

As mentioned above, SOC makes up a large portion of SOM and is very important to soil physical, chemical, and biological properties. The active or soluble fraction of SOC is a major contributor/player in soil functions and processes. This soluble OC fraction has been given numerous descriptive titles without giving much description of their differences. This literature review will focus on but a few of those terms, mainly WSOC and water extractable organic carbon (WEOC). The confusion between the plethora of acronyms dealing with OM are clarified in Chantigny's (2003) review article and are partially explained below. Just as SOM is used an a generic term describing all the non-living organic compounds in soil, dissolved organic matter (DOM) and water extractable organic matter (WEOM) are used in the same manner for soluble organic compounds. However, when a specific soluble fraction is being investigated it is referred to as: dissolved organic carbon (DOC), dissolved organic nitrogen (DON), WEOC, water extractable organic phosphorus (WEOP), and so on (Chantigny, 2003).

It is generally accepted that DOC, WEOC, and WSOC are operationally defined as OC containing molecules that are able to pass through a 0.45 μm filter (Kalbitz et al., 2000; Zsolnay, 2003; Corvasce et al., 2006). The difference between DOC and WSOC/WEOC is how the solution was extracted from the soil. Dissolved OC is sampled by inserting lysimeters or porous cups into intact soil (in-situ) and collecting soil solution from macropores via natural water flow. Water soluble/extractable OC samples are obtained by extracting a known mass of soil with a mild extractant followed by shaking to disperse soil aggregates so as to extract both micro- and macropore soil solutions (Chantigny, 2003). Water soluble OC extracts significantly more OC than DOC samples because WSOC extracts from both macropores and micropores, whereas, DOC only collects from macropores (Zsolnay, 1996). Water soluble OC is defined as the OC that is extracted from both soluble OC adsorbed on soil surfaces and dissolved in soil solution. The total amount of WSOC is never completely extracted from soil samples due to the affinity for soluble hydrophobic organic compounds to be quickly adsorbed back onto soil particles after dispersion. The actual amount of soluble OC extracted is called WEOC and the degree of its extraction depends on the strength of the extractant used (Tao and Lin, 2000). This review will use the term WSOC when referring to both theoretical properties as well as actual amounts of water soluble/dissolved OC. Most literature does not differentiate between the WSOC and WEOC when reporting values.

Water soluble OC makes up a small fraction of the SOC pool, but is measured as total organic carbon (TOC) in soil and ranges from <1% (Riffaldi et al., 1998; Zhao et al., 2008) to approximately 7% (Riffaldi et al., 1998). The proportion or amount of soluble OC in soil is directly related to the amount of TOC present (Burford and Bremner, 1975; Zhang et al., 2006; Scaglia and Adani, 2009). The proportion or percentage of TOC that is WSOC tends to be lowest at the soil surface and increases with increasing soil depth (Corvasce et al., 2006; Zhang et al., 2006).

WSOC Composition and Fractionation

Water soluble OC is a very complex solution much like SOM, its parent material. Fifty percent of WSOC is made up of unidentifiable humic substances, whose main constituents are FAs. Hydrophilic acids comprise another 30% of WSOC. The remaining substances are organic compounds such as: simple sugars, carbohydrates, amino acids, lipids, polyphenols, and carboxylic acids (Thurman, 1985; Qualls and Haines, 1991; Stevenson, 1994). In a review by Herbert and Bertsch (1995), they found that although FA makes up a large proportion of WSOC, the FA extracted by Leenheer’s method (1981) was slightly different from the FA that was extracted from SOM with

NaOH. The difference being that Leenheer's FA had a higher proportion of polysaccharides than the alkaline extracted FA.

The standard method for characterizing WSOC and DOC was developed by Leenheer who separated WSOC/DOC compounds by molecular weight and polarity into hydrophilic (acid, base, and neutral) and hydrophobic (acid, base, and neutral) groupings (Leenheer, 1981). Jandl and Sollins (1997) measured extractable C under a douglas fir forest soil and fractionated the aliquot according to Leenheer (1981) and found that hydrophobic acids were the largest contributor to extractable C across litter and mineral soil layers. Within the mineral soil, they observed that hydrophobic acid made up 42.3%, hydrophilic acid 25.5%, and hydrophilic neutrals composed the remaining 32.2% of extractable carbon (Jandl and Sollins, 1997). Qualls and Haines (1991) studied oak and hickory forested soils and found that hydrophobic acids were the largest fraction followed by hydrophilic acids, neutrals, and then bases, in decreasing magnitude. However, Cook and Allan (1992) found that the hydrophilic acid was the dominant fraction under old field and oak savanna soils, comprising half of the DOC collected. Some researchers found hydrophobic acid compounds to have similar properties to FA (Vance and David, 1991; Guo and Chorover, 2003) and others HA (Cook and Allan, 1992). Hydrophilic substances tend to have lower molecular weights, more carboxylic groups (Cook and Allan, 1992), and more aliphatic compounds compared to hydrophobic compounds (Guo and Chorover, 2003), which have higher molecular weights and contain complex mixtures of aliphatic and aromatic substances (Jandl and Sollins, 1997).

Biodegradability of WSOC

Burford and Bremner (1975) reported that soil mineralizable OC had a significant positive relationship with WSOC. They also found that WSOC supplied just over 50% of the mineralizable organic carbon in the uppermost 15 cm of the soils studied. The amount of WSOC that is readily available to microorganisms for decomposition/oxidation is termed bioavailable dissolved organic carbon (BDOC) and was determined in the laboratory as the loss of WSOC after 30 days incubation

(Corre et al., 1999). Numerous researchers found that approximately 10 to 40 percent of WSOC was readily bioavailable to microorganisms (Qualls and Haines, 1992; Boyer and Groffman, 1996; Jandl and Sollins, 1997; Corre et al., 1999). There does not seem to be a consensus among researchers dealing with the proportion of WSOC that is bioavailable (%BDOC) by soil depth. Boyer and Groffman (1996) found that %BDOC was greatest at the soil surface and decreased with soil depth; whereas Corre et al. (1999), discovered that %BDOC did not significantly change with increasing soil depth.

The chemical composition and degree of biodegradability of WSOC are dependent upon vegetation type, land use (Boyer and Groffman, 1996; Corre et al., 1999; Tian et al., 2010), and type of organic manure or amendment applied (Zhou and Wong, 2003). Water soluble OC fractions that are more resistant to microbial oxidation are likely due to the presence of humic substances, which are relatively refractory. Zhou and Wong (2003), found that DOM with low molecular weight hydrophilic compounds were more easily oxidized compared to hydrophobic substances with relatively higher molecular weight. However, Boyer and Groffman (1996), reported findings that were contrary to the popular belief that low-molecular weight FAs have a greater affinity to be decomposed compared to HAs with higher molecular weights. The hydrophilic neutral fraction supplies the majority of the most readily bioavailable WSOC and is rich in plant and microorganism derived carbohydrates (Qualls and Haines, 1992; Jandl and Sollins, 1997). Aromatic compounds in WSOC are known to be relatively more recalcitrant to microbial oxidation and can therefore be used to determine the biodegradability of WSOC. The aromaticity of WSOC can be measured via nuclear magnetic resonance ($^{13}$C -NMR) as well as with UV absorbance at 280 nm (Guo and Chorover, 2003; Kalbitz et al., 2003).

WSOC Distribution by Depth

Water soluble OC follows the same distribution by depth trend as TOC. Both TOC and WSOC concentrations tend to be highest near the soil surface and decrease with increasing soil depth

(Boyer and Groffman, 1996; Corre et al., 1999; Corvasce et al., 2006). The decrease of WSOC with increasing depth is likely due to the removal or adsorption of WSOC from interstitial pore water onto mineral surfaces (Kalbitz et al., 2003; Corvasce et al., 2006; Sanderman et al., 2008). The majority of WSOC/DOC is located just beneath the bulk of plant roots and decreases proportionately with declining root biomass at deeper soil depths (Sanderman et al., 2008).

Common patterns exist for specific WSOC characteristics by depth such as aromaticity, molecular weight, C to nitrogen ratios (C:N), and hydrophobicity. Molecular weight (Schoenau and Bettany, 1987) and amount of aromatic compounds in WSOC decrease with increasing soil depth. The accumulation of compounds with higher molecular weight and aromaticity near the soil surface is possibly due to the preferential adsorption of these compounds due to their highly complexed, refractory, hydrophobic chemical properties. This would explain why more simple molecules such as hydrophilic compounds with lower molecular weights are leached deeper into the soil profile before adsorbing onto mineral surfaces, due to their lower adsorption affinity compared to hydrophobics (Corvasce et al., 2006; Sanderman et al., 2008). Carbon to nitrogen ratios and $\delta^{13}C$ values can be used to determine the extent of microbial oxidation on OM. The age, or mean residence time of OC in soil can be calculated by measuring the amount of $^{14}C$ present. Sanderman et al. (2008), found C:N ratios decreased and $\delta^{13}C$ values increased with increasing soil depth. They also discovered that $^{14}C$ concentrations increased with increasing soil depth. These results show that the WSOC at deeper depths is older and has undergone more humification than organic substances near the soil surface (Sanderman et al., 2008). It is also believed that fresh WSOC near the soil surface is preferentially oxidized and adsorbed, while older more stabile OC is resolubilized and translocated to deeper soil depths (Steinbeiss et al., 2008).

WSOC Additions to Soil

Water soluble OC is added to the soil from leachate from aboveground detritus (Jandl and Sollins, 1997), soil microorganisms (Kieft et al., 1987), humus (Boyer and Groffman, 1996), organic amendments (Zhou and Wong, 2003; Wright et al., 2005; Zhao et al., 2008), and to a large extent rhizodeposition (Kalbitz et al., 2000; Kuzyakov, 2002; Amos and Walters, 2006; Vong et al., 2007). The chemical composition, or recalcitrance of WSOC depends on its source. Green manures and pig manures are easily oxidizable and contain large amounts of low molecular weight hydrophilic substances whereas, composted organic wastes supply WSOC with a high molecular weight and aromatic compounds that are more difficult to decompose because they have already undergone numerous oxidation events (Zhou and Wong, 2003; Zhao et al., 2008). A large portion of WSOC is derived from rhizodeposition, which is the addition of soluble OC from root structures in the form of exudates, secretions, sloughed fine roots, mucilage, and decomposition products from senescing root structures (Kuzyakov, 2002; Amos and Walters, 2006). The root exudates are low in molecular weight and are present as sugars and organic acids. Secretions consist of carbohydrates, lipids, and proteins with slightly higher molecular weights. Mucilages are high molecular weight compounds mainly found as polysaccharides (Kuzyakov, 2002). Plant species have an effect on the amount of rhizodeposition released into soil. Vong et al. (2007) discovered that the root structures of rape added significantly higher concentrations of WSOC to the soil than the roots of barley.

### WSOC Storage Factors

The addition and subsequent sequestration of WSOC in soil is influenced by a number of factors that affect both the amount of OC being added to the soil and the rate of decomposition. The natural and anthropogenic factors affecting those additions and losses include land use, management practices, and environmental factors. The most influential factor affecting WSOC storage is land use and is mainly due to vegetation type and disturbance. A study by Zhang et al. (2006), found that intact wetlands had significantly greater amounts of DOC in the upper 20 cm of the soil compared to the following, in decreasing order of DOC concentration: upland forest, abandoned old fields, and cultivated fields. When comparing deciduous woodlands to cornfields, forests had higher TOC contents than cornfields, but cornfields had a higher proportion of WSOC relative to woodlands due to corn's higher biodegradability. The conversion of woodlands to cornfields had an initial decrease in both TOC and WSOC, but then WSOC slowly increased after the first few years (Boyer and Groffman, 1996). Water soluble OC from forest soils are more resistant to decay than agricultural soils due to a higher concentration of lignin, tannins, and phenolics derived from woody species. Agricultural soils tend to have more carbohydrates and amino acids in WSOC and fewer of the refractory compounds found in woody plants (Scaglia and Adani, 2009). In a review by Chantigny (2003), total WSOC content was highest under forests, followed by grasslands, and then croplands with the lowest concentrations. The conversion of grassland into agricultural cropland significantly decreased the amount of WSOC in soil and continued to be depleted over time when cropped due to SOM losses. Gregorich et al. (2000), discovered supporting evidence that grasslands accumulate higher levels of WSOC compared to croplands. They found that the continued planting of maize on 5 fields ranging from 4 to 37 years had significantly lower WSOC concentrations compared to fields with continuous growth of grasses.

Vegetative cover can be categorized within land use, when comparing biomes and as a management practice such as when comparing fallow cropland to grassland, or perennially grown crop. When comparing fallow/barren soils to grassland soils, barren soils have significantly less DOC than the grassland/cropland due to the presence of roots. Root structures add DOC/WSOC to the soil via rhizodeposition. It is also possible that the roots caused more drying and wetting events along with precipitation events, which would also increase DOC content (Khalid et al., 2007). Soluble OC levels can be enhanced through the implementation of legumes in crop rotations as well as liming. Liming increases WSOC by moderating soil pH, creating better growing conditions for plants and microbes, as well as increasing the solubility of OC that is adsorbed on mineral surfaces. However, additions of $CaCO_3$ into the soil also have the potential to remove WSOC from solution due to flocculation, or aggregation of soil particles. The use of tillage and the intensity of tillage, or disturbance of soil increased the loss of WSOC due to microbial growth near the soil surface. The literature showed both losses and gains of WSOC due to nitrogen fertilizer application (Chantigny, 2003). Organic amendments such as animal manure, compost, and green manures supplement soil with additions of WSOC (Zhou and Wong, 2003; Wright et al., 2005; Zhao et al., 2008). Under saturated/waterlogged conditions, the addition of nitrogen fertilizer can cause a significant increase of WSOC leaching (McTiernan et al., 2001).

Land use and management practices have a large influence on the amount of WSOC that is added to or lost from a soil. However, soil properties such as texture, moisture, pH, and OM content determine how much WSOC can be retained. A positive correlation exists between TOC and WSOC, indicating that WSOC is dependent upon SOM content (Zhang et al., 2006). Finer-textured soils have greater surface area with a greater number of exchange sites available for WSOC to be adsorbed onto relative to coarse-textured sandy soils. Clay soils have lower WSOC compared to loamy and sandy soils due to the presence and type of clay, especially 2:1 phyllosilicates that are able to adsorb more WSOC on its exchange sites as well their ability to physically trap organic compounds between its layers (Chantigy et al., 1999; Corvasce et al., 2006). The moisture content of a soil is a limiting factor in the growth potential of microbial communities. Optimal microbial growth occurs when soil pores are 30 to 60% water filled (Doran et al., 1990), but when soils become saturated, or waterlogged for long periods of time, those microbial populations sharply decline. A decline in microbial biomass decreases the amount of WSOC and SOM being oxidized, resulting in higher WSOC concentrations. However, waterlogged conditions also greatly reduce plant growth and WSOC additions (McTiernan et al., 2001).

As mentioned above, soil properties influence the storage of WSOC in soil. Environmental factors such as moisture and temperature also have an effect on the accumulation of WSOC in soil. Both moisture and temperature affect the net primary productivity of plants as well as their decomposition. Wetting and drying as well as freezing and thawing cycles can also have an effect on WSOC. Studies have shown that the rewetting of a dry soil produces a small, but measurable release of soluble C, which can be partially attributed to microorganisms. The amount of soluble carbon released after rewetting is positively correlated to the severity of drying before the rewetting (Kieft et al., 1987; Williams and Xia, 2009). It is likely that microorganisms have undergone phenotypic plasticity over time, adapting to extreme moisture and desiccation events within the soil environment. It is thought that when the soil dries, microbes take up soluble organics from the soil to offset their loss of water. When moisture returns to the soil, they expel these organic compounds, creating a small flush of WSOC. Another explanation for the increase in WSOC after rewetting could be due to an accumulation of WSOC on soil surfaces during the dry-down period and were released into the soil solution upon rewetting due to the slaking or dispersion of soil aggregates (Williams and Xia, 2009). Freezing and thawing can also release small amounts of labile OC. The rupturing of microbial cell walls by freezing and thawing releases some WSOC, but it is not the only source. The expansion and then contraction of wet soil caused by freezing and thawing acts to physically fragment SOM as well as exposing fresh surfaces to microbial oxidation, which can add to the release of WSOC. When flooding is added to the thawing, large quantities of WSOC and SOM have the potential to be leached out of the soil (Wang and Bettany, 1993).

As noted above, soil processes and properties have a large effect on the net accumulation of WSOC in soil. Just as certain soil properties influence C storage, so do the type of vegetation, species, and specie richness. Differences in WSOC content can be seen between vegetation types such as $C_3$ and $C_4$ plant species. In a grass and maize study performed by Gregorich et al. (2000), they found that $C_4$ plant species accumulated lower amounts of WSOC than $C_3$ plant species, with $C_4$ derived WSOC ranging from 17 to 34% of the total WSOC. Converting $C_3$ species dominated grasslands into $C_4$ species dominated grasslands resulted in a reduction of OC, which subsequently causes a drop in WSOC. After the conversion to a $C_4$ species grassland, it took approximately 18 years to return the C stocks to what they were prior to conversion (Corre et al., 1999). A possible explanation for the reduced accumulation of WSOC under $C_4$ grass species could be due to their efficient use of nutrients compared to $C_3$ grass species. These plants use fewer nutrients and therefore do not need to allocate as much C to their roots as a $C_3$ species would, resulting in less rhizodeposition of exudates (Kuzyakov, 2002). Overall, grassland species like *Panicum virgatum* (switchgrass) and *Andropogon gerardii* (big bluestem) tend to accumulate more OC than row crop species like *Zea mays* (corn), *Glycine max* (soybeans), and *Triticum aestivum (*wheat) (Omonode and Vyn, 2006). As noted above, plants add soluble OC to the soil through their roots as well as solubilizing more recalcitrant OC as a result of the priming effect (Khalid et al., 2007). In a root biomass study at Dickinson, North Dakota, Lauenroth and Whitman (1977), found that approximately 70% of the root biomass was located in the upper 15 cm (6 in) of the soil, with roughly 11% in the 15 to 30 cm (6 to 12 in) depth, and decreasing amounts down to 90 cm (36 in). Jobbagy and Jackson (2000), found that the uppermost 20 cm of 17 temperate grassland soil samples from various continents contained 70% of the root biomass in temperate grasslands and 62% in croplands; these large proportions of root biomass in the upper 20 cm can be used to determine if root biomass is correlated to OC by depth. Increases in species richness and diversity tend to have increased biomass production along with increased microbial activity, which speeds up SOM decomposition and addition of WSOC to the soil (Fan et al., 2008). Skinner et al. (2006), looked at the differences in root distribution and SOC below 2, 3, and 11 species richness mixtures and found that the 11 species mixtures had the greatest root biomass and also had the deepest roots, but had the lowest amount of SOC. Further investigation is needed to determine the effect of species richness on WSOC; it is likely that it will follow the same trend as SOC.

Factors Influencing WSOC Adsorption

The amount of WSOC in solution is affected by microbial decomposition and adsorption to soil surfaces. Adsorption to mineral surfaces removes considerably more WSOC from the soil than by microbial oxidation. The adsorption or transfer of a labile, soluble OC into a stabilized, solid phase is carried out through the following mechanisms: (a) ligand exchange and surface complexation, (b) cation bridging, (c) hydrogen bonding, (d) van der Waals forces, (e) physical adsorption, and, (f) anion exchange (Gu et al., 1994; Kalbitz, 2000; Kothawala et al., 2009; Zhang and Zhang, 2010). These adsorption mechanisms are influenced by the hydrophobicity and aromaticity of WSOC, soil acidity, clay mineralogy, Fe and Al oxide and hydroxide concentrations, and fertilizer applications.

Water soluble OC adsorption increases with increasing soil depth, with lower adsorption to mineral soil at depths with higher SOM content (Jardine et al., 1989). It is generally accepted that hydrophobic organic compounds in WSOC have a greater affinity to be adsorbed onto mineral surfaces than hydrophilic WSOC (Jardine et al., 1989; Kaiser and Zech, 1997; Guo and Chorover, 2003; Corvasce et al., 2006). Hydrophobic WSOC has a stronger affinity for sorption than hydrophilic WSOC because it has higher molecular weights, more aromatic compounds, and more favorably arranged functional groups than hydrophilic WSOC (Kaiser and Zech, 1997). Aromaticity in WSOC decreases with increasing soil depth due to the adsorption of hydrophobic compounds onto mineral soil; leaving the hydrophilic WSOC with less aromatic compounds in soil solution (Jardine et al., 1989; Corvasce et al., 2006).

Soil solution pH has an effect on the amount of WSOC that is adsorbed to soil mineral surfaces. Maximum WSOC adsorption occurs at approximately pH 4.5 and significantly decreases with increasing pH values (Jardine et al., 1989; Gu et al., 1994). Decreased adsorption occurs with increasing alkalinity due to the reduction of available adsorption sites on the mineral surfaces (Gu et al., 1994). Iron and Al oxides and hydroxides as well as clay mineralogy play integral roles in the amount of WSOC that can be adsorbed onto soil mineral surfaces. The Fe and Al hydrous oxides and oxyhydroxides have variable charge sites with a net positive charge, allowing WSOC to be adsorbed due to its net negative charge (Guggenberger and Kaiser, 2003; Kothawala et al., 2009). The main mechanism of WSOC adsorption onto Fe and Al is through ligand exchange. The desorption of WSOC from these surfaces remains very small due to the strong chemical interaction and physical protection of WSOC, until soil pH changes (Jardine et al., 1989; Gu et al., 1994).

Clay mineralogy and the amount of clay also influences WSOC sorption in soil. Liang et al. (1996), found that as clay content and clay surface area increased, the amount of WSOC adsorbed in soil increased proportionately. Jardine et al. (1989), discovered that soils with kaolinitic clay have a greater adsorption of WSOC than soils with illite clay. Approximately 70% of WSOC that is adsorbed in soil is adsorbed onto Fe and Al oxides and hydroxides (Jardine et al., 1989; Gu et al., 1994). The remaining adsorbed WSOC in soil is attached to phyllosilicate clay minerals (Jardine et al., 1989; Kothawala et al., 2009). Cation bridging is the main adsorption mechanism used because clays and WSOC tend to have a net negative charge, which would repel them from each other. However, cations such as $Ca^{2+}$, $Fe^{3+}$, and $Al^{3+}$ are positively charged and when adsorbed onto clay surfaces, WSOC can attach onto their available positive adsorption sites/functional groups (Guggenberger and Kaiser, 2003).

The adsorption of WSOC in soil is believed to be influenced by sulfate and phosphate based fertilizers. Sulfate and $PO_4^{3-}$ anions compete with WSOC for sorption sites on mineral surfaces. Water soluble OC concentrations significantly increase in soil solution after the application of P fertilizer due to phosphate's stronger attraction to anion exchange sites, allowing it to replace WSOC at those sites (Zhang and Zhang, 2010). According to Kaiser and Zech (1997), phosphates have the highest affinity for sorption sites, followed by hydrophobic WSOC, hydrophilic WSOC, and the weakest being sulfates as well as having the ability to displace all of these.

WSOC Role in the Soil Environment

Water soluble OC plays an important role in the increased mobility of nutrients, heavy metals, and organic pollutants by increasing their solubility in soil. Hydrophilic WSOC is the dominant fraction that binds with heavy metals due to its high concentration of carboxylic functional groups (Zhou and Wong, 2003). Heavy metals form strong associations with WSOC's carboxylic and phenolic functional groups. Hydrophilic WSOC is the most often the organic substance in these organo-metal complexes. Due to hydrophilics repellency in soil water these complexes may be leached due to their low sorptive affinity/competitiveness. For example, if phosphate fertilizer is applied to soil containing organo-metal complexes with Cu, Zn, and Cd these heavy metals will likely be leached due to phosphate's greater sorption affinity for adsorption sites (Zhang and Zhang, 2010). When WSOC is adsorbed on a suspended soil particle, its hydrophilic properties can convert that molecule from having a net positive charge to a net negative charge. However, the adsorption of WSOC onto these particles can also transform WSOC from hydrophilic to hydrophobic, allowing organic pollutants to become adsorbed onto a mobile compound (Gu et al., 1994). Small amounts of WSOC in soil solution have the ability to complex with hydrophobic organic pollutants such as DDT and PCB's increasing their ability to be leached from the soil. However, these organic pollutants have a greater attraction to HA and FA in soil, which are more stable; thus reducing their mobility (Chiou et al., 1986). Herbert et al. (1993), discovered similar results with WSOC and pyrene. Pyrene had a greater affinity to be complexed HA and FA than with WSOC, therefore reducing the amount of soluble organo-pyrene complexes.

The cycling or transformation of organic nutrients into plant-available inorganic nutrients from SOM is made possible mainly due to the rhizodeposition of WSOC. Water soluble OC is the microbial energy source that makes the mineralization process possible, sustaining plant growth and food webs (Kuzyakov, 2002). Although nutrient cycling may be the most important indirect benefit of WSOC, WSOC is also important when used as an indicator of soil quality and soil fertility as well as for determining minute impacts on soil properties due to changes in management practices (Lou et al., 2011).

## Objectives

The objectives of this study were to determine: 1) the concentration and trend of WSOC by soil depth relative to TOC; 2) the effect of different plant species on the accumulation of WSOC as compared to a cropland check; 3) the effect of species richness on WSOC; and 4) the effect of N and P fertilizer application on WSOC. The proposed testable hypotheses within these objectives are as follows:

Testable Hypothesis 1: WSOC will make up a significant proportion of TOC and will mimic the distribution of TOC by depth with the greatest concentrations near the soil surface followed by decreases in WSOC with increasing soil depth.

Testable Hypothesis 2: WSOC will be greater for the individual grassland 0species compared to the cropland check due to greater amounts of rhizodeposition from grassland plants.

Testable Hypothesis 3: Grass plots with the greatest species richness will accumulate the highest amount of WSOC, due to resilience to extreme weather changes and greater root production compared to monocultures.

Testable Hypothesis 4: WSOC will have larger accumulations under plants receiving N and P fertilizer compared to no fertilizer due to increased biomass production.

MATERIALS AND METHODS

Soil cores were collected from three sampling sites located throughout the state of North Dakota (Figure 1): 1) Albert Ekre Grassland Preserve (Ekre Ranch) plots in Richland County located near Kindred; 2) Carrington Research Extension Center (CREC) plots in Foster County located near Carrington; and 3) Dickinson Research Extension Center (DREC) plots located in Stark County near Dickinson. Table 1 contains the details about each site's plot date of establishment, sampling dates, annual precipitation, and coordinate locations while Table 2 displays the soil particle sizes and associated textures of each site.

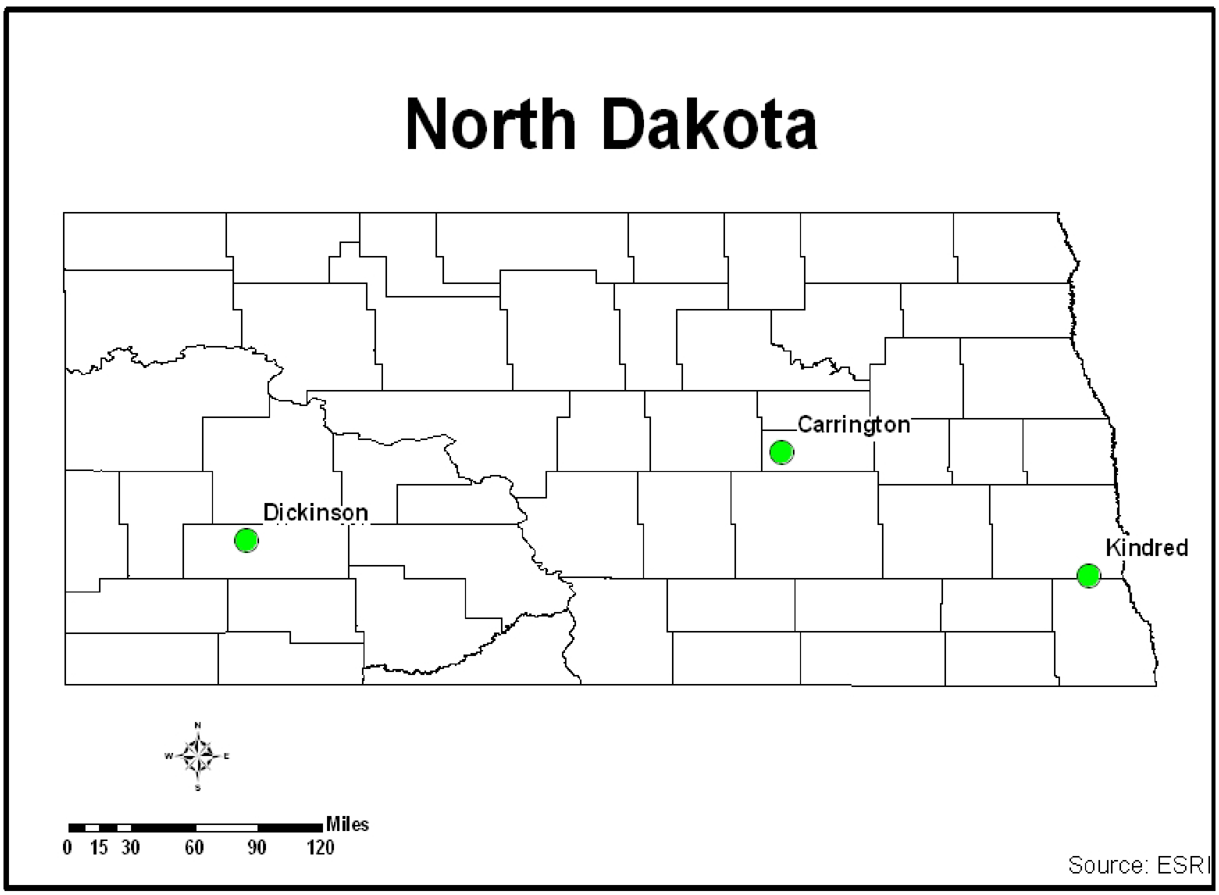


Figure 1. Ekre Ranch (Kindred), Carrington, and Dickinson sampling site locations within the state of North Dakota.

Table 1. Ekre Ranch, Carrington, and Dickinson sampling site details.

| Site | Date Created | Date(s) Sampled | Annual Precipitation | Latitude | Longitude |
|---|---|---|---|---|---|
| Ekre Ranch | Fall 1998 | 8/2009[†] | 556 mm[‡] | 46° 33' 12.8412" N | 97° 8' 0.8736" W |
| | | 5/2010 | | | |
| Carrington | Spring 2008 | 8/2010[§] | 381 mm | 47° 30' 27.1722" N | 99° 7' 24.4518" W |
| | | 5/2011 | | | |
| Dickinson | Spring 2005 | 8/2010[¶] | 323 mm | 46° 53' 54.6864" N | 102° 49' 40.3638" W |
| | | 5/2011 | | | |

[†]Ekre Ranch individual species and cropland check samples were collected 8/2009. Species richness samples were collected 5/2010.
[‡]Annual precipitation amounts as of 2011 were obtained from North Dakota State University's North Dakota Agricultural Weather Network (NDAWN, 2011).
[§]Carrington individual species and mixture samples were collected 8/2010 and cropland check samples were sampled 5/2011.
[¶]Dickinson species and species richness samples were collected 8/2010 and cropland check samples were sampled 5/2011.

Table 2. Ekre Ranch, Carrington, and Dickinson soil particle size analysis and associated soil textures.

| Sampling Site | Sand | Silt | Clay | Texture |
|---|---|---|---|---|
| | ----------------------- | % | ----------------------- | |
| Ekre Ranch | 70[†] | 15 | 15 | Sandy Loam |
| Carrington | 42.5 | 32.5 | 25 | Loam |
| Dickinson | 50 | 27.5 | 22.5 | Sandy Clay Loam |

[†]Particle size analysis was performed via the hydrometer method by North Dakota State University's Soil Testing Laboratory. Sub-samples of equal amounts from the 0-10, 10-20, and 20-30 cm depths of 4 random soil profiles from each site were composited for the analysis.

## Sampling Designs

### Albert Ekre Grassland Preserve

The Albert Ekre Ranch species competition research plots lie completely within the Mantador-Delamere-Wyndmere soil map unit. The official series description for both the Mantador and Delamere soil series are Coarse-loamy, mixed, superactive, frigid aquic Pachic Hapludolls. The Wyndmere soil series are classified as Coarse-loamy, mixed, superactive, frigid, Aeric Calciaquolls (USDA-NRCS, 2011). These mollisol soils are situated on 0 to 2% slopes and have a sandy loam texture as determined by NDSU's Soil Testing Laboratory (Table 2). Table 1 shows the average annual precipitation from the previous 5 years at the Ekre Ranch to be 556 mm (NDAWN, 2011).

The Ekre Ranch research plot designs as shown in Figures B1 and B2 (Appendix B) were developed in the fall of 1998 following a completely randomized factorial design with 3 factors: N and P fertilizer applied as Sierra slow release fertilizer prills (Pursell Technologies, Inc.), high or low fertilization application rates (200 or 20 kg N $ha^{-1}yr^{-1}$) (40 or 4 kg P $ha^{-1}yr^{-1}$), and species richness treatments of 1, 2, 5, 10, or 20 plant species per paired plot which were randomly assigned from 49 grass and forb species. For a complete description of site preparation and design refer to Biondini, 2007 and Biondini et al., 2011. Paired plots combined two small plots into one larger plot by planting the same species or mixture in both plots. Each treatment within the species richness factor was replicated 10 times across 4 replicate blocks each containing 100 plots or 50 paired plots. The plots were 3 × 3 meters with a 1 meter buffer between each plot. Prior to the conversion into research plots, this area was row-cropped in a *Zea mays* (corn) and *Glycine max* (soybean) rotation.

Soil samples were collected within species clusters/patches of approximately 1 $m^2$ in size or larger, of the following grass and forb species at the Ekre Ranch: *Panicum virgatum* L. (switchgrass), *Andropogon gerardii* Vitman (big bluestem), *Elymus canadensis* L. (Canada wildrye), *Helianthus maximiliana* Schrad. (maximillian sunflower), *Agropyron cristatum* (L.) Gaertn. (crested wheatgrass), *Bromus inermis Leyss.* (smooth bromegrass), *Poa pratensis* L. (Kentucky bluegrass), *Solidago canadensis/ missouriensis* Nutt. (Canadian/ Missouri goldenrod), and *Triticum aestivum* (wheat stubble), which was adjacent to the plots and sampled for the cropland check.

At the Ekre Ranch, 4 soil cores, 4.45 cm in diameter, were collected with a truck-mounted Giddings hydraulic soil probe from each block, totaling 4 cores per repetition or 16 cores per species across the site. When species could not be visually located within a block, additional samples were taken from other blocks to collect 16 cores per species. The cropland check samples were located within the same soil map unit as the individual species and species richness samples and were collected 50 feet from the edge of the plots in wheat stubble. Four soil cores were taken at equal distances running parallel to the edge of each of the blocks, totaling 16 cores for the cropland check. In addition to the plant species and cropland check, 20 plots were sampled to determine the effect of species richness on TOC and WSOC accumulation. Selection of the species richness plots to be sampled were based on the number of species present and a broad range of biomass based on results from Biondini, 2007 and Biondini et al., 2011. Within each of these plots, 4 cores were collected and then composited by soil depth increment in the laboratory.

Soil cores were collected and stored in acrylic sleeves, which were sealed by plastic caps wrapped in duct tape. Cores were stored at room temperature until they were sub-sampled. Sub-sampling divided the cores at 10 cm increments within the uppermost 30 cm of the soil core, followed by 15 cm increments from 30 cm down to 90 cm. The lack of adequately sized 1 $m^2$ or larger clusters of species within each block of plots prevented collecting and compositing 4 soil cores within fertilizer rate treatments; causing cores to be composited across fertilizer treatments. Since sampling did not go as planned to be able to make fertilizer comparisons with the individual species samples due to the current distribution of species among the plots, only the species richness samples were used when conducting analyses on fertilization affects. The four cores from each species richness plot were composited by soil depth increments, resulting in one representative sample per depth increment for that individual plot.

Carrington Research and Extension Center (CREC)

The grassland biofuel plots at the Carrington Research and Extension Center were situated entirely within the Heimdal-Emrick soil map unit. Particle size analysis (Table 2) determined the Carrington soils to be a loam texture. The official soil description of the Heimdal is a Coarse-loamy, mixed, superactive, frigid Calcic Hapludolls. The Emrick soil series is made up of soils that are Coarse-loamy, mixed, superactive, frigid Pachic Hapludolls (USDA-NRCS, 2011). The annual precipitation averaged over 20 years, prior to 2011, was 381 mm (NDAWN, 2011) (Table 1). The plot diagram shown in Figure B3 (Appendix B), for these research plots was developed using a split-block, split-plot design with 4 randomized replicate blocks each containing 20 plots of monocultures and mixtures of species. Plots were 5 x 10 meters in size. Within a block, each species or mixture of species had two replicate plots, of which one was harvested annually and the other biennially; both were sampled. Soil samples were collected from plots of the following species and mixture of species: *Panicum virgatum* var. Sunburst (sunburst switchgrass), *Panicum virgatum* var. Trailblazer (trailblazer switchgrass), *Thinopyrum ponticum* var. Alkar (alkar tall wheatgrass), *Agropyron intermedium* var. Haymaker (haymaker intermediate wheatgrass), and a Conservation Reserve Program (CRP) mixture which contained *Agropyron* sp. (wheatgrasses), *Medicago sativa* L. (alfalfa), and *Melilotus* Mill. (sweetclover).

Two—5.72 cm diameter soil cores were taken per plot, to depths of 120 cm in August 2009 for each of the species and CRP mixture listed above. The two cores from each plot were combined by depth in the same manner as the Ekre Ranch samples; resulting in one composited sample per depth, per plot. Within each block, 2 cores were collected from each species and CRP mixture from both annually and biennially harvested plots. In total, each species and CRP mixture had 4 composited cores (8 individual cores) each from annually and biennially harvested plots. Eight cores were taken in May 2011, as cropland check samples at four locations on similar slopes in an agricultural field on the opposing slope of a shallow natural draw bordering the southern edge of the grass plots, 50 m from the research plots in the same soil map unit. The two cores at each of the 4 cropland sampling positions were composited by soil depth increment, yielding 4 composited soil cores. Prior to the conversion into grassland plots in the spring of 2008, the sampling area had been utilized as an agricultural row-crop field under convention tillage, cropped to a small grain-legume rotation for at least 10 years prior to conversion into plots and managed the same as the area from which the cropland check samples were collected.

Dickinson Research and Extension Center (DREC)

The grassland competition plots at the Dickinson Research and Extension Center site were situated completely within the Reeder-Farnuf soil map unit and were determined to be a sandy clay loam texture according to a particle size analysis performed by NDSU's Soil Testing Lab (Table 2). The official soil series description for both the Reeder and Farnuf series describes soils that are Fine-loamy, mixed, superactive, frigid Typic Argiustolls. The average annual precipitation from 20 years of data, prior to 2011, was 323 mm (NDAWN, 2011) (Table 1). The Dickinson plot diagram shown in Figure B4 (Appendix B) was created in 2005 as a randomized 7 x 3 factorial design with 10 replications per treatment totaling 210 plots as described in a paper by Biondini et al. (2011). Each plot was 5 x 5 m with a 3 m buffer between plots. There were 7 species richness treatments of 1, 2, 5, 5, 10, 10, and 20 plant species. There were two-5 and 10 species richness treatments due to different numbers of functional forms (FF) with 2 or 3 FF for a species richness of 5, and 3 or 4 FF for a species richness of 10 (Biondini et al., 2011). The second factor in the design incorporated 3 fertilization application treatments: no fertilization, N fertilizer application at 200 kg N $ha^{-1}yr^{-1}$, and P fertilizer application at 40 kg P $ha^{-1}yr^{-1}$. Both N and P fertilizers were applied as Sierra slow release fertilizer prills (Pursell Technologies, Inc.). Prior to the conversion into research plots in

2005, this area had been planted to *A. cristatum* and *B. inermis* and had been hayed since the 1930s. For a complete explanation of site preparation and design refer to Biondini et al. (2011).

Soil cores were collected within clusters of the desired species that were at least approximately 1 $m^2$ in size, from plots that were originally seeded to the desired species to sample and were still present. The three species sampled were: *Agropyron cristatum* (L.) Gaertn., *Bromus inermis Leyss.*, and *Poa pratensis* L.. Twelve—5.72 cm diameter soil cores were taken for each grass species in August 2010. Of those 12 cores, 4 cores were collected from each of the three fertilizer treatments so as to determine fertilizer application affect on TOC and WSOC. The four individual grass species cores per fertilizer treatment were not composited together by soil depth increment to create one composited and representative sample per depth increment. They were analyzed separately so that they could be used to make C comparisons within both species and fertilizer application treatments. Twenty-nine of the species richness plots were sampled by collecting two soil cores from each plot, which were then composited by soil depth increments. In May of 2011, cropland check samples were collected from a cropland field 50 m to the south of the original sampling site. Both the research plots and the cropland field were situated within the same soil map unit. Eight soil cores were taken at 4 locations along a transect running down the middle of the 100 m long field. The 2 cores taken at each location were composited by soil depth increments, yielding 4 composited cores. The cropland field had been in a no-tillage management system since 1997 and had been continuously planted to a 3-year rotation of two small grains followed by a *Pisum sativum* (pea) crop; prior to the sampling of the field, it had been planted to an *Avena sativa* (oats) crops in the 2010 field season.

## Sample Preparation

As previously described, soil cores were dissected, or subsampled at 10 cm increments in the uppermost 30 cm and then at 15 cm increments from 30 cm down to 90 cm, or the total depth of the core. Subsamples of the same depth increment were then composited as required. The final composited subsample depths were weighed and then a small amount of soil (approximately 50 g) was oven-dried for 24 h at 105 °C for determination of gravimetric water content. Gravimetric water content represents the percent of soil weight that is water. Gravimetric water content and subsequently oven-dry soil weights are used to determine the bulk density of soil and were calculated with Coyne and Thompson's (2006) equations.

The core method was used at Carrington and Dickinson to collect data for determining soil bulk density. The fine sand particles at the Ekre Ranch caused soil cores to become compacted at various soils depths as shallow as 30 cm below the soil surface. Due to the limited amount of quality bulk density data from the core method at the Ekre Ranch, bulk density was determined from samples that had been collected from two soil pits dug to a depth of 120 cm. Three cylinders of a known volume were inserted into the vertical face of the soil pits at the Ekre Ranch at the same soil depth intervals as used for compositing cores by soil depth increment. The 6 values obtained from the two soil pits were averaged for each soil depth increment and were then used in place of the core method bulk densities from the depths of 30 down to 120 cm at the Ekre Ranch due to the varying depth to compaction. The uppermost 30 cm of soil at the Ekre Ranch was not compacted due to sampling, so core bulk density estimates were used for these sample depths. Bulk densities from Carrington and Dickinson samples were calculated from individual soil core samples following Blake and Hartge's (1986) bulk density core method.

The remaining soil samples were air-dried and then ground to pass through a 2 mm screen. Ten grams of each sample were ball milled to pass through a #100 mesh sieve prior to analysis of TC, IC, and TOC by NDSU's Soil and Water Environmental Laboratory.

Analysis

Total C is the measurement of both IC and OC in soil. Total C was analyzed by measuring the amount of $CO_2$ emitted via high temperature combustion (1000°C) in a Skalar Primacs™ Solid Carbon analyzer. Inorganic C was measured as the $CO_2$ released from the soil sample after reacting with phosphoric acid in a Skalar Primacs™ Solid Carbon analyzer. Total OC was estimated by subtracting IC from TC. Bulk density (g/cm$^3$) was factored into the calculation of converting percent C, which was the unit of measure from the analyzer readouts, into C mass per area, per depth (kg C m$^{-2}$depth$^{-1}$) from the following equation:

$$\text{kg m}^{-2}\text{ depth}^{-1} = \frac{\%\text{ carbon}}{100\ \%} \times \frac{\text{g}}{\text{cm}^3} \times \frac{\text{cm}}{\text{depth increment}} \times \frac{10{,}000\text{ cm}^2}{\text{m}^2} \times \frac{1\text{ kg}}{1{,}000\text{ g}} \qquad [1]$$

The WSOC extraction method was developed by modifying the extraction methods of Delprat et al. (1997) and Scaglia and Adani (2009). Prior to analysis, soil samples were air dried and ground to pass through a 2 mm mesh screen, as noted above. Fifteen grams of soil were shaken with 30 mL of deionized (DI) water (1:2 w/v) for 30 min on an end-over-end shaker at 180 rpm. Samples were centrifuged at 1000x g for 20 min. The supernatant was vacuum filtered through a 0.45 µm cellulose membrane filter (Millipore). Water soluble OC was determined by $CO_2$ evolution via high temperature catalytic combustion at 680°C after acidification (2M HCl) and sparging of IC on a Shimadzu TOC-$V_{CPH}$ analyzer. Since WSOC was extracted using DI water, a separate DI water sample was extracted and analyzed with each batch of 30 samples. The average WSOC value for DI water was then subtracted from each sample so the values would only represent WSOC from the soil sample. Parts per million of WSOC, or mg WSOC/g soil, was converted into WSOC mass per volume of soil (kg WSOC m$^{-2}$depth$^{-1}$) by first accounting for the DI water dilution factor, followed by a units conversion, which was performed with the two equations shown below:

$$\text{Dilution Factor}\ \frac{\text{mg WSOC}}{\text{g soil}} = \frac{\text{mg WSOC x 2(dilution factor)}}{15\text{ g soil}} \qquad [2]$$

$$\text{kg WSOC m}^{-2}\text{depth}^{-1} = \frac{\text{mg WSOC}}{\text{g soil}} \times \frac{\text{g}}{\text{cm}^3} \times \frac{1\text{g}}{1000\text{ mg}} \times \frac{1\text{ kg}}{1{,}000\text{ g}} \times \frac{\text{cm}}{\text{depth increment}} \times \frac{10{,}000\text{ cm}^2}{\text{m}^2} \qquad [3]$$

## Statistical Comparisons

Statistical analysis of TOC, WSOC, and %WSOC as affected by individual species, species richness, fertilizer application, and harvest treatment were performed using JMP® 8.0.2 statistical software. An analysis of variance (ANOVA) was used to determine if significant statistical differences existed due to a treatment within TOC, WSOC, and %WSOC by soil depth increment and soil profile sum/mean. The Tukey-Kramer honestly significant difference (HSD) was used to separate means so as to determine where the significant differences existed within the data. All statistical comparisons were performed at an $\alpha = 0.05$ and considered significant at the $p < 0.05$ level.

Ekre Ranch samples were analyzed to determine the effect of individual plant species, species richness mixtures, and fertilizer application treatments on TOC, WSOC, and %WSOC means. Fertilizer application treatment comparisons were performed with only data collected from the species richness samples. Differences between N and P (type) as well as high and low (rate) fertilizer application at the Ekre Ranch was not possible due to the combination of samples across fertilizer type and rate treatments with the individual species because of the uneven distribution of the individual species between plots and treatments. However, the species richness samples at Ekre Ranch were not composited across fertilizer treatments allowing comparisons of fertilizer application type and rate to be made on those samples.

Carrington soil samples were analyzed to determine the effect of individual grass species, a Conservation Reserve Program mixture, and harvest frequency on mean TOC, WSOC, and %WSOC by soil depth increment and soil profile sum/mean. Carrington was the only site that did not incorporate a fertilizer treatment into its design. Dickinson samples were analyzed to determine the effect of individual species, species richness mixtures, and fertilizer application on TOC, WSOC, and %WSOC means by soil depth increment and soil profile sum/mean.

## RESULTS

## Albert Ekre Ranch Site

Site Summary

Total OC, WSOC, and %WSOC by soil depth increment across all samples taken at Ekre Ranch are shown in Table 3 with graphics for TOC and WSOC in Figure 2. The TOC accumulation trend across all samples and treatments at Ekre Ranch was greatest near the soil surface, and then decreased with increasing soil depth. Total OC concentrations were greatest in the upper 45 cm and significantly decreased with increasing soil depth increments. The mean TOC soil profile sum was 10.91 kg $m^{-2}$ 90 $cm^{-1}$.

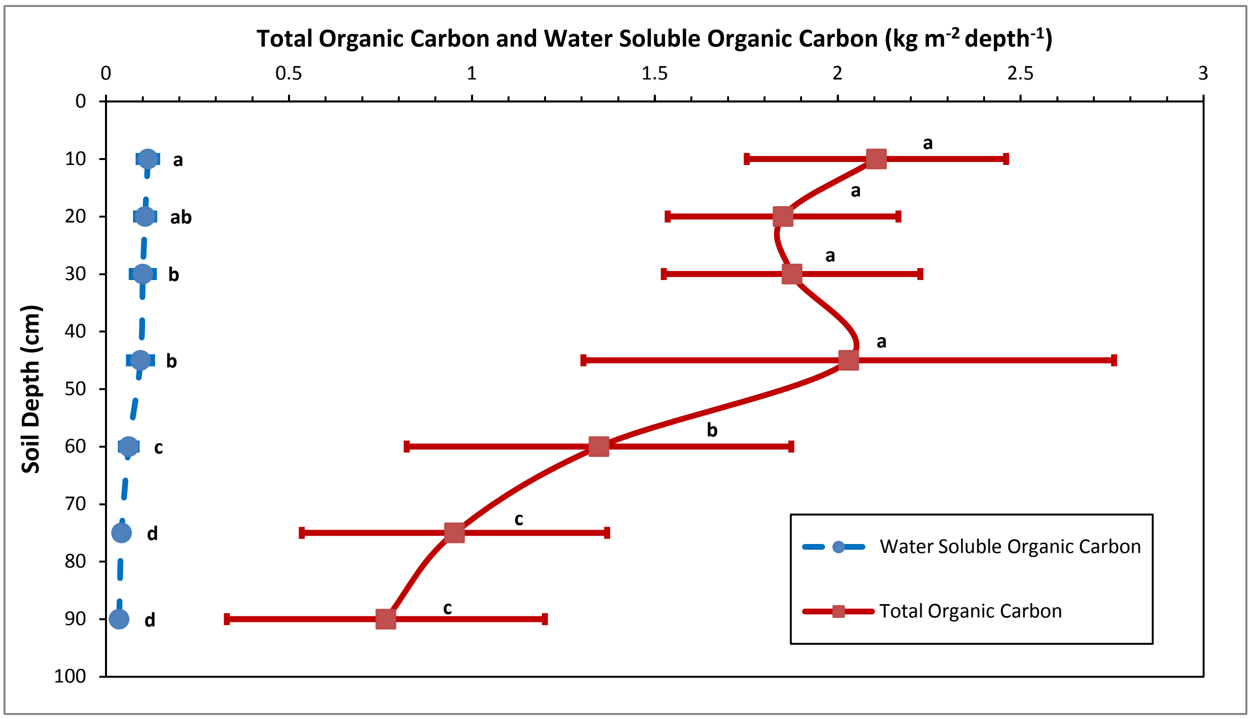


Figure 2. Ekre Ranch total organic carbon and water soluble organic carbon by soil depth increment across all treatments and samples, shown with standard deviations. Depths followed by the same lowercase letter are not significantly different ($p<0.05$).

The trend for WSOC across all Ekre Ranch samples and treatments tended to decrease with increasing soil depth just as TOC did. Water soluble OC was significantly greater in the 0-10 cm range (0.11 kg $m^{-2}$) of the soil profile compared to the 20-90 cm range (0.10 to 0.04 kg $m^{-2}$);

Table 3. Ekre Ranch water soluble organic carbon (WSOC), total organic carbon (TOC), and proportion of TOC that is comprised of WSOC (%WSOC) by soil depth increment across all grass and species richness samples as well as for the cropland check.

| | Species + Species Richness | | | Cropland Check | | |
|---|---|---|---|---|---|---|
| Soil Depth | WSOC | TOC | %WSOC[†] | WSOC | TOC | %WSOC |
| ---cm--- | ------------kg $m^{-2}$ $depth^{-1}$------------ | | ---------%--------- | -------------kg $m^{-2}$ $depth^{-1}$------------ | | --------%-------- |
| 0-10 | 0.11 (0.03[‡])a[§] | 2.11 (0.35)a | 5.54 (0.01)a | 0.13 (0.01)ab | 1.77 (0.23)a | 7.25 (0.01)abc |
| 10-20 | 0.11 (0.02)ab | 1.85 (0.32)a | 6.11 (0.03)a | 0.15 (0.01)a | 1.75 (0.17)a | 8.42 (0.01)a |
| 20-30 | 0.10 (0.03)b | 1.88 (0.35)a | 5.61 (0.03)a | 0.11 (0.01)b | 1.52 (0.32)ab | 7.58 (0.01)ab |
| 30-45 | 0.09 (0.03)b | 2.03 (0.73)a | 5.32 (0.05)a | 0.08 (0.02)c | 1.54 (0.52)ab | 5.27 (0.01)bcd |
| 45-60 | 0.06 (0.02)c | 1.35 (0.53)b | 4.94 (0.02)a | 0.05 (0.01)cd | 1.20 (0.31)abc | 4.15 (0.01)d |
| 60-75 | 0.04 (0.01)d | 0.95 (0.42)c | 4.85 (0.02)a | 0.04 (0.01)d | 0.91 (0.20)bc | 4.20 (0.02)d |
| 75-90 | 0.04 (0.01)d | 0.76 (0.43)c | 5.35 (0.02)a | 0.03 (0.00)d | 0.77 (0.14)c | 4.61 (0.01)cd |
| Profile Sum[¶] | 0.55 (0.11) | 10.91 (1.67) | N/A | 0.58 (0.06) | 9.45 (1.62) | N/A |
| Profile Mean[#] | N/A | N/A | 5.39 (0.02) | N/A | N/A | 5.93 (0.01) |
| n[††] | 58 | 58 | 58 | 4 | 4 | 4 |

[†]%WSOC is the proportion of total organic carbon that is comprised of water soluble organic carbon, expressed as a percent.

[‡]Standard deviation.

[§]Means within carbon type columns that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean sequentially followed by letters with lower mean values.

[¶]Soil profile sum is the average of all individual soil profile sums across all species treatments.

[#]Soil profile mean is the average of all individual soil profile means across all species and fertilizer application treatments.

[††]n is the sample size of the treatment.

significant differences existed between soil depth increments within the 20-90 cm range and can be found in Table 3. The mean WSOC soil profile sum was 0.55 kg $m^{-2}$ 90 $cm^{-1}$. The proportion of TOC that is made up of WSOC (%WSOC) did not exhibit statistical differences between soil depth increments. However, the highest value (6.11%) was observed in the 10-20 cm depth increment. On average, WSOC made up 5.36% of TOC throughout the 90 cm soil profile across the site.

Species Comparisons

Total OC, WSOC, and %WSOC by soil depth increment and soil profile sum were compared among eight individual species and a cropland check in an adjacent field that had previously been planted to spring wheat. Total OC concentrations are shown in Table 4 and Figure B5 (Appendix B). Total OC at 0-10 cm was significantly greater for *A. gerardii* (2.61 kg $m^{-2}$) compared to *E. canadensis* (1.74 kg $m^{-2}$) and the check (1.77 kg $m^{-2}$). At 20-30 cm, TOC for *S. canadensis / missouriensis* (2.33 kg $m^{-2}$) was significantly greater than the check (1.52 kg $m^{-2}$). *Elymus canadensis* (2.92 kg $m^{-2}$) was significantly greater than the check, *P. virgatum*, and *A. gerardii* (1.54, 1.47, and 1.33 kg $m^{-2}$, respectively) at 30-45 cm. Total OC soil profile sums ranged from 12.39 kg $m^{-2}$ 90 $cm^{-1}$ (*S. canadensis / missouriensis*) to 9.36 kg $m^{-2}$ 90 $cm^{-1}$ (*P. virgatum*), but did not contain statistical differences between any of the species or the cropland check. The trend for TOC as affected by individual species tended to decrease with increasing soil depth for the majority of the species (Figure B5, Appendix B).

Water soluble OC concentrations by soil depth as affected by species are shown in Table 5 and Figure B6 (Appendix B). Water soluble OC for the check (0.15 kg $m^{-2}$) at 10 to 20 cm, was significantly greater compared to *P. pratensis* (0.09 kg $m^{-2}$) and *S. canadensis / missouriensis* (0.09 kg $m^{-2}$). *Elymus canadensis* (0.09 kg $m^{-2}$) was significantly greater than the check (0.05 kg $m^{-2}$) at 45-60 cm. Water soluble OC soil profile sums ranged from 0.69 (*E. canadensis*) to 0.52 kg $m^{-2}$ 90 $cm^{1}$ (*P. virgatum*), but were not statistically different from one another. Water soluble OC distribution by soil depth as affected by species was similar to TOC. Percent WSOC by soil depth

Table 4. Ekre Ranch total organic carbon by soil depth increment as affected by plant species treatment.

| | Total Organic Carbon | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Soil Depth | Solidago candensis/ missouriensis | Elymus canadensis | Poa pratensis | Andropogon gerardii | Agropyron cristatum | Helianthus maximilliana | Bromus inermis | Wheat Check | Panicum virgatum |
| ---cm--- | -----kg $m^{-2}$ $depth^{-1}$----- | | | | | | | | |
| 0-10 | 2.51 (0.25[†])ab[‡] | 1.74 (0.29)b | 2.26 (0.27)ab | 2.61 (0.50)a | 1.93 (0.23)ab | 2.00 (0.35)ab | 2.28 (0.40)ab | 1.77 (0.23)b | 2.16 (0.37)ab |
| 10-20 | 2.25 (0.23)a | 1.78 (0.18)a | 1.93 (0.10)a | 1.86 (0.95)a | 1.82 (0.21)a | 1.86 (0.15)a | 1.97 (0.27)a | 1.75 (0.17)a | 1.73 (0.12)a |
| 20-30 | 2.33 (0.27)a | 2.09 (0.19)ab | 2.16 (0.27)ab | 1.62 (0.71)ab | 1.95 (0.16)ab | 1.83 (0.16)ab | 1.86 (0.25)ab | 1.52 (0.32)b | 1.78 (0.24)ab |
| 30-45 | 2.58 (0.27)ab | 2.92 (0.34)a | 2.33 (0.31)abc | 1.33 (0.65)c | 2.09 (0.37)abc | 1.94 (0.48)abc | 1.96 (0.58)abc | 1.54 (0.52)bc | 1.47 (0.29)c |
| 45-60 | 1.14 (0.29)a | 1.92 (0.39)a | 1.46 (0.62)a | 1.19 (0.85)a | 1.33 (0.19)a | 1.45 (0.26)a | 1.24 (0.55)a | 1.20 (0.31)a | 1.02 (0.26)a |
| 60-75 | 0.81 (0.20)a | 1.13 (0.33)a | 0.82 (0.36)a | 1.35 (1.08)a | 1.13 (0.13)a | 1.10 (0.41)a | 0.75 (0.37)a | 0.91 (0.20)a | 0.65 (0.14)a |
| 75-90 | 0.49 (0.14)a | 0.60 (0.15)a | 0.51 (0.08)a | 1.32 (1.40)a | 0.77 (0.16)a | 0.83 (0.26)a | 0.84 (0.51)a | 0.77 (0.14)a | 0.55 (0.30)a |
| Profile Sum[§] | 12.39 (0.51)a | 12.17 (0.92)a | 11.47 (1.64)a | 11.28 (1.27)a | 11.03 (0.40)a | 11.02 (1.74)a | 10.91 (1.72)a | 9.45 (1.62)a | 9.36 (1.19)a |
| n[¶] | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 4 | 4 |

[†]Standard deviation.

[‡]Means within soil depth rows that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean sequentially followed by letters with lower mean values.

[§]Soil profile sum is the average of all individual soil profile sums within a species treatment.

[¶]n is the sample size within the treatment.

Table 5. Ekre Ranch mean water soluble organic carbon by soil depth increment as affected by plant species treatment.

| | Water Soluble Organic Carbon | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Soil Depth | Solidago candensis/ missouriensis | Elymus canadensis | Poa pratensis | Andropogon gerardii | Agropyron cristatum | Helianthus maximilliana | Bromus inermis | Wheat Check | Panicum virgatum |
| ---cm--- | ---kg $m^{-2}$ $depth^{-1}$--- | | | | | | | | |
| 0-10 | 0.13 (0.02†)a‡ | 0.10 (0.01)a | 0.13 (0.02)a | 0.11 (0.02)a | 0.11 (0.01)a | 0.13 (0.01)a | 0.13 (0.04)a | 0.13 (0.01)a | 0.13 (0.01)a |
| 10-20 | 0.09 (0.04)c | 0.12 (0.02)abc | 0.09 (0.01)bc | 0.11 (0.01)abc | 0.12 (0.01)abc | 0.13 (0.01)ab | 0.13 (0.02)abc | 0.15 (0.01)a | 0.10 (0.02)bc |
| 20-30 | 0.12 (0.01)a | 0.14 (0.01)a | 0.11 (0.01)a | 0.09 (0.04)a | 0.12 (0.02)a | 0.12 (0.01)a | 0.10 (0.04)a | 0.11 (0.01)a | 0.09 (0.01)a |
| 30-45 | 0.09 (0.02)a | 0.13 (0.01)a | 0.10 (0.02)a | 0.08 (0.05)a | 0.13 (0.04)a | 0.10 (0.02)a | 0.11 (0.04)a | 0.08 (0.02)a | 0.08 (0.02)a |
| 45-60 | 0.06 (0.01)ab | 0.09 (0.02)a | 0.06 (0.02)ab | 0.06 (0.01)ab | 0.06 (0.01)ab | 0.07 (0.02)ab | 0.08 (0.03)ab | 0.05 (0.01)b | 0.05 (0.01)ab |
| 60-75 | 0.04 (0.01)a | 0.06 (0.02)a | 0.03 (0.01)a | 0.05 (0.02)a | 0.05 (0.01)a | 0.05 (0.01)a | 0.04 (0.01)a | 0.04 (0.01)a | 0.03 (0.01)a |
| 75-90 | 0.04 (0.01)a | 0.04 (0.01)a | 0.03 (0.01)a | 0.04 (0.02)a | 0.04 (0.01)a | 0.04 (0.01)a | 0.04 (0.01)a | 0.03 (0.005)a | 0.03 (0.005)a |
| Profile Sum§ | 0.57 (0.06)a | 0.69 (0.01)a | 0.55 (0.05)a | 0.54 (0.16)a | 0.63 (0.09)a | 0.66 (0.07)a | 0.63 (0.15)a | 0.58 (0.06)a | 0.52 (0.03)a |
| n¶ | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 4 | 4 |

†Standard deviation.

‡Means within soil depth rows that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean sequentially followed by letters with lower mean values.

§Soil profile sum is the average of all individual soil profile sums within a species treatment.

¶n is the sample size within the treatment.

increment did not show any statistical differences among species at any depth or soil profile mean. Percent WSOC soil profile means ranged from 7.25% (*A. gerardii*) to 4.84% (*P. pratensis*) as seen in Table A1 (Appendix A).

Species Richness Comparisons

Total OC by soil depth increment and soil profile sum as affected by species richness treatments are shown in Table A2 (Appendix A) and Figure B7 (Appendix B). There were no statistical differences found at any soil depth increment or soil profile sum for TOC among species richness treatments. Total OC soil profile sums ranged from 11.65 (1 species) to 9.81 kg $m^{-2}$ 90 $cm^{-1}$ (20 species). Water soluble OC by soil depth increment and soil profile sum as affected by species richness can be found in Table A3 (Appendix A) and Figure B8 (Appendix B). Again, there were no statistical differences at any soil depth increment or soil profile sum for WSOC among species richness treatments. Water soluble OC soil profile sums ranged from 0.43 (10 and 20 species) to 0.51 kg $m^{-2}$ 90 $cm^{-1}$ (1 and 2 species). Percent WSOC by soil depth increment and soil profile sum as affected by species richness treatments are shown in Table A4 (Appendix A). There were no statistical differences among species richness treatments when comparing %WSOC soil profile means. Percent WSOC soil profile means ranged from 4.75% (2 species) to 4.18% (10 species). It appears that an increase in species richness may reduce the effects that individual species have on the percentage of WSOC present in the soil profile.

Fertilization Comparisons

Ekre Ranch TOC by depth increment and soil profile sum as affected by the type and rate of fertilizer applied, analyzed across all species richness treatments are shown in Table 6 and Figures B9 and B10 (Appendix B). At the 0-10 and 10-20 cm depth increments, TOC as affected by P fertilization (2.13 and 1.94 kg $m^{-2}$, respectively) were significantly greater compared to N fertilizer application (1.95 and 1.64 kg $m^{-2}$, respectively). On the other hand, N (2.48 and 1.11 kg $m^{-2}$) was significantly greater compared to P fertilizer application (1.64 and 0.77 kg $m^{-2}$) at 30-45 and 60-75

Table 6. Ekre Ranch mean total organic carbon by soil depth increment across all species richness treatments as affected by fertilizer type and application rate.

| | Total Organic Carbon | | | |
|---|---|---|---|---|
| | Fertilizer Type | | Fertilizer Application Rate | |
| Soil Depth | Nitrogen | Phosphorus | High† | Low‡ |
| ---cm--- | ---kg m$^{-2}$ depth$^{-1}$--- | | | |
| 0-10 | 1.95 (0.19§)b¶ | 2.13 (0.17)a | 1.98 (0.19)a | 2.13 (0.18)a |
| 10-20 | 1.64 (0.19)b | 1.94 (0.19)a | 1.70 (0.24)a | 1.92 (0.20)a |
| 20-30 | 1.88 (0.26)a | 1.78 (0.36)a | 1.75 (0.33)a | 1.94 (0.25)a |
| 30-45 | 2.48 (0.99)a | 1.64 (0.56)b | 2.04 (1.15)a | 2.09 (0.27)a |
| 45-60 | 1.57 (0.78)a | 1.09 (0.32)a | 1.36 (0.76)a | 1.27 (0.40)a |
| 60-75 | 1.11 (0.32)a | 0.77 (0.32)b | 1.03 (0.34)a | 0.80 (0.36)a |
| 75-90 | 0.88 (0.17)a | 0.71 (0.18)a | 0.87 (0.17)a | 0.67 (0.18)b |
| Profile Sum# | 11.50 (2.25)a | 9.97 (1.19)a | 10.73 (2.45)a | 10.75 (0.74)a |
| n†† | 10 | 10 | 12 | 8 |

†High fertilizer application rates were 200 kg N ha$^{-1}$ yr$^{-1}$ and 40 kg P ha$^{-1}$ yr$^{-1}$.

‡Low fertilizer application rates were 20 kg N ha$^{-1}$ yr$^{-1}$ and 4 kg P ha$^{-1}$ yr$^{-1}$.

§Standard deviation.

¶Means within soil depth rows that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean followed by sequential letters with lower mean values.

#Soil profile sum is the average of all individual soil profile sums within fertilizer type and application rate treatments across all species richness treatments.

††n is the sample size within the treatment

cm, respectively. There was no statistical difference between TOC soil profile sums for N (11.50 kg $m^{-2}$ 90 $cm^{-1}$) and P (9.97 kg $m^{-2}$ 90 $cm^{-1}$) when comparing the type of fertilizer applied. Total OC was significantly greater at the 75-90 cm soil depth increment for the high (0.87 kg $m^{-2}$) compared to the low fertilizer application rate (0.67 kg $m^{-2}$). However, there was no statistical difference in TOC between the high (10.73 kg $m^{-2}$ 90 $cm^{-1}$) and low fertilizer application rates (10.75 kg $m^{-2}$ 90 $cm^{-1}$) when comparing soil profile sums.

Fertilizer type and rate effects on Ekre Ranch WSOC by soil depth increment and soil profile sum, analyzed across all species richness treatments are shown in Table 7 and Figures B11 and B12 (Appendix B). Water soluble OC was significantly greater at 0-10 cm for P (0.11 kg $m^{-2}$) compared to N (0.08 kg $m^{-2}$). The N treatment showed significantly greater WSOC at deeper soil depth increments compared to P. The effects of nutrient application on WSOC are similar to TOC in that P had a greater effect on TOC concentrations near the soil surface and N has significantly greater TOC accumulation in the subsoil compared to P fertilizer application. There was no statistical difference between soil profile sums for N (0.50 kg $m^{-2}$ 90 $cm^{-1}$) and P (0.44 kg $m^{-2}$ 90 $cm^{-1}$). Water soluble OC was significantly greater for the high fertilizer application rate (0.08 kg $m^{-2}$) at the 20-30 cm depth compared to the low rate (0.06 kg $m^{-2}$). There was no statistical difference between soil profile sums for the high (0.49 kg $m^{-2}$ 90 $cm^{-1}$) and the low fertilizer application rate (0.44 kg $m^{-2}$ 90 $cm^{-1}$). The %WSOC by soil depth increment and soil profile mean as affected by the type and rate of fertilizer applied across all species richness treatments are shown in Table 8. Percent WSOC in the 0-10 cm soil depth increment was significantly greater for P (5.32%) compared to N fertilizer application (4.12%). There was no statistical difference between N (4.45%) and P fertilizer (4.59%) when soil profile means were compared. Percent WSOC was significantly greater for the high N and P fertilizer application rates (4.83 and 4.84%, respectively) compared to the low rates (3.71 and 3.58%, respectively) at the 20-30 and 30-45 cm soil depth increments. The low rate (5.17%) was significantly greater compared to the high rate (3.81%) at the 60-75 cm depth, but

Table 7. Ekre Ranch mean water soluble organic carbon by soil depth increment across all species richness treatments as affected by fertilizer type and fertilizer application rate.

| | Water Soluble Organic Carbon | | | |
|---|---|---|---|---|
| | Fertilizer Type | | Fertilizer Application Rate | |
| Soil Depth | Nitrogen | Phosphorus | High[†] | Low[‡] |
| ---cm--- | ----------kg m$^{-2}$ depth$^{-1}$---------- | | | |
| 0-10 | 0.08 (0.02[§])b[¶] | 0.11 (0.02)a | 0.10 (0.03)a | 0.10 (0.02)a |
| 10-20 | 0.08 (0.01)a | 0.09 (0.01)a | 0.09 (0.01)a | 0.09 (0.02)a |
| 20-30 | 0.09 (0.02)a | 0.07 (0.03)b | 0.08 (0.02)a | 0.06 (0.03)b |
| 30-45 | 0.10 (0.03)a | 0.07 (0.02)b | 0.09 (0.03)a | 0.07 (0.01)a |
| 45-60 | 0.07 (0.03)a | 0.04 (0.01)b | 0.06 (0.03)a | 0.05 (0.01)a |
| 60-75 | 0.04 (0.02)a | 0.03 (0.01)a | 0.04 (0.02)a | 0.04 (0.01)a |
| 75-90 | 0.04 (0.01)a | 0.03 (0.01)a | 0.03 (0.01)a | 0.03 (0.01)a |
| Profile Sum[#] | 0.50 (0.11)a | 0.44 (0.06)a | 0.49 (0.10)a | 0.44 (0.07)a |
| n[††] | 10 | 10 | 12 | 8 |

[†]High fertilizer application rates were 200 kg N ha$^{-1}$ yr$^{-1}$ and 40 kg P ha$^{-1}$ yr$^{-1}$.

[‡]Low fertilizer application rates were 20 kg N ha$^{-1}$ yr$^{-1}$ and 4 kg P ha$^{-1}$ yr$^{-1}$.

[§]Standard deviation.

[¶]Means within soil depth rows that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean followed by sequential letters with lower mean values.

[#]Soil profile sum is the average of all individual soil profile sums within fertilizer type and application rate treatments across all species richness treatments.

[††]n is the sample size within the treatment.

Table 8. Ekre Ranch mean proportion of total organic carbon that is comprised of water soluble organic carbon, expressed as a percent (%WSOC) by soil depth increment as affected by fertilizer type and fertilizer application rate.

| | %WSOC | | | |
|---|---|---|---|---|
| | Fertilizer Type | | Fertilizer Application Rate | |
| Soil Depth | Nitrogen | Phosphorus | High[†] | Low[‡] |
| ---cm--- | ---% | --- | --- | --- |
| 0-10 | 4.12 (0.01[§])b[¶] | 5.32 (0.01)a | 4.79 (0.01)a | 4.61 (0.01)a |
| 10-20 | 5.11 (0.01)a | 4.88 (0.01)a | 5.25 (0.01)a | 4.62 (0.01)a |
| 20-30 | 4.65 (0.01)a | 4.16 (0.01)a | 4.83 (0.01)a | 3.71 (0.01)b |
| 30-45 | 4.31 (0.01)a | 4.36 (0.01)a | 4.84 (0.01)a | 3.58 (0.01)b |
| 45-60 | 4.91 (0.02)a | 4.08 (0.01)a | 4.95 (0.01)a | 3.81 (0.01)a |
| 60-75 | 3.80 (0.01)a | 4.92 (0.02)a | 3.81 (0.01)b | 5.17 (0.02)a |
| 75-90 | 4.26 (0.02)a | 4.83 (0.01)a | 4.06 (0.01)a | 5.35 (0.01)a |
| Profile Mean[#] | 4.45 (0.01)a | 4.59 (0.005)a | 4.65 (0.004)a | 4.33 (0.01)a |
| n[††] | 10 | 10 | 12 | 8 |

[†]High fertilizer application rates were 200 kg N $ha^{-1}$ $yr^{-1}$ and 40 kg P $ha^{-1}$ $yr^{-1}$.

[‡]Low fertilizer application rates were 20 kg N $ha^{-1}$ $yr^{-1}$ and 4 kg P $ha^{-1}$ $yr^{-1}$.

[§]Standard deviation.

[¶]Means within soil depth rows that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean followed by sequential letters with lower mean values.

[#]Soil profile mean is the average of all individual soil profile means within fertilizer type and application rate treatments across all species richness treatments.

[††]n is the sample size within the treatment.

there was no statistical difference between soil profile means for the high (4.65%) compared to the low fertilizer application rate (4.33%).

## Carrington Site

### Site Summary

Total OC, WSOC, and %WSOC by soil depth increment across all samples taken at the site are shown in Table 9 with graphics for TOC and WSOC in Figure 3. Total OC concentrations across all samples and treatments at Carrington were greatest near the soil surface, and then decreased with increasing soil depth. The 0-10 cm depth was significantly greater than deeper depth increments, but was not statistically different from the 10-20 or 30-45 cm depths. The mean TOC soil profile sum, averaged across all Carrington treatments, was 18.89 kg $m^{-2}$ 90 $cm^{-1}$.

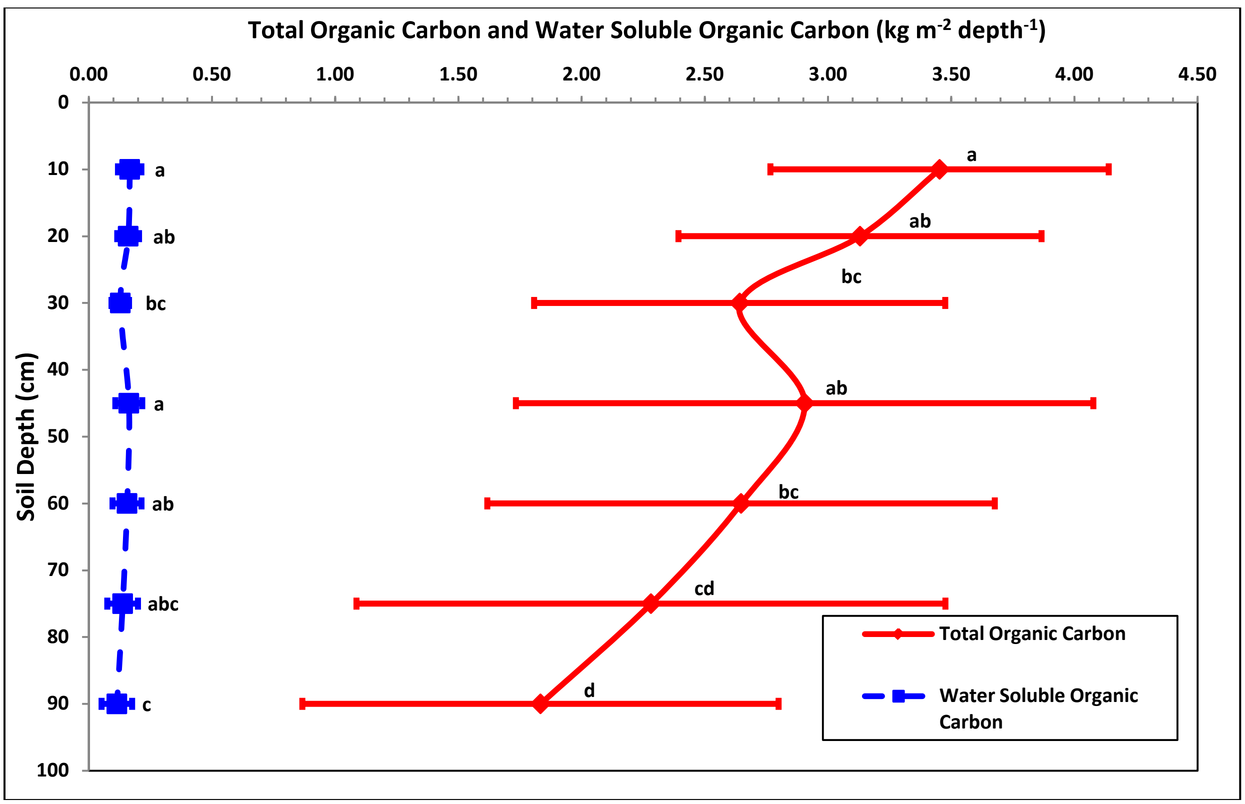


Figure 3. Carrington total organic carbon and water soluble organic carbon by soil depth increment across all species and harvest treatments, with standard deviations. Depths followed by the same lowercase letter are not significantly different ($p<0.05$).

Table 9. Carrington mean water soluble organic carbon (WSOC), total organic carbon (TOC), and proportion of TOC that is comprised of WSOC (%WSOC) by soil depth increment across all species and harvest treatments as well as for the cropland check.

| | Species | | | Cropland Check | | |
|---|---|---|---|---|---|---|
| Soil Depth | WSOC | TOC | %WSOC† | WSOC | TOC | %WSOC |
| ---cm--- | ------------kg $m^{-2}$ $depth^{-1}$----------- | | ----------%--------- | ------------kg $m^{-2}$ $depth^{-1}$---------- | | ---------%--------- |
| 0-10 | 0.17 (0.05‡)a§ | 3.45 (0.69)a | 4.92 (0.02)b | 0.05 (0.04)a | 2.91 (0.27)a | 1.82 (0.01)a |
| 10-20 | 0.16 (0.04)ab | 3.13 (0.74)ab | 5.35 (0.02)ab | 0.05 (0.03)a | 2.70 (0.28)ab | 1.95 (0.01)a |
| 20-30 | 0.13 (0.04)bc | 2.64 (0.83)bc | 5.15 (0.02)ab | 0.06 (0.01)a | 2.12 (0.36)abc | 2.74 (0.01)a |
| 30-45 | 0.16 (0.05)a | 2.91 (1.17)ab | 6.01 (0.02)ab | 0.07 (0.01)a | 1.98 (0.29)bcd | 3.35 (0.01)a |
| 45-60 | 0.16 (0.06)ab | 2.65 (1.03)bc | 6.12 (0.02)ab | 0.05 (0.03)a | 2.17 (0.30)abc | 2.36 (0.01)a |
| 60-75 | 0.14 (0.06)abc | 2.28 (1.19)cd | 6.23 (0.02)ab | 0.03 (0.01)a | 1.62 (0.55)cd | 2.13 (0.00)a |
| 75-90 | 0.11 (0.06)c | 1.83 (0.97)d | 6.47 (0.03)a | 0.04 (0.03)a | 1.23 (0.47)d | 2.81 (0.01)a |
| Profile Sum¶ | 1.03 (0.30) | 18.89 (5.59) | N/A | 0.35 (0.05) | 14.73 (1.22) | N/A |
| Profile Mean# | N/A | N/A | 5.75 (0.01) | N/A | N/A | 2.45 (0.00) |
| n†† | 44 | 44 | 44 | 4 | 4 | 4 |

†%WSOC is the proportion of total organic carbon that is comprised of water soluble organic carbon, expressed as a percent.

‡Standard deviation.

§Means within carbon type columns that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean sequentially followed by letters with lower mean values.

¶Soil profile sum is the average of all individual soil profile sums across all species and harvest treatments.

#Soil profile mean is the average of all individual soil profile means across all species and harvest treatments.

††n is the sample size of the treatment.

The WSOC distribution within the soil profile at Carrington tended to be greatest near the soil surface, then decreased with increasing depth until concentrations significantly increased at 30-45 cm, and then once again decreased with increasing soil depth. Water soluble OC at the 0-10 and 30-45 cm depth (0.17 and 0.16 kg $m^{-2}$, respectively) were significantly greater than the 20-30 and 75-90 cm depth increments (0.13 and 0.11 kg $m^{-2}$, respectively). However, the 0-10 and 30-45 cm depth increments were not statistically different from one another. The mean WSOC soil profile sum was 1.03 kg $m^{-2}$ 90 $cm^{-1}$. The greatest percentage of WSOC relative to TOC was found at the 75-90 cm depth with 6.47%, which was significantly greater than the 0-10 cm depth (4.92%). All other soil depths were not statistically different than the 0-10 and 75-90 cm depth increments. Averaged throughout the soil profile, WSOC made up 5.75% of TOC.

Species Comparisons

The effect of individual species on TOC by soil depth increment, when analyzed across all harvest treatments are shown in Table A5 (Appendix A) and Figure B13 (Appendix B). There were no significant differences between the five species treatments and the cropland check at any soil depth increment or soil profile sum. The mean soil profile sum ranged from 21.10 (CRP mix) to 14.73 kg $m^{-2}$ 90 $cm^{-1}$ (cropland check). Although the CRP mix had the greatest soil profile mean, it also had the greatest variability, with a standard deviation of 8.83 kg $m^{-2}$, compared to 1.22 kg $m^{-2}$ for the cropland check.

Water soluble OC by soil depth increment as affected by the five species treatments and cropland check are shown in Table 10 and Figure B14 (Appendix B). The cropland check was significantly lower than all other species treatments from the soil surface down to 60 cm. Comparisons between WSOC mean soil profile sums indicated that the cropland check was significantly smaller than *Panicum virgatum* var. Sunburst, *Panicum virgatum* var. Trailblazer, *Thinopyrum ponticum* var. Alkar, *Agropyron intermedium* var. Haymaker, and the CRP mix; with no

Table 10. Carrington mean water soluble organic carbon by soil depth increment across all harvest treatments as affected by species.

| | Water Soluble Organic Carbon | | | | | |
|---|---|---|---|---|---|---|
| Soil Depth | Alkar† | Haymaker | Sunburst | Trailblazer | CRP | Check |
| ---cm--- | ---kg $m^{-2}$ $depth^{-1}$--- | | | | | |
| 0-10 | 0.17 (0.04‡)a§ | 0.17 (0.03)a | 0.18 (0.04)a | 0.19 (0.01)a | 0.17 (0.03)a | 0.05 (0.04)b |
| 10-20 | 0.15 (0.03)a | 0.17 (0.03)a | 0.18 (0.02)a | 0.19 (0.02)a | 0.17 (0.03)a | 0.05 (0.03)b |
| 20-30 | 0.13 (0.04)a | 0.13 (0.01)a | 0.13 (0.04)a | 0.13 (0.01)a | 0.15 (0.03)a | 0.06 (0.01)b |
| 30-45 | 0.17 (0.06)a | 0.17 (0.04)a | 0.16 (0.05)a | 0.18 (0.04)a | 0.19 (0.05)a | 0.07 (0.01)b |
| 45-60 | 0.18 (0.05)a | 0.16 (0.05)a | 0.16 (0.07)a | 0.16 (0.05)a | 0.18 (0.05)a | 0.05 (0.03)b |
| 60-75 | 0.17 (0.04)a | 0.13 (0.03)a | 0.14 (0.07)a | 0.13 (0.04)ab | 0.17 (0.07)a | 0.03 (0.01)b |
| 75-90 | 0.12 (0.03)ab | 0.11 (0.04)ab | 0.13 (0.09)ab | 0.11 (0.06)ab | 0.15 (0.07)a | 0.04 (0.03)b |
| Profile Sum¶ | 1.08 (0.22)a | 1.05 (0.15)a | 1.08 (0.32)a | 1.08 (0.18)a | 1.18 (0.26)a | 0.35 (0.05)b |
| n# | 8 | 8 | 8 | 8 | 8 | 4 |

†Alkar, Alkar Tall Wheatgrass; Haymaker, Haymaker Intermediate Wheatgrass; Sunburst, Sunburst Switchgrass; Trailblazer, Trailblazer Switchgrass; CRP, Conservation Reserve Program Mixture (Wheatgrass+Alfalfa+Sweet Clover).

‡Standard deviation.

§Means within soil depth rows that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean sequentially followed by letters with lower mean values.

¶Soil profile sum is the average of all individual soil profile sums within a species across all harvest treatments.

#n is the sample size of the treatment.

significant differences among the five species treatments. Figure B14 (Appendix B) clearly shows the separation between the cropland check and the species treatments distribution by soil depth.

The %WSOC by soil depth increment as affected by species treatment across all harvest treatments are shown in Table 11. All five species treatments have significantly greater proportions of WSOC relative to TOC, in comparison to the cropland check at the 0-10, 10-20, 45-60, and 60-75 cm depth increments. At the 20-30 cm depth, *A. intermedium* var. Haymaker (5.69%) and the CRP mix (5.57%) were the only two that were significantly greater than the cropland check (2.74%). The *P. virgatum* var. Trailblazer treatment was the only species that was significantly greater than the cropland check at the 30-45 cm depth. The average soil profile sum for the cropland check was significantly smaller in comparison to *Panicum virgatum* var. Sunburst, *Panicum virgatum* var. Trailblazer, *Thinopyrum ponticum* var. Alkar, *Agropyron intermedium* var. Haymaker, and the CRP mix. Looking at the average soil profile sum, it is evident that individual grasses as well as a mixture of grasses and forbs (CRP mix) have greater concentrations of WSOC relative to TOC when compared to a cropland soil.

Harvest Comparisons

Total OC, WSOC, and %WSOC by soil depth increment and soil profile sum as affected by biomass harvest treatment are shown in Table A6 (Appendix A) with graphics depicted for TOC in Figure B15 (Appendix B) and WSOC in Figure B16 (Appendix B). Total OC was significantly greater under the biennial harvesting treatment (2.22 kg $m^{-2}$) compared to annual harvesting (1.57 kg $m^{-2}$) only at the 75-90 cm soil depth. There were no significant differences in TOC between the harvest treatments at any other depth increment or soil profile sum. The average profile sums for annual and biennial harvesting were 17.8 and 20.8 kg $m^{-2}$ 90 $cm^{-1}$, respectively. There were no statistical differences in WSOC means between harvest treatments at any soil depth increment or soil profile sum. The mean profile sums for annual and biennial harvesting were 1.08 and 1.11 kg $m^{-2}$ 90 $cm^{-1}$, respectively. Percent WSOC means were not statistically different between either harvest

Table 11. Carrington proportion of total organic carbon that is comprised of water soluble organic carbon (%WSOC) by soil depth increment as affected by species across all harvest treatments.

| | %WSOC | | | | | |
|---|---|---|---|---|---|---|
| Soil Depth | Alkar[†] | Haymaker | Sunburst | Trailblazer | CRP | Check |
| ---cm--- | ---% | | | | | |
| 0-10 | 4.70 (0.01[‡])a[§] | 5.09 (0.01)a | 5.39 (0.01)a | 6.00 (0.01)a | 4.96 (0.01)a | 1.82 (0.01)b |
| 10-20 | 4.84 (0.02)a | 5.59 (0.01)a | 5.89 (0.01)a | 6.75 (0.02)a | 5.38 (0.01)a | 1.95 (0.01)b |
| 20-30 | 4.73 (0.01)ab | 5.69 (0.02)a | 5.47 (0.01)ab | 5.47 (0.01)ab | 5.57 (0.02)a | 2.74 (0.01)b |
| 30-45 | 5.81 (0.01)ab | 6.18 (0.02)ab | 5.75 (0.02)ab | 7.12 (0.02)a | 6.54 (0.02)ab | 3.35 (0.01)b |
| 45-60 | 6.96 (0.01)a | 6.08 (0.02)a | 5.87 (0.02)a | 6.67 (0.01)a | 6.92 (0.02)a | 2.36 (0.01)b |
| 60-75 | 7.72 (0.01)a | 5.99 (0.01)a | 6.01 (0.03)a | 6.38 (0.02)a | 7.09 (0.03)a | 2.13 (0.004)b |
| 75-90 | 7.30 (0.02)a | 6.88 (0.03)a | 6.53 (0.04)a | 6.25 (0.04)a | 7.22 (0.03)a | 2.81 (0.01)a |
| Profile Mean[¶] | 6.01 (0.004)a | 5.93 (0.01)a | 5.84 (0.01)a | 6.38 (0.01)a | 6.24 (0.01)a | 2.45 (0.004)b |
| n[#] | 8 | 8 | 8 | 8 | 8 | 4 |

[†]Alkar, Alkar Tall Wheatgrass; Haymaker, Haymaker Intermediate Wheatgrass; Sunburst, Sunburst Switchgrass; Trailblazer, Trailblazer Switchgrass; CRP, Conservation Reserve Program Mixture (Wheatgrass+Alfalfa+Sweet Clover).

[‡]Standard deviation.

[§]Means within soil depth rows that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean sequentially followed by letters with lower mean values.

[¶]Soil profile mean is the average of all individual soil profile means within a species across all harvest treatments.

[#]n is the sample size of the treatment.

treatment at any soil depth increment or soil profile mean. The %WSOC soil profile means for annual and biennial harvesting were 6.35 and 5.81%, respectively.

Total OC, WSOC, and %WSOC by soil depth increment and soil profile sum/mean as affected by species that were harvested annually and biennially are shown in Tables A7 (Appendix A), A8 (Appendix A), and A9 (Appendix A), respectively. There were no statistical differences among TOC, WSOC, and %WSOC due to harvest treatment at any soil depth or soil profile sum/mean for any of the species treatments.

## Dickinson Site

### Site Summary

Total OC, WSOC, and %WSOC by soil depth increment across all treatments sampled at Dickinson are shown in Table 12 with TOC and WSOC distribution by depth graphically displayed in Figure 4. Contrary to the trends found in Ekre Ranch and Carrington data, where TOC was greatest at the surface and decreased with increasing soil depth, TOC across the Dickinson site was greatest near the soil surface, then decreased with depth until TOC concentrations increased starting at 30 cm and then decreased with increasing depth starting at 60 cm. The average soil profile sum of TOC across the site was 12.32 kg $m^{-2}$ 90 $cm^{-1}$.

Throughout the Dickinson site, WSOC tended to be greatest near the soil surface and then decreased with increasing depth. The mean WSOC soil profile sum across the site was 0.70 kg $m^{-2}$ 90 $cm^{-1}$. Percent WSOC was not statistically different between any of the soil depth increments and ranged from 6.89% (10-20 cm) to 5.63% (45-60 cm). On average throughout the soil profile, WSOC made up 6.27% of TOC.

### Species Comparisons

Mean TOC by soil depth increment as affected by species treatment across all fertilizer treatments as compared to the cropland check are presented in Table A10 (Appendix A) and Figure B17 (Appendix B). Statistical differences did not exist between species and cropland check at any

Table 12. Dickinson water soluble organic carbon (WSOC), total organic carbon (TOC), and the proportion of TOC that is WSOC (%WSOC) by soil depth increment across all grass and species richness samples as well as for the cropland check.

| | Species + Species Richness | | | Cropland Check | | |
|---|---|---|---|---|---|---|
| Soil Depth | WSOC | TOC | %WSOC† | WSOC | TOC | %WSOC |
| ---cm--- | ------------kg m$^{-2}$ depth$^{-1}$------------ | | ----------%---------- | ----------kg m$^{-2}$ depth$^{-1}$--------- | | -------%------- |
| 0-10 | 0.14 (0.04‡)a§ | 2.71 (0.67)a | 5.91 (0.06)a | 0.09 (0.02)a | 3.19 (1.71)a | 3.40 (0.01)a |
| 10-20 | 0.13 (0.04)a | 1.92 (0.43)b | 6.89 (0.02)a | 0.13 (0.02)a | 2.05 (0.10)ab | 6.18 (0.01)a |
| 20-30 | 0.10 (0.03)b | 1.48 (0.42)cd | 6.83 (0.03)a | 0.10 (0.04)a | 1.52 (0.09)b | 6.19 (0.02)a |
| 30-45 | 0.11 (0.04)b | 1.96 (0.47)b | 5.74 (0.02)a | 0.10 (0.08)a | 2.01 (0.32)ab | 4.76 (0.03)a |
| 45-60 | 0.09 (0.03)bc | 1.71 (0.52)bc | 5.63 (0.02)a | 0.08 (0.05)a | 1.66 (0.29)ab | 4.96 (0.03)a |
| 60-75 | 0.07 (0.03)cd | 1.41 (0.62)de | 6.16 (0.03)a | 0.07 (0.05)a | 1.36 (0.48)b | 5.54 (0.04)a |
| 75-90 | 0.06 (0.04)d | 1.14 (0.61)e | 6.73 (0.05)a | 0.06 (0.06)a | 1.10 (0.23)b | 5.85 (0.06)a |
| Profile Sum¶ | 0.70 (0.19) | 12.32 (2.30) | N/A | N/A | N/A | 5.27 (0.02) |
| Profile Mean# | N/A | N/A | 6.27 (0.02) | 0.64 (0.30) | 12.89 (2.68) | N/A |
| n†† | 69 | 69 | 69 | 4 | 4 | 4 |

†%WSOC is the proportion of total organic carbon that is comprised of water soluble organic carbon, expressed as a percent.

‡Standard deviation.

§Means within columns that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean sequentially followed by letters with lower mean values.

¶Soil profile sum is the average of all individual soil profile sums across all species and fertilizer application treatments.

#Soil profile mean is the average of all individual soil profile means across all species and fertilizer application treatments.

††n is the sample size of the treatment.

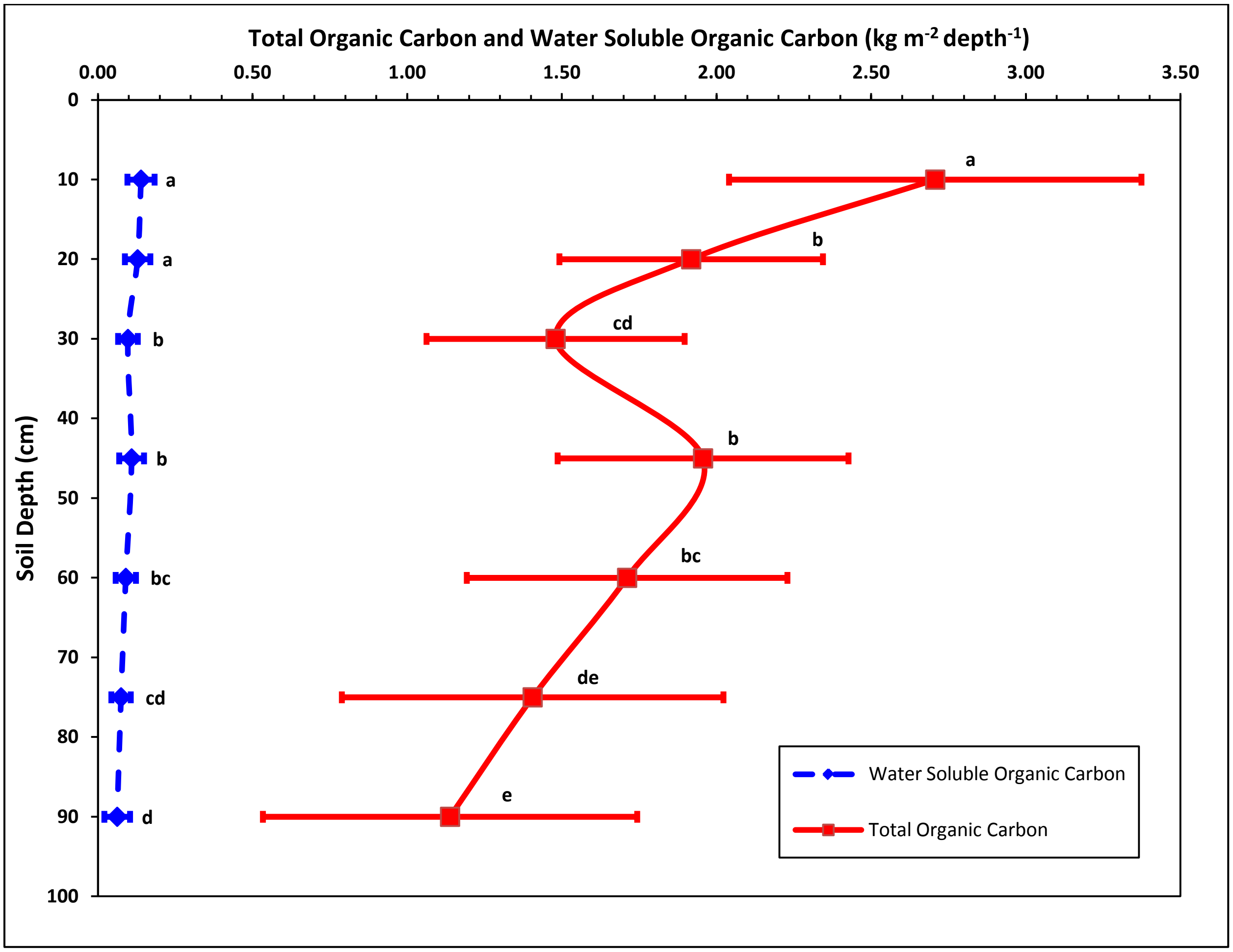


Figure 4. Dickinson total organic carbon and water soluble organic carbon by soil depth increment across all species and species richness treatments with standard deviations. Depths followed by the same lowercase letter are not significantly different ($p<0.05$).

soil depth increment, or between mean soil profile sums. Total OC profile sums ranged from 12.89 to 11.77 kg m$^{-2}$ 90 cm$^{-1}$ for the cropland check and *A. cristatum*, respectively.

The effect of individual species on WSOC across all fertilizer treatments, as compared to the cropland check are revealed in Table 13 and Figure B18 (Appendix B). Within the majority of the upper 60 cm of the soil profile, *B. inermis* had significantly greater WSOC compared to *A. cristatum* and *P. pratensis*. There were no differences between the species and the cropland check from 10 to 90 cm. The WSOC profile sum was significantly greater for *B. inermis* (0.89 kg m$^{-2}$ 90 cm$^{-1}$)

Table 13. Dickinson mean water soluble organic carbon by soil depth increment as affected by species across all fertilizer treatments.

| | Water Soluble Organic Carbon | | | |
|---|---|---|---|---|
| Soil Depth | Agropyron cristatum | Poa pratensis | Bromus inermis | Check |
| ---cm--- | --------------------kg m$^{-2}$ depth$^{-1}$-------------------- | | | |
| 0-10 | 0.16 (0.03[†])a[‡] | 0.15 (0.05)ab | 0.18 (0.04)a | 0.09 (0.02)b |
| 10-20 | 0.12 (0.03)a | 0.13 (0.05)a | 0.17 (0.04)a | 0.13 (0.02)a |
| 20-30 | 0.09 (0.02)b | 0.10 (0.03)b | 0.13 (0.03)a | 0.10 (0.04)ab |
| 30-45 | 0.09 (0.02)b | 0.11 (0.03)ab | 0.14 (0.03)a | 0.10 (0.08)ab |
| 45-60 | 0.08 (0.02)b | 0.09 (0.03)b | 0.12 (0.02)a | 0.08 (0.05)ab |
| 60-75 | 0.08 (0.04)a | 0.07 (0.02)a | 0.09 (0.03)a | 0.07 (0.05)a |
| 75-90 | 0.05 (0.01)a | 0.07 (0.02)a | 0.05 (0.01)a | 0.06 (0.06)a |
| Profile Sum[§] | 0.68 (0.12)b | 0.72 (0.16)b | 0.89 (0.12)a | 0.64 (0.30)b |
| n[¶] | 12 | 12 | 12 | 4 |

[†] Standard deviation.

[‡]Means within soil depth rows that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean sequentially followed by letters with lower mean values.

[§]Soil profile sum is the average of all individual soil profile sums within a species, across all fertilizer treatments.

[¶]n is the sample size of the treatment.

compared to the cropland check, *A. cristatum*, and *P. pratensis* (0.64, 0.68, and 0.72 kg $m^{-2}$ 90 $cm^{-1}$, respectively).

The percentage of TOC that constituted WSOC (%WSOC) is displayed by soil depth increment as well as averaged throughout the soil profile in Table 14. From 10 to 45 cm, *B. inermis* had significantly greater %WSOC compared to at least one or both of *A. cristatum* and *P. pratensis*. There were no statistical differences among the cropland check and individual species at all other depths as well as the soil profile mean. The soil profile mean ranged from 8.23 to 5.27% (*B. inermis* and cropland check, respectively).

Species Richness Comparison

The effects of various species richness treatments on TOC by soil depth increment are shown in Table A11 (Appendix A) and Figure B19 (Appendix B). There were no statistical differences in TOC between the 1, 2, 5, 10, and 20 species richness treatments at any soil depth increment, or among soil profile sums. Soil profile sums ranged from 14.10 to 10.80 kg $m^{-2}$ 90 $cm^{-1}$ (2 and 20 species, respectively). Water soluble OC by soil depth increment as affected by species richness treatment are found in Table A12 (Appendix A) and Figure B20 (Appendix B). Statistical differences were not found between the species richness treatments at any soil depth, or soil profile sum. Soil profile sums ranged from 0.73 to 0.54 kg $m^{-2}$ 90 $cm^{-1}$ (2 and 5 species, respectively). The %WSOC as affected by species richness are displayed in Table A13 (Appendix A). Species richness treatments did not appear to have a significant effect on %WSOC by soil depth, or soil profile mean. Soil profile means ranged from 6.09 to 5.06 % (10 and 5 species, respectively).

Fertilizer Comparisons

The effect of fertilizer application treatment on TOC and WSOC by soil depth increment and soil profile sum across all Dickinson samples is shown in Table A14 (Appendix A) and graphically displayed in Figures B21 and B22 (Appendix B) for TOC and WSOC, respectively. Statistical differences in TOC and WSOC between fertilizer treatments were not found at any soil

Table 14. Proportion of total organic carbon that is comprised of water soluble organic carbon (%WSOC) by soil depth increment as affected by species across all fertilizer application treatments.

| | %WSOC | | | |
|---|---|---|---|---|
| Soil Depth | Agropyron cristatum | Poa pratensis | Bromus inermis | Check |
| ---cm--- | ---------------------------% | --------------------------- | --------------------------- | --------------------------- |
| 0-10 | 6.41 (0.02[†])a[‡] | 5.52 (0.01)a | 10.37 (0.14)a | 3.40 (0.01)a |
| 10-20 | 6.63 (0.03)b | 6.93 (0.02)b | 9.45 (0.02)a | 6.18 (0.01)ab |
| 20-30 | 6.96 (0.02)b | 6.79 (0.02)b | 10.24 (0.03)a | 6.19 (0.02)b |
| 30-45 | 4.98 (0.02)b | 6.58 (0.03)ab | 7.77 (0.01)a | 4.76 (0.03)ab |
| 45-60 | 5.83 (0.03)a | 5.48 (0.02)a | 6.69 (0.02)a | 4.96 (0.03)a |
| 60-75 | 7.43 (0.06)a | 5.81 (0.02)a | 7.06 (0.03)a | 5.54 (0.04)a |
| 75-90 | 6.75 (0.03)a | 8.55 (0.06)a | 6.04 (0.02)a | 5.85 (0.06)a |
| Profile Mean[§] | 6.43 (0.02)a | 6.52 (0.02)a | 8.23 (0.02)a | 5.27 (0.02)a |
| n[¶] | 12 | 12 | 12 | 4 |

[†]Standard deviation.

[‡]Means within soil depth rows that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean sequentially followed by letters with lower mean values.

[§]Soil profile mean is the average of all individual soil profile means within a species across all fertilizer application treatments.

[¶]n is the sample size of the treatment.

depth increment or soil profile sum. Soil profile sums ranged from 13.00 to 11.58 kg $m^{-2}$ 90 $cm^{-1}$ (P and no fertilizer, respectively) for TOC and 0.75 and 0.67 kg $m^{-2}$ 90 $cm^{-1}$ (P and N, respectively) for WSOC. Table A15 (Appendix A) shows %WSOC by soil depth increment and soil profile mean as affected by fertilizer application treatment. There were no significant differences at any soil depth or soil profile mean between the no fertilizer, N, and P fertilizer treatments. Soil profile means ranged from 6.74 to 6.12 % (no fertilizer and P, respectively).

Total OC, WSOC, and %WSOC by soil depth increment and soil profile sum/mean as affected by species treatment within the 'no fertilizer' application treatment are displayed in Tables 15 (TOC and WSOC) and 16 (%WSOC). Total OC comparisons at the 45-60 cm depth showed *B. inermis* and *P.* pratensisto be significantly greater than *A. cristatum.* At the 60-75 cm depth, *P. pratensis* was significantly greater than *A. cristatum*. There were no other statistically different TOC means between the three species at any other depth increment, or the soil profile sum. Soil profile sums ranged from 12.77 to 10.59 kg $m^{-2}$ 90 $cm^{-1}$ (*P. pratensis* and *A. cristatum,* respectively). Statistical differences existed between species at three depths, but did not show a trend between the three depths. There was no statistical difference in WSOC soil profile sums between the species. Soil profile sums ranged from 0.84 to 0.77 kg $m^{-2}$ 90 $cm^{-1}$ (*B. inermis* and *P. pratensis*, respectively). The %WSOC for *A. cristatum* was significantly greater from 45 to 60 cm compared to *P. pratensis*. There was no significant difference in %WSOC profile mean between species. Percent WSOC profile means ranged from 8.70 to 7.03% (*A. cristatum* and *P. pratensis*, respectively).

Total OC, WSOC, and %WSOC by soil depth increment and soil profile sum/mean as affected by species treatment within the N fertilizer application treatment are displayed in Tables 17 (TOC and WSOC) and 16 (%WSOC). At the 10-20 cm depth, *B. inermis* had significantly greater concentrations of TOC compared to *P. pratensis.* From 30 to 45 cm, *Bromus inermis* was significantly greater than both *P. pratensis* and *A. cristatum*. There were no other statistical differences at any other soil depth or soil profile sum between species within the nitrogen

Table 15. Dickinson mean water soluble organic carbon and total organic carbon by species as affected by no fertilizer application.

| | No Fertilizer Application | | | | | |
|---|---|---|---|---|---|---|
| | Water Soluble Organic Carbon | | | Total Organic Carbon | | |
| Soil Depth | Agropyron cristatum | Bromus inermis | Poa pratensis | Agropyron cristatum | Bromus inermis | Poa pratensis |
| ---cm--- | ---------------------------------------------------------kg $m^{-2}$ $depth^{-1}$--------------------------------------------------------- | | | | | |
| 0-10 | 0.15 (0.01†)a‡ | 0.17 (0.04)a | 0.13 (0.03)a | 2.56 (0.48)a | 3.02 (0.73)a | 2.37 (0.37)a |
| 10-20 | 0.15 (0.03)a | 0.17 (0.04)a | 0.11 (0.03)a | 2.18 (0.81)a | 1.90 (0.28)a | 1.73 (0.32)a |
| 20-30 | 0.10 (0.01)a | 0.13 (0.02)a | 0.11 (0.02)a | 1.24 (0.10)a | 1.37 (0.19)a | 1.37 (0.24)a |
| 30-45 | 0.11 (0.01)b | 0.12 (0.01)ab | 0.14 (0.02)a | 1.93 (0.54)a | 1.84 (0.11)a | 1.88 (0.62)a |
| 45-60 | 0.10 (0.01)a | 0.12 (0.02)a | 0.11 (0.02)a | 1.13 (0.20)b | 2.09 (0.27)a | 2.39 (0.63)a |
| 60-75 | 0.13 (0.02)a | 0.08 (0.004)b | 0.09 (0.02)b | 0.90 (0.11)b | 1.21 (0.42)ab | 1.87 (0.73)a |
| 75-90 | 0.07 (0.001)ab | 0.05 (0.01)b | 0.09 (0.02)a | 0.65 (0.05)a | 0.87 (0.09)a | 1.16 (0.51)a |
| Profile Sum§ | 0.81 (0.06)a | 0.84 (0.10)a | 0.77 (0.07)a | 10.59 (1.08)a | 12.30 (1.45)a | 12.77 (3.07)a |
| n¶ | 4 | 4 | 4 | 4 | 4 | 4 |

† Standard deviation.

‡Means within soil depth rows that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean sequentially followed by letters with lower mean values.

§Soil profile sum is the average of all individual soil profile sums within a species treatment as affected by no fertilizer application.

¶n is the sample size of the treatment.

Table 16. Dickinson proportion of total organic carbon as water soluble organic carbon (%WSOC) as affected by species treatment within fertilizer treatment.

| | No Fertilizer | | | Nitrogen | | | Phosphorus | | |
|---|---|---|---|---|---|---|---|---|---|
| Soil Depth | Agropyron cristatum | Bromus inermis | Poa pratensis | Agropyron cristatum | Bromus inermis | Poa pratensis | Agropyron cristatum | Bromus inermis | Poa pratensis |
| ---cm--- | ---% | | | | | | | | |
| 0-10 | 6.14 (0.01†)a‡ | 5.96 (0.02)a | 5.43 (0.02)a | 5.51 (0.01)a | 18.81 (0.24)a | 5.31 (0.02)a | 7.59 (0.03)a | 6.35 (0.01)a | 5.82 (0.01)a |
| 10-20 | 7.35 (0.02)a | 9.12 (0.01)a | 6.50 (0.02)a | 6.55 (0.02)a | 7.72 (0.01)a | 7.14 (0.02)a | 5.97 (0.04)a | 11.51 (0.03)a | 7.15 (0.02)a |
| 20-30 | 7.69 (0.01)a | 9.42 (0.01)a | 8.25 (0.03)a | 6.58 (0.02)a | 9.62 (0.04)a | 5.59 (0.01)a | 6.62 (0.01)a | 11.69 (0.05)a | 6.52 (0.01)a |
| 30-45 | 6.10 (0.02)a | 6.76 (0.01)a | 8.75 (0.05)a | 4.91 (0.01)b | 8.21 (0.02)a | 4.70 (0.01)b | 3.93 (0.01)b | 8.36 (0.01)a | 6.27 (0.01)ab |
| 45-60 | 8.76 (0.01)a | 5.73 (0.01)ab | 4.86 (0.02)b | 4.36 (0.02)a | 8.52 (0.02)a | 5.36 (0.03)a | 4.37 (0.02)a | 5.82 (0.01)a | 6.23 (0.01)a |
| 60-75 | 14.41 (0.02)a | 7.31 (0.03)b | 5.18 (0.02)b | 3.84 (0.02)a | 8.76 (0.03)a | 4.88 (0.03)a | 4.03 (0.03)a | 5.11 (0.02)a | 7.37 (0.01)a |
| 75-90 | 10.48 (0.01)a | 5.34 (0.01)a | 10.22 (0.09)a | 5.17 (0.01)a | 7.95 (0.01)a | 7.20 (0.07)a | 4.59 (0.02)a | 4.84 (0.02)a | 8.22 (0.04)a |
| Profile Mean§ | 8.70 (0.01)a | 7.09 (0.01)a | 7.03 (0.03)a | 5.27 (0.01)b | 9.94 (0.04)a | 5.74 (0.01)ab | 5.30 (0.01)b | 7.67 (0.01)a | 6.80 (0.01)ab |
| n¶ | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |

† Standard deviation.

‡Means within soil depth rows that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean sequentially followed by letters with lower mean values.

§Soil profile mean is the average of all individual soil profile means within a fertilizer treatment as affected by species treatment.
¶n is the sample size within the treatment.

Table 17. Dickinson mean water soluble organic carbon and total organic carbon by species as affected by nitrogen fertilizer application.

| | Nitrogen Fertilizer Application[†] | | | | | |
|---|---|---|---|---|---|---|
| | Water Soluble Organic Carbon | | | Total Organic Carbon | | |
| Soil Depth | Agropyron cristatum | Bromus inermis | Poa pratensis | Agropyron cristatum | Bromus inermis | Poa pratensis |
| ---cm--- | ----------kg m$^{-2}$ depth$^{-1}$---------- | | | | | |
| 0-10 | 0.14 (0.04[‡])a[§] | 0.19 (0.04)a | 0.15 (0.07)a | 2.48 (0.34)a | 2.20 (1.26)a | 2.77 (0.49)a |
| 10-20 | 0.12 (0.04)a | 0.15 (0.01)a | 0.11 (0.02)a | 1.80 (0.07)ab | 1.96 (0.11)a | 1.51 (0.29)b |
| 20-30 | 0.09 (0.02)b | 0.14 (0.01)a | 0.06 (0.01)b | 1.40 (0.20)a | 1.62 (0.52)a | 1.18 (0.23)a |
| 30-45 | 0.08 (0.01)b | 0.16 (0.03)a | 0.07 (0.02)b | 1.66 (0.09)b | 2.00 (0.25)a | 1.59 (0.13)b |
| 45-60 | 0.07 (0.02)b | 0.14 (0.01)a | 0.05 (0.01)b | 1.67 (0.26)a | 1.71 (0.33)a | 1.21 (0.50)a |
| 60-75 | 0.05 (0.02)b | 0.11 (0.03)a | 0.05 (0.02)b | 1.47 (0.32)a | 1.32 (0.24)a | 1.29 (0.65)a |
| 75-90 | 0.05 (0.01)a | 0.06 (0.004)a | 0.05 (0.02)a | 0.94 (0.22)a | 0.81 (0.001)a | 1.12 (0.73)a |
| Profile Sum[¶] | 0.60 (0.09)b | 0.96 (0.10)a | 0.54 (0.05)b | 11.42 (0.70)a | 11.61 (1.52)a | 10.66 (1.78)a |
| n[#] | 4 | 4 | 4 | 4 | 4 | 4 |

[†]Nitrogen applied at 200 kg N ha$^{-1}$yr$^{-1}$.

[‡]Standard deviation.

[§]Means within soil depth rows that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean sequentially followed by letters with lower mean values.

[¶]Soil profile sum is the average of all individual soil profile sums within a species treatment as affected by nitrogen fertilizer application.

[#]n is the sample size of the treatment.

treatment. The soil profile sum ranged from 11.61 to 10.66 kg $m^{-2}$ 90 $cm^{-1}$ (*B. inermis* and *P. pratensis*, respectively). Statistical comparisons of WSOC from 20 to 75 cm and the soil profile sum showed that *B. inermis* was significantly greater than both *A. cristatum* and *P. pratensis*. The only depth that %WSOC was affected by N fertilizer application was from 30 to 45 cm where *B. inermis* was significantly greater compared to *P. pratensis* and *A. cristatum*. The soil profile mean for %WSOC was significantly greater for *B. inermis* (9.94%) compared to *A. cristatum* (5.27%).

Total OC, WSOC, and %WSOC by soil depth increment and soil profile sum/mean as affected by species treatment within the P fertilizer application treatment are shown in Tables 18 (TOC and WSOC) and 16 (%WSOC). The only statistical difference among TOC means existed at the 20-30 cm soil depth where *P. pratensis* was significantly greater than both *B. inermis* and *A. cristatum*. Soil profile sums ranged from 13.30 to 11.91 kg $m^{-2}$ 90 $cm^{-1}$ (*A. cristatum* and *B. inermis*, respectively). Water soluble OC comparisons indicated that *P. pratensis* and *B. inermis* were significantly greater compared to *A. cristatum* from 30 to 45 cm. Whereas, at the 75-90 cm depth, *P. pratensis* was significantly greater than both *A. cristatum* and *B. inermis*. Soil profile sum WSOC means were not statistically different, but ranged from 0.87 to 0.63 kg $m^{-2}$ 90 $cm^{-1}$ (*B. inermis* and *A. cristatum*, respectively). The only significant difference between %WSOC comparisons was at the 30-45 cm soil depth and the soil profile mean where *B. inermis* was significantly greater compared to *A. cristatum*.

Table 18. Dickinson mean water soluble organic carbon and total organic carbon by species as affected by phosphorus fertilizer application.

| | Phosphorus Fertilizer Application† | | | | | |
|---|---|---|---|---|---|---|
| | Water Soluble Organic Carbon | | | Total Organic Carbon | | |
| Soil Depth | Agropyron cristatum | Bromus inermis | Poa pratensis | Agropyron cristatum | Bromus inermis | Poa pratensis |
| ---cm--- | ---kg $m^{-2}$ $depth^{-1}$--- | | | | | |
| 0-10 | 0.18 (0.03‡)a§ | 0.19 (0.05)a | 0.18 (0.04)a | 2.54 (0.71)a | 3.08 (0.89)a | 3.15 (0.23)a |
| 10-20 | 0.10 (0.05)a | 0.18 (0.05)a | 0.16 (0.06)a | 1.92 (0.59)a | 1.54 (0.09)a | 2.25 (0.43)a |
| 20-30 | 0.09 (0.02)a | 0.12 (0.04)a | 0.12 (0.01)a | 1.32 (0.18)b | 1.08 (0.15)b | 1.85 (0.22)a |
| 30-45 | 0.08 (0.01)b | 0.14 (0.02)a | 0.13 (0.02)a | 2.23 (0.64)a | 1.71 (0.15)a | 2.00 (0.16)a |
| 45-60 | 0.08 (0.02)a | 0.11 (0.03)a | 0.10 (0.02)a | 2.13 (0.71)a | 1.92 (0.27)a | 1.57 (0.15)a |
| 60-75 | 0.06 (0.02)a | 0.08 (0.03)a | 0.08 (0.01)a | 2.06 (1.33)a | 1.54 (0.29)a | 1.17 (0.21)a |
| 75-90 | 0.04 (0.01)b | 0.05 (0.01)b | 0.07 (0.01)a | 1.10 (0.48)a | 1.04 (0.41)a | 1.11 (0.57)a |
| Profile Sum¶ | 0.63 (0.10)a | 0.87 (0.16)a | 0.85 (0.13)a | 13.30 (2.73)a | 11.91 (1.33)a | 13.09 (1.73)a |
| n# | 4 | 4 | 4 | 4 | 4 | 4 |

†Phosphorus fertilizer applied at 40 kg P $ha^{-1}yr^{-1}$.

‡Standard deviation.

§Means within soil depth rows that are followed by the same letter are not significantly different according to Tukey-Kramer HSD (p <0.05). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean sequentially followed by letters with lower mean values.

¶Soil profile sum is the average of all individual soil profile sums within a species treatment as affected by phosphorus fertilizer application.

#n is the sample size of the treatment.

## DISCUSSION

### Site Summaries

The overall trend for TOC and WSOC distribution by soil depth at the three sampling sites tended to be greatest near the soil surface and then decreased with increasing soil depth. However, Carrington's WSOC distribution by depth varied in that it had a significant statistical increase in WSOC at the 30-45 cm depth compared to the 20-30 cm depth increment above it and then decreased with increasing soil depth below 45 cm. The other exception to the general carbon distribution trend was seen in Dickinson's TOC data, where TOC concentrations were greatest near the soil surface and declined with increasing soil depth until TOC significantly increased within the 30-45 cm depth increment and then again decreased with increasing soil depth. The majority of literature concurred that WSOC and TOC decrease with increasing soil depth (Boyer and Groffman, 1996; Corre et al., 1999; Corvasce et al., 2006; Jinbo et al., 2006; Omonode and Vyn, 2006; Sanderman et al., 2008). Jinbo et al. (2006) attributed the pattern of decreasing total organic carbon with increasing soil depth to the decreasing vertical distribution of plant roots because of their pivotal role in supplying fresh carbon to the soil. In a study conducted at the Dickinson Research Extension Center, Lauenroth and Whitman (1977), reported that root biomass under a grassland setting decreased with increasing soil depth. They found 70% of the total root biomass in the upper 15 cm of the soil and 83% of total root biomass was within the upper 30 cm of the soil which reflects the WSOC trend at Dickinson where WSOC is greatest near the surface and then decreases with depth. The significant increase in TOC at Dickinson's 30-45 cm depth could be the result of rhizodeposition and root decay, which add large amounts of organic carbon to the soil from the large concentration of root biomass within the upper 30 cm of the soil profile, which helps fuel the priming effect of microbial communities, due to the abundance of easily oxidizable organic carbon provided by the roots. The microbial boom during the priming effect oxidizes large amounts of fresh soluble carbon as well as the more stable TOC. The resulting WSOC that is produced/reduced after these oxidation events is more hydrophilic and flows down the soil column until it finds a sorption site where it has the competitive advantage over other molecules to become adsorbed. Since the bulk of the roots were above 30 cm in Laurenroth and Whitmans' Dickinson study, it is possible that the WSOC sorbed onto the mineral surfaces just below the roots and became stable, explaining the increase in TOC at this depth; assuming that root distributions were similar to Laurenroth and Whitmans.

The decreasing concentration of WSOC with increasing soil depth is likely due to its sorption onto mineral surfaces as it moves down the soil column; removing it from soil solution, thus, increasing its residence time in soil (Kalbitz et al., 2000; Corvasce et al., 2006). It is possible that the significant increase of TOC at the 30-45 cm depth at the Dickinson site was caused by the release of soluble carbon near the surface due to severe drying of the soil followed by rewetting, which causes the release of WSOC (Williams and Xia, 2009). With only 323 mm of annual rainfall at Dickinson, soil near the surface can become very dry until a rainfall event rewets this zone. The destruction of soil aggregates (Williams and Xia, 2009) caused by a rainfall event after severe drying releases WSOC into soil pore water where it is then transported down the soil profile due to gravity, with other sources of WSOC that were once sorbed onto mineral surfaces or within interstitial pore water (Cao et al., 1999) until all of the plant available water is entirely utilized by plant roots or held within soil micro- and macropores, tying up WSOC within those pores along the wetting front of the soil, which could be near the 30-45 cm depth increment.

The %WSOC by soil depth increment had no significant differences at Ekre Ranch or Dickinson. However, Carrington's 75-90 cm depth was significantly greater than the 0-10 cm depth, with no significant difference between any of the other depths. Even though the depth increments from 10 to 75 cm were not significantly different from any depth, the %WSOC at Carrington tended to increase with increasing soil depth from the surface, which is similar to findings in literature where %WSOC and %DOC increased with increasing soil depth (Boyer and Groffman, 1996;

Corvasce et al., 2006; Jinbo et al., 2006). The mean %WSOC by soil profile for Ekre Ranch, Carrington, and Dickinson were 5.36, 5.75, and 6.27%, respectively. Many researchers reported %DOC as being less than 1% to upwards of 3% (Burford and Bremner, 1975; Cook and Allan, 1992; Chantigny, 2003; Tian et al., 2010) and WEOC with values ranging from 0.5 to 14% (Boyer and Groffman, 1996). Direct extraction of WSOC within laboratory settings produces 8 to 10 times more soluble carbon than DOC methods, where soluble carbon is collected with porous cups in situ (Delprat et al., 1997), so it is apparent that Ekre Ranch, Carrington, and Dickinson %WSOC values are within typical WSOC ranges compared to literature.

Individual Species

There were no statistical trends that stood out between the TOC and WSOC concentrations of the eight individual species by soil depth increment or soil profile sum at Ekre Ranch. However, TOC for all eight species was significantly greater than that of the cropland check at 0-10, 20-30, and 30-45 cm. There were no significant differences at Carrington between the 5 species treatments and the cropland check for TOC by soil depth increment or soil profile sum. These results were similar to those of two switchgrass (*P. virgatum*) studies that both found no significant difference in TOC between cultivars of switchgrass. Although there were no differences between cultivars, one study found that when switchgrass follows a fallow period, TOC was greatly increased by 1.01 kg TOC $m^{-2}$ 90 $cm^{-1}$ $y^{-1}$ over the course of 3 years (Frank et al., 2004) and the other study saw a 44% increase in TOC within the upper 15 cm of soil over a 10 year period (Ma et al., 2000). Water soluble OC for the cropland check at Carrington was significantly less compared to all 5 species treatments at all soil depths including the soil profile sum, with the exception of the 60-75 cm depth where only the Trailblazer switchgrass was significantly greater than the cropland check. The cropland check also had significantly lower %WSOC than all other species treatments at the soil depths of 0-10, 10-20, 45-60, 60-75 cm, and the soil profile mean.

Dickinson TOC data did not display any differences between the three grass species and the cropland check. Water soluble OC at Dickinson was only significantly lower for the cropland check compared to *A. cristatum, B. inermis,* and *P. pratensis* at the 0-10 cm depth. *Bromus inermis* appeared to have significantly greater concentrations of WSOC within the majority of the upper 60 cm of the soil profile compared to *A. cristatum* and *P. pratensis.* The WSOC soil profile sum was also significantly greater for *B. inermis* compared to both *A. cristatum* and *P. pratensis*. There were no significant differences between the three species when comparing %WSOC.

It is possible that the individual species at each site had significantly greater TOC and WSOC concentrations compared to the cropland check due to greater biomass produced and returned to the soil as well as root exudates produced by the individual plant species; all of which are likely due to more active growing days during the year compared to cropland species. Our results did not show any significant differences in TOC among the individual species sampled. Within WSOC comparisons by species, *B. inermis* at Dickinson was the only species to have a greater WSOC concentration compared to the other species. Although WSOC was not compared, Cihacek and Meyer (2002) found TOC to be significantly greater for smooth bromegrass (*B. inermis*) compared to long-term plantings of continuous spring wheat (*Triticum aestivum* L.) and flax (*Linum usitatissimum* L). Other studies showed higher WSOC under grassland systems compared to continuous maize production (Gregorich et al., 2000) as well as increased TOC after conversion from a cropland to grassland system (Steinbeiss et al., 2007) showing that grasslands accumulate more organic carbon compared to cropland. Numerous studies found that soils containing vegetation compared to fallow soils had significantly greater amounts of soil organic carbon (Ma et al., 2000; Frank et al., 2004; Khalid et al., 2007) likely due to the organic matter additions from both above- and belowground plant biomass, root exudates, and desorption of WSOC from soil surfaces due to increased drying and wetting events.

Species Richness

There were no significant differences in TOC, WSOC, or %WSOC means among the species richness treatments at either Ekre Ranch or Dickinson. In a species richness study by Skinner et al. (2006), they found that of the 2, 3, and 11 species mixture treatments, the 11 species mixture had the greatest amount of photosynthetic activity and biomass production, but had the greatest loss of TOC among the three treatments. They also found that as species richness increased, plant roots became distributed more deeply in the soil. The findings in literature as well as our results contradict our expectation that as species richness increases, WSOC and TOC increases within the soil.

Fertilizer Application

The effect of fertilizer application on TOC at Ekre Ranch was not detected between the high and low application rates, but was significant between nitrogen and phosphorus application. Within the upper 20 cm of the soil profile phosphorus had a significantly greater positive effect on TOC, whereas nitrogen displayed significantly greater TOC concentrations from 30-45 and 60-75 cm. Just as with TOC, WSOC was significantly greater for phosphorus near the surface from 0 to 10 cm and nitrogen was significantly greater in the subsoil from 20 to 60 cm. Phosphorus also had significantly greater %WSOC compared to nitrogen at 0-10 cm.

There were no significant differences between nitrogen and phosphorus fertilizer application at Dickinson when comparing TOC, WSOC, and %WSOC means. However, significant differences were observed within each fertilizer treatment as affected by species. Although there was no fertilizer effects across the site at Dickinson, Ekre Ranch's overall trend of fertilizer application showed that phosphorus had a greater effect on organic carbon in the upper portion of the soil profile, whereas nitrogen had a greater effect in the lower half of the soil profile. Within the Dickinson fertilizer treatments, *B. inermis* appeared to benefit the most from nitrogen fertilization while both *B. inermis* and *P. pratensis* showed increases in organic carbon due to phosphorus application. Zhang and Zhang (2010) found that WSOC significantly increased in the soil solution with increasing amounts of phosphorus fertilization causing WSOC to be leached deeper into the soil profile. They attributed this to WSOC being displaced/desorbed from exchange sites on soil surfaces by phosphorus because of phosphorus' greater attraction (lyotrophic potential) to the exchange site compared to WSOC.

The literature varies on the effect of nitrogen fertilizer on TOC and WSOC. Some have found that nitrogen fertilizer had no effect on TOC (Ma et al., 2000, McTiernan et al., 2001), while other studies (Cihacek and Meyer, 2002; Liebig et al., 2002) and reviews (Lal et al., 1999; Miles et al., 2008) found that nitrogen fertilization caused increases in TOC most likely due to increased root growth and overall biomass production. Chantigny et al. (1999) found that WSOC reacted differently depending on the amount of nitrogen applied. They found that nitrogen applications above 60 mg N $kg^{-1}$ soil created small changes in WSOC, whereas nitrogen applications below that critical level caused WSOC to quickly increase within sandy clay and sandy loam soils. The increase in WSOC below that critical level was due to decreased microbial activity caused by a lack of mineralizable nitrogen.

Harvest Frequency

The only significant difference in TOC between harvest treatments occurred at 75 to 90 cm with biennial harvesting having greater amounts of TOC compared to annual harvesting. Overall, there was no effect on WSOC, TOC, or %WSOC due to harvest treatment, which was similar to what Ma et al. (2000) reported when observing the effect of annual and semi-annual harvesting on 3 switchgrass varieties over the course of 2 years. It is possible that the Carrington site had not been established long enough for these effects to become apparent.

## SUMMARY AND CONCLUSIONS

The summarized results of this research project below address the four research questions of this research project, as well as how the results compared to our testable hypotheses. The first objective was to determine the concentration by soil depth trend of WSOC as compared to TOC. As a general trend across all three sites, TOC and WSOC were greatest at the 0 to 10 cm soil depth increment and then decreased with increasing depth. With that being said, Carrington and Dickinson data followed this trend, but showed a significant increase in WSOC and TOC, respectively, at the 30-45 cm soil depth. Across each site, the percentage of TOC that was made up of WSOC (%WSOC) was 5.36, 5.75, and 6.27% for Ekre Ranch, Carrington, and Dickinson, respectively. Testable hypothesis 1 was correct in that WSOC, like TOC, is greatest near the soil surface and decreases with depth.

Our second research objective was to determine the effect of various plant species on the accumulation of TOC and WSOC as compared to a cropland check. Total OC data did not indicate that any one species accumulated more TOC than the other at Ekre Ranch, Carrington, and Dickinson. The individual species at Ekre Ranch all had greater TOC accumulation in the upper 45 cm of the soil compared to the cropland check. There was no significant difference in TOC accumulation between the species and cropland checks for both Carrington and Dickinson. Ekre Ranch WSOC data did not display any significant differences among the species or cropland check. Carrington WSOC was not significantly different between species, but all the species were significantly greater than the cropland check. *Bromus inermis* at Dickinson had significantly greater WSOC concentrations compared to the other species and the cropland check. The cropland check had significantly less WSOC than the other species at the shallowest and deepest depths at Dickinson. Overall across the sites, species did not have much of an effect on TOC and WSOC. However, they had greater OC concentrations compared to the cropland checks, which agrees with testable hypothesis 2.

Our third research objective was to determine the effect that varying levels of species richness had on WSOC concentrations at Ekre Ranch and Dickinson sites. We hypothesized that WSOC would increase with increasing species richness, but our results showed that species richness did not have a significant effect on TOC or WSOC. Our fourth research objective was to determine the effect that fertilizer application had on WSOC. Comparisons among TOC and WSOC at the Ekre Ranch showed that P tended to have a more pronounced effect on WSOC than N within the uppermost 20 cm, whereas N had greater accumulations than P at deeper depths ranging from 20 to 75 cm. At the Dickinson site, N and P fertilization did not have an effect on TOC or WSOC. Within the N treatment at Dickinson, *B. inermis* had greater accumulation of TOC and WSOC compared to *A. cristatum* and *P. pratensis* due to N application. Within the P treatment, *P. pratensis* and *B. inermis* both showed greater WSOC accumulation due to P application compared to *A. cristatum*. Although it was not one of the research questions, the data at the Carrington site showed that harvest frequency did not have an effect on TOC or WSOC concentrations.

The implications of this research, coupled with corresponding biomass production values could be useful for selecting species or mixtures of species to be used as biofuel crops. Determining species, mixtures of species, and which fertilizer rate accumulates the most C in the soil and produces the most biomass for biofuel production can be environmentally and economically beneficial to both producers and energy consumers. Studies similar to this could be carried out to determine mixtures of species that perform well on marginal sites, as a means to increase the amount of OC in the soil, which subsequently increases the productivity of that soil for future agricultural use. A study such as this could be utilized within the United States Department of Agriculture's Conservation Reserve Program, where highly erodible land is taken out of agricultural production so as to reduce erosion and transport of sediment, pesticides, and nutrients from agricultural lands into water bodies. Selecting a mixture of species that are able to become established on soils that have a high erosion potential, have experienced severe erosion, and have low productivity levels will be able to add large amounts of carbon to the soil, which will help these degraded lands improve the functioning of soil processes, increase soil productivity, and provide wildlife habitat.

Our data represent treatment effects on TOC and WSOC at one point in time and to get a better idea of how species, fertilizers, and harvesting affect WSOC it would helpful to look at how these treatments affect OC at multiple points in time. It would be ideal to take soil samples from well established plots of ten years or more on a monthly or biweekly basis during periods of the year when sampling is physically possible. Although this would be very expensive to carry out, this would allow us to get a better understanding of how these treatments affect WSOC concentration and flux from periods of inactive growth to maximum growth as well as from dry to wet soil conditions. Understanding the role that WSOC plays in the long-term storage of soil organic carbon as well as its physical and chemical properties can help us to make inferences about other processes taking place in the soil that are affected by WSOC, making it an important soil component to study. Ultimately, we can take what we learn from these experiments to develop or refine current agricultural management systems in ways that maximizes soil carbon sequestration while maintaining and/or increasing productivity and profitability.

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## APPENDIX A

Table A1. Ekre Ranch mean proportions of total organic carbon that is comprised of water soluble organic carbon, expressed as a percent (%WSOC) by soil depth increment as affected by plant species.

| | %WSOC | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Soil Depth | Solidago candensis/ missouriensis | Elymus canadensis | Poa pratensis | Andropogon gerardii | Agropyron cristatum | Helianthus maximilliana | Bromus inermis | Wheat Check | Panicum virgatum |
| ---cm--- | ------------------------------------------------------- | ------- | ------- | ------- | %- | ------- | ------- | ------- | ------- |
| 0-10 | 5.23 (0.01†)a‡ | 6.21 (0.02)a | 6.03 (0.02)a | 4.37 (0.01)a | 5.88 (0.01)a | 6.69 (0.01)a | 5.85 (0.02)a | 7.25 (0.01)a | 6.02 (0.02)a |
| 10-20 | 4.17 (0.02)a | 7.05 (0.01)a | 4.93 (0.00)a | 9.81 (0.11)a | 6.41 (0.01)a | 7.20 (0.01)a | 6.40 (0.01)a | 8.42 (0.01)a | 5.88 (0.01)a |
| 20-30 | 5.07 (0.01)a | 6.74 (0.00)a | 5.24 (0.00)a | 8.58 (0.09)a | 6.39 (0.02)a | 6.80 (0.004)a | 5.62 (0.02)a | 7.58 (0.01)a | 5.19 (0.01)a |
| 30-45 | 3,64 (0.01)a | 4.60 (0.00)a | 4.11 (0.01)a | 12.35 (0.17)a | 6.23 (0.03)a | 5.56 (0.01)a | 5.39 (0.01)a | 5.27 (0.01)a | 5.52 (0.01)a |
| 45-60 | 4.09 (0.01)a | 4.87 (0.01)a | 4.11 (0.01)a | 7.21 (0.06)a | 4.91 (0.01)a | 5.11 (0.01)a | 6.44 (0.02)a | 4.15 (0.01)a | 5.39 (0.00)a |
| 60-75 | 5.69 (0.02)a | 5.46 (0.01)a | 4.39 (0.01)a | 4.71 (0.02)a | 4.31 (0.01)a | 4.71 (0.02)a | 6.89 (0.03)a | 4.20 (0.02)a | 5.30 (0.02)a |
| 75-90 | 8.05 (0.02)a | 6.34 (0.02)a | 5.08 (0.02)a | 3.73 (0.01)a | 5.29 (0.01)a | 5.26 (0.01)a | 5.45 (0.02)a | 4.61 (0.01)a | 8.13 (0.06)a |
| Profile Mean§ | 5.13 (0.00)a | 5.90 (0.00)a | 4.84 (0.00)a | 7.25 (0.06)a | 5.63 (0.01)a | 5.91 (0.01)a | 6.01 (0.00)a | 5.93 (0.01)a | 5.92 (0.01)a |
| n¶ | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 4 | 4 |

†Standard deviation.

‡Means within species treatment rows that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean sequentially followed by letters with lower mean values.

§Soil profile mean is the average of all individual soil profile means within a species treatment.

¶n is the sample size within the treatment.

Table A2. Ekre Ranch mean total organic carbon by soil depth increment as affected by species richness treatments across all fertilizer treatments.

| | Total Organic Carbon | | | |
|---|---|---|---|---|
| Soil Depth | 1 Species | 2 Species | 10 Species | 20 Species |
| ---cm--- | ---------------------------kg $m^{-2}$ $depth^{-1}$--------------------------- | | | |
| 0-10 | 1.84 (0.10[†])a[‡] | 2.09 (0.25)a | 2.05 (0.10)a | 2.08 (0.19)a |
| 10-20 | 1.60 (0.14)a | 1.68 (0.25)a | 1.85 (0.13)a | 1.96 (0.23)a |
| 20- 30 | 1.92 (0.23)a | 1.85 (0.33)a | 1.82 (0.37)a | 1.76 (0.34)a |
| 30-45 | 2.48 (0.65)a | 2.38 (1.17)a | 1.89 (0.74)a | 1.59 (0.61)a |
| 45-60 | 1.74 (0.17)a | 1.46 (0.88)a | 1.31 (0.63)a | 0.98 (0.26)a |
| 60-75 | 1.18 (0.21)a | 1.06 (0.41)a | 0.82 (0.21)a | 0.76 (0.37)a |
| 75-90 | 0.89 (0.21)a | 0.85 (0.21)a | 0.82 (0.19)a | 0.69 (0.15)a |
| Profile Sum[§] | 11.65 (1.10)a | 11.24 (2.70)a | 10.56 (1.40)a | 9.81 (1.29)a |
| n[#] | 3 | 7 | 4 | 6 |

[†]Standard deviation.

[‡]Means within soil depth rows that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean followed by sequential letters with lower mean values.

[§]Soil profile sum is the average of all individual soil profile sums within a species richness treatment across fertilizer type and application rate treatments.

[#]n is the sample size within the treatment.

Table A3. Ekre Ranch mean water soluble organic carbon by soil depth increment as affected by species richness treatments across all fertilizer treatments.

| Soil Depth | Water Soluble Organic Carbon | | | |
|---|---|---|---|---|
| | 1 Species | 2 Species | 10 Species | 20 Species |
| ---cm--- | -----kg $m^{-2}$ $depth^{-1}$----- | | | |
| 0-10 | 0.08 (0.01†)a‡ | 0.09 (0.02)a | 0.10 (0.04)a | 0.11 (0.02)a |
| 10-20 | 0.08 (0.01)a | 0.09 (0.01)a | 0.08 (0.02)a | 0.09 (0.01)a |
| 20- 30 | 0.09 (0.02)a | 0.09 (0.01)a | 0.06 (0.01)a | 0.06 (0.03)a |
| 30-45 | 0.10 (0.01)a | 0.10 (0.03)a | 0.07 (0.02)a | 0.06 (0.02)a |
| 45-60 | 0.07 (0.001)a | 0.07 (0.03)a | 0.05 (0.01)a | 0.04 (0.01)a |
| 60-75 | 0.04 (0.002)a | 0.04 (0.02)a | 0.03 (0.01)a | 0.03 (0.01)a |
| 75-90 | 0.04 (0.01)a | 0.03 (0.01)a | 0.04 (0.01)a | 0.03 (0.01)a |
| Profile Sum§ | 0.51 (0.05)a | 0.51 (0.12)a | 0.43 (0.05)a | 0.43 (0.07)a |
| n¶ | 3 | 7 | 4 | 6 |

†Standard deviation.

‡Means within soil depth rows that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean followed by sequential letters with lower mean values.

§Soil profile sum is the average of all individual soil profile sums within a species richness treatment across fertilizer type and application rate treatments.

¶n is the sample size within the treatment.

Table A4. Ekre Ranch mean proportion of total organic carbon that is comprised of water soluble organic carbon (%WSOC), expressed as a percent by soil depth increment as affected by species richness treatment across all fertilizer treatments.

| | %WSOC | | | |
|---|---|---|---|---|
| Soil Depth | 1 Species | 2 Species | 10 Species | 20 Species |
| ---cm--- | ---------------------------- | ---------------------------- % | ---------------------------- | ---------------------------- |
| 0-10 | 4.61 (0.01[†])a[‡] | 4.14 (0.01)a | 4.96 (0.02)a | 5.28 (0.01)a |
| 10-20 | 5.11 (0.004)a | 5.50 (0.01)a | 4.42 (0.01)a | 4.74 (0.01)a |
| 20- 30 | 4.79 (0.01)ab | 4.98 (0.01)a | 3.50 (0.01)b | 4.15 (0.01)ab |
| 30-45 | 4.39 (0.02)a | 4.58 (0.01)a | 3.71 (0.01)a | 4.43 (0.02)a |
| 45-60 | 3.87 (0.004)a | 5.40 (0.02)a | 3.82 (0.01)a | 4.20 (0.01)a |
| 60-75 | 3.61 (0.01)a | 4.56 (0.02)a | 4.18 (0.005)a | 4.62 (0.01)a |
| 75-90 | 4.74 (0.02)a | 4.03 (0.02)a | 4.70 (0.02)a | 4.83 (0.01)a |
| Profile Mean[§] | 4.45 (0.01)a | 4.75 (0.004)a | 4.18 (0.003)a | 4.61 (0.003)a |
| n[¶] | 3 | 7 | 4 | 6 |

[†]Standard deviation.

[‡]Means within soil depth rows that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean followed by sequential letters with lower mean values.

[§]Soil profile mean is the average of all individual soil profile means within a species richness treatment across fertilizer type and application rate treatments.

[¶]n is the sample size of the treatment.

Table A5. Carrington mean total organic carbon by soil depth increment as affected by species across all harvest treatments.

| | Total Organic Carbon | | | | | |
|---|---|---|---|---|---|---|
| Soil Depth | Alkar[†] | Haymaker | Sunburst | Trailblazer | CRP | Check |
| ---cm--- | ---kg m$^{-2}$ depth$^{-1}$--- | | | | | |
| 0-10 | 3.70 (0.88[‡])a[§] | 3.43 (0.78)a | 3.47 (0.65)a | 3.39 (0.69)a | 3.54 (0.58)a | 2.91 (0.27)a |
| 10-20 | 3.30 (0.77)a | 3.15 (0.76)a | 3.13 (0.75)a | 3.01 (0.95)a | 3.27 (0.70)a | 2.70 (0.28)a |
| 20-30 | 2.93 (0.93)a | 2.49 (0.76)a | 2.50 (0.86)a | 2.62 (0.83)a | 2.93 (0.97)a | 2.12 (0.36)a |
| 30-45 | 2.93 (0.85)a | 3.03 (1.09)a | 3.02 (1.45)a | 2.80 (1.28)a | 3.21 (1.45)a | 1.98 (0.29)a |
| 45-60 | 2.54 (0.58)a | 2.71 (0.67)a | 2.86 (1.37)a | 2.48 (1.00)a | 2.87 (1.58)a | 2.17 (0.30)a |
| 60-75 | 2.15 (0.40)a | 2.29 (0.44)a | 2.38 (1.11)a | 2.04 (0.65)a | 2.88 (2.42)a | 1.62 (0.55)a |
| 75-90 | 1.65 (0.18)a | 1.73 (0.31)a | 1.95 (0.80)a | 1.74 (0.27)a | 2.40 (2.04)a | 1.23 (0.47)a |
| Profile Sum[¶] | 19.20 (3.98)a | 18.85 (3.96)a | 19.32 (6.24)a | 18.08 (5.10)a | 21.10 (8.83)a | 14.73 (1.22)a |
| n[#] | 8 | 8 | 8 | 8 | 8 | 4 |

[†]Alkar, Alkar Tall Wheatgrass; Haymaker, Haymaker Intermediate Wheatgrass; Sunburst, Sunburst Switchgrass; Trailblazer, Trailblazer Switchgrass; CRP, Conservation Reserve Program Mixture (Wheatgrass+Alfalfa+Sweet Clover).

[‡]Standard deviation.

[§]Means within soil depth rows that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean sequentially followed by letters with lower mean values.

[¶]Soil profile sum is the average of all individual soil profile sums within a species across all harvest treatments.

[#]n is the sample size of the treatment.

Table A6. Carrington mean total organic carbon (TOC), water soluble organic carbon (WSOC), and proportion of total organic carbon that is comprised of water soluble organic carbon (%WSOC) by soil depth increment as affected by harvest treatment across all species treatments.

| | TOC | | WSOC | | %WSOC | |
|---|---|---|---|---|---|---|
| Soil Depth | Annual | Biennial | Annual | Biennial | Annual | Biennial |
| ---cm--- | ----------------------------------kg $m^{-2}$ $depth^{-1}$---------------------------------- | | | | --------------------%-------------------- | |
| 0-10 | 3.42 (0.80[†])a[‡] | 3.59 (0.58)a | 0.18 (0.03)a | 0.17 (0.03)a | 5.57 (0.01)a | 4.88 (0.01)a |
| 10-20 | 3.08 (0.77)a | 3.26 (0.75)a | 0.18 (0.03)a | 0.17 (0.03)a | 5.96 (0.01)a | 5.42 (0.02)a |
| 20-30 | 2.48 (0.83)a | 2.90 (0.84)a | 0.13 (0.03)a | 0.14 (0.03)a | 5.61 (0.01)a | 5.16 (0.02)a |
| 30-45 | 2.77 (0.98)a | 3.23 (1.35)a | 0.17 (0.06)a | 0.17 (0.04)a | 6.61 (0.02)a | 5.94 (0.02)a |
| 45-60 | 2.43 (0.66)a | 2.96 (1.32)a | 0.16 (0.06)a | 0.17 (0.05)a | 6.76 (0.02)a | 6.24 (0.02)a |
| 60-75 | 2.04 (0.49)a | 2.65 (1.63)a | 0.14 (0.06)a | 0.15 (0.05)a | 6.88 (0.02)a | 6.40 (0.02)a |
| 75-90 | 1.57 (0.23)b | 2.22 (1.31)a | 0.11 (0.05)a | 0.14 (0.07)a | 7.04 (0.03)a | 6.63 (0.03)a |
| Profile Sum[§] | 17.8 (4.04)a | 20.8 (6.73)a | 1.08 (0.26)a | 1.11 (0.18)a | N/A | N/A |
| Profile Mean[¶] | N/A | N/A | N/A | N/A | 6.35 (0.01)a | 5.81 (0.01)a |
| n[#] | 20 | 20 | 20 | 20 | 20 | 20 |

[†]Standard Deviation.

[‡]Means within soil depth rows that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean sequentially followed by letters with lower mean values.

[§]Soil profile sum is the average of all individual soil profile sums within a harvest treatment across all species treatments. N/A indicates that this data is not applicable in this case.

[¶]Soil profile mean is the average of all individaul soil profile means within a harvest treatment across all species treatments. N/A indicates that this data is not applicable in this case.

[#]n is the sample size of the treatment.

Table A7. Carrington mean total organic carbon by soil depth increment as affected by species that were either annually or biennially harvested.

| | Total Organic Carbon | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Alkar[†] | | Haymaker | | Sunburst | | Trailblazer | | CRP | |
| Soil Depth | Annual | Biennial | Annual | Biennial | Annual | Biennial | Annual | Biennial | Annual | Biennial |
| ---cm--- | ---kg m$^{-2}$ depth$^{-1}$--- | | | | | | | | | |
| 0-10 | 3.76 (1.21[‡])a[§] | 3.64 (0.59)a | 3.20 (0.78)a | 3.66 (0.81)a | 3.41 (0.80)a | 3.53 (0.57)a | 3.26 (0.70)a | 3.52 (0.76)a | 3.47 (0.76)a | 3.61 (0.45)a |
| 10-20 | 3.15 (0.89)a | 3.46 (0.73)a | 3.12 (0.76)a | 3.19 (0.88)a | 3.28 (0.92)a | 2.99 (0.63)a | 2.85 (0.83)a | 3.17 (1.15)a | 3.02 (0.85)a | 3.51 (0.51)a |
| 20-30 | 2.70 (1.18)a | 3.16 (0.69)a | 2.23 (0.67)a | 2.75 (0.85)a | 2.33 (0.95)a | 2.67 (0.87)a | 2.45 (0.39)a | 2.79 (1.18)a | 2.71 (1.11)a | 3.16 (0.92)a |
| 30-45 | 3.01 (1.00)a | 2.84 (0.80)a | 3.05 (1.13)a | 3.01 (1.22)a | 2.71 (1.27)a | 3.34 (1.74)a | 2.39 (0.75)a | 3.20 (1.68)a | 2.68 (1.13)a | 3.73 (1.71)a |
| 45-60 | 2.57 (0.79)a | 2.51 (0.39)a | 2.70 (0.79)a | 2.73 (0.66)a | 2.42 (0.69)a | 3.30 (1.85)a | 2.15 (0.77)a | 2.81 (1.20)a | 2.32 (0.50)a | 3.43 (2.19)a |
| 60-75 | 2.10 (0.49)a | 2.19 (0.36)a | 2.42 (0.52)a | 2.17 (0.38)a | 2.02 (0.54)a | 2.73 (1.49)a | 1.74 (0.40)a | 2.33 (0.78)a | 1.93 (0.49)a | 3.83 (3.33)a |
| 75-90 | 1.60 (0.18)a | 1.70 (0.19)a | 1.65 (0.38)a | 1.81 (0.26)a | 1.43 (0.11)a | 2.47 (0.87)a | 1.61 (0.17)a | 1.87 (0.31)a | 1.57 (0.29)a | 3.22 (2.79)a |
| Profile Sum[¶] | 18.89 (5.29)a | 19.50 (2.94)a | 18.37 (3.50)a | 19.33 (4.87)a | 17.60 (4.91)a | 21.04 (7.68)a | 16.46 (3.26)a | 19.69 (6.56)a | 17.71 (4.88)a | 24.49 (11.29)a |
| n[#] | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |

[†]Alkar, Alkar Tall Wheatgrass; Haymaker, Haymaker Intermediate Wheatgrass; Sunburst, Sunburst Switchgrass; Trailblazer, Trailblazer Switchgrass; CRP, Conservation Reserve Program Mixture (Wheatgrass+Alfalfa+Sweet Clover).

[‡]Standard deviation.

[§]Means within soil depth rows that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean sequentially followed by letters with lower mean values.

[¶]Soil profile sum is the average of all soil profile sums within a species, seperated by harvest treatment.

[#]n is the sample size of the treatment.

Table A8. Carrington mean water soluble organic carbon by soil depth increment as affected by species that were either annually or biennially harvested.

| | Water Soluble Organic Carbon | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Alkar† | | Haymaker | | Sunburst | | Trailblazer | | CRP | |
| Soil Depth | Annual | Biennial | Annual | Biennial | Annual | Biennial | Annual | Biennial | Annual | Biennial |
| ---cm--- | ---kg $m^{-2}$ $depth^{-1}$--- | | | | | | | | | |
| 0-10 | 0.18 (0.04‡)a§ | 0.15 (0.02)a | 0.17 (0.02)a | 0.17 (0.03)a | 0.19 (0.04)a | 0.18 (0.04)a | 0.20 (0.01)a | 0.19 (0.02)a | 0.18 (0.02)a | 0.17 (0.05)a |
| 10-20 | 0.17 (0.03)a | 0.13 (0.03)a | 0.18 (0.03)a | 0.16 (0.02)a | 0.18 (0.03)a | 0.17 (0.01)a | 0.19 (0.03)a | 0.19 (0.01)a | 0.16 (0.03)a | 0.18 (0.03)a |
| 20-30 | 0.14 (0.05)a | 0.13 (0.04)a | 0.13 (0.01)a | 0.13 (0.01)a | 0.12 (0.04)a | 0.15 (0.03)a | 0.13 (0.01)a | 0.14 (0.02)a | 0.15 (0.04)a | 0.15 (0.02)a |
| 30-45 | 0.16 (0.05)a | 0.18 (0.07)a | 0.17 (0.06)a | 0.17 (0.01)a | 0.17 (0.07)a | 0.15 (0.04)a | 0.18 (0.05)a | 0.17 (0.03)a | 0.20 (0.07)a | 0.18 (0.02)a |
| 45-60 | 0.18 (0.07)a | 0.18 (0.04)a | 0.16 (0.06)a | 0.16 (0.04)a | 0.14 (0.07)a | 0.17 (0.07)a | 0.15 (0.05)a | 0.17 (0.06)a | 0.18 (0.06)a | 0.17 (0.03)a |
| 60-75 | 0.15 (0.05)a | 0.18 (0.03)a | 0.13 (0.03)a | 0.14 (0.02)a | 0.14 (0.09)a | 0.14 (0.06)a | 0.11 (0.04)a | 0.14 (0.04)a | 0.17 (0.09)a | 0.18 (0.07)a |
| 75-90 | 0.11 (0.03)a | 0.13 (0.04)a | 0.11 (0.04)a | 0.12 (0.04)a | 0.10 (0.07)a | 0.15 (0.11)a | 0.09 (0.05)a | 0.12 (0.08)a | 0.13 (0.06)a | 0.16 (0.08)a |
| Profile Sum¶ | 1.08 (0.28)a | 1.08 (0.19)a | 1.05 (0.21)a | 1.04 (0.07)a | 1.05 (0.37)a | 1.11 (0.32)a | 1.05 (0.21)a | 1.12 (0.16)a | 1.17 (0.35)a | 1.18 (0.18)a |
| n# | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |

†Alkar, Alkar Tall Wheatgrass; Haymaker, Haymaker Intermediate Wheatgrass; Sunburst, Sunburst Switchgrass; Trailblazer, Trailblazer Switchgrass; CRP, Conservation Reserve Program Mixture (Wheatgrass+Alfalfa+Sweet Clover).

‡Standard deviation.

§Means within soil depth rows that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean sequentially followed by letters with lower mean values.

¶Soil profile sum is the average of all individual soil profile sums within a species, separated by harvest treatment.

#n is the sample size of the treatment.

Table A9. Carrington mean proportion of total organic carbon that is comprised of water soluble organic carbon (%WSOC), expressed as a percent, by soil depth increment as affected by species that were either annually or biennially harvested.

| | %WSOC | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Alkar[†] | | Haymaker | | Sunburst | | Trailblazer | | CRP | |
| Soil Depth | Annual | Biennial | Annual | Biennial | Annual | Biennial | Annual | Biennial | Annual | Biennial |
| ---cm--- | ---% | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0-10 | 5.03 (0.01[‡])a[§] | 4.36 (0.01)a | 5.53 (0.01)a | 4.64 (0.01)a | 5.75 (0.01)a | 5.03 (0.01)a | 6.38 (0.01)a | 5.62 (0.02)a | 5.17 (0.01)a | 4.75 (0.02)a |
| 10-20 | 5.53 (0.01)a | 4.16 (0.02)a | 5.98 (0.01)a | 5.20 (0.01)a | 5.85 (0.01)a | 5.93 (0.01)a | 6.82 (0.02)a | 6.69 (0.03)a | 5.62 (0.01)a | 5.14 (0.02)a |
| 20-30 | 5.22 (0.01)a | 4.23 (0.02)a | 6.45 (0.02)a | 4.93 (0.02)a | 5.15 (0.01)a | 5.80 (0.01)a | 5.45 (0.01)a | 5.50 (0.02)a | 5.79 (0.01)a | 5.36 (0.02)a |
| 30-45 | 5.35 (0.01)a | 6.27 (0.02)a | 6.08 (0.02)a | 6.27 (0.02)a | 6.43 (0.01)a | 5.07 (0.02)a | 7.58 (0.01)a | 6.65 (0.03)a | 7.63 (0.01)a | 5.46 (0.02)a |
| 45-60 | 6.77 (0.01)a | 7.16 (0.01)a | 6.09 (0.02)a | 6.07 (0.02)a | 6.12 (0.02)a | 5.62 (0.02)a | 7.11 (0.02)a | 6.23 (0.01)a | 7.73 (0.01)a | 6.11 (0.02)a |
| 60-75 | 7.17 (0.01)a | 8.28 (0.01)a | 5.56 (0.02)a | 6.42 (0.01)a | 6.82 (0.04)a | 5.20 (0.01)a | 6.45 (0.02)a | 6.32 (0.02)a | 8.41 (0.03)a | 5.78 (0.02)a |
| 75-90 | 6.99 (0.03)a | 7.61 (0.02)a | 6.98 (0.03)a | 6.77 (0.02)a | 7.19 (0.04)a | 5.87 (0.04)a | 5.79 (0.04)a | 6.70 (0.04)a | 8.25 (0.03)a | 6.20 (0.03)a |
| Profile Mean[¶] | 6.01 (0.003)a | 6.01 (0.01)a | 6.10 (0.01)a | 5.76 (0.01)a | 6.19 (0.01)a | 5.50 (0.01)a | 6.51 (0.01)a | 6.24 (0.02)a | 6.94 (0.01)a | 5.54 (0.02)a |
| n[#] | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |

[†]Alkar, Alkar Tall Wheatgrass; Haymaker, Haymaker Intermediate Wheatgrass; Sunburst, Sunburst Switchgrass; Trailblazer, Trailblazer Switchgrass; CRP, Conservation Reserve Program Mixture (Wheatgrass+Alfalfa+Sweet Clover).

[‡]Standard deviation.

[§]Means within soil depth rows that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean sequentially followed by letters with lower mean values.

[¶]Soil profile mean is the average of all individual soil profile means within a species, separated by harvest treatment.

[#]n is the sample size of the treatment.

Table A10. Dickinson mean total organic carbon by soil depth increment as affected by species across all fertilizer treatments.

| | Total Organic Carbon | | | |
|---|---|---|---|---|
| Soil Depth | Agropyron cristatum | Poa pratensis | Bromus inermis | Check |
| ---cm--- | ---------------------------------------------kg m$^{-2}$ depth$^{-1}$--------------------------------------------- | | | |
| 0-10 | 2.52 (0.48†)a‡ | 2.76 (0.48)a | 2.77 (0.98)a | 3.19 (1.71)a |
| 10-20 | 1.97 (0.55)a | 1.83 (0.45)a | 1.80 (0.26)a | 2.05 (0.10)a |
| 20-30 | 1.32 (0.16)a | 1.47 (0.36)a | 1.36 (0.37)a | 1.52 (0.09)a |
| 30-45 | 1.94 (0.51)a | 1.82 (0.39)a | 1.85 (0.20)a | 2.01 (0.32)a |
| 45-60 | 1.64 (0.59)a | 1.72 (0.67)a | 1.90 (0.31)a | 1.66 (0.29)a |
| 60-75 | 1.48 (0.87)a | 1.44 (0.61)a | 1.35 (0.33)a | 1.36 (0.48)a |
| 75-90 | 0.90 (0.34)a | 1.13 (0.55)a | 0.91 (0.24)a | 1.10 (0.23)a |
| Profile Sum§ | 11.77 (1.97)a | 12.17 (2.35)a | 11.94 (1.33)a | 12.89 (2.68)a |
| n¶ | 12 | 12 | 12 | 4 |

† Standard deviation.

‡Means within soil depth rows that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean sequentially followed by letters with lower mean values.

§Soil profile sum is the average of all individual soil profile sums within a species, across all fertilizer treatments.

¶n is the sample size of the treatment.

Table A11. Dickinson total organic carbon by soil depth increment as affected by species richness across all fertilizer application treatments.

| | Total Organic Carbon | | | | |
|---|---|---|---|---|---|
| Soil Depth | 1 Species | 2 Species | 5 Species | 10 Species | 20 Species |
| ---cm--- | ------------------------------------------------- | ------------------------------------------------- | -----kg $m^{-2}$ $depth^{-1}$----- | ------------------------------------------------- | ------------------------------------------------- |
| 0-10 | 2.58 (0.30†)a‡ | 2.88 (0.55)a | 2.56 (0.34)a | 2.89 (0.45)a | 2.48 (0.32)a |
| 10-20 | 1.96 (0.37)a | 2.28 (0.67)a | 1.86 (0.34)a | 2.05 (0.59)a | 1.72 (0.12)a |
| 20-30 | 1.61 (0.51)a | 1.94 (0.69)a | 1.46 (0.36)a | 1.70 (0.74)a | 1.34 (0.02)a |
| 30-45 | 2.17 (0.35)a | 2.30 (0.38)a | 1.77 (0.19)a | 2.34 (1.08)a | 1.77 (0.13)a |
| 45-60 | 1.95 (0.58)a | 1.83 (0.46)a | 1.39 (0.36)a | 1.65 (0.70)a | 1.58 (0.08)a |
| 60-75 | 1.46 (0.37)a | 1.53 (0.61)a | 1.19 (0.39)a | 1.71 (1.15)a | 0.99 (0.12)a |
| 75-90 | 1.55 (0.64)a | 1.36 (0.63)a | 1.09 (0.67)a | 1.69 (1.22)a | 0.92 (0.10)a |
| Profile Sum§ | 13.28 (2.26)a | 14.10 (1.57)a | 11.31 (2.10)a | 14.02 (4.07)a | 10.80 (0.28)a |
| n¶ | 7 | 4 | 9 | 6 | 3 |

† Standard deviation.

‡Means within soil depth rows that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean sequentially followed by letters with lower mean values.

§Soil profile sum is the average of all individual soil profile sums within a species richness treatment, across all fertilizer treatments.

¶n is the sample size of the treatment.

Table A12. Dickinson water soluble organic carbon by soil depth increment as affected by species richness across all fertilizer application treatments.

| | Water Soluble Organic Carbon | | | | |
|---|---|---|---|---|---|
| Soil Depth | 1 Species | 2 Species | 5 Species | 10 Species | 20 Species |
| ---cm--- | ---kg m$^{-2}$ depth$^{-1}$--- | | | | |
| 0-10 | 0.11 (0.02[†])a[‡] | 0.12 (0.03)a | 0.10 (0.03)a | 0.12 (0.02)a | 0.12 (0.02)a |
| 10-20 | 0.11 (0.03)a | 0.12 (0.03)a | 0.11 (0.04)a | 0.13 (0.04)a | 0.11 (0.02)a |
| 20-30 | 0.08 (0.03)a | 0.11 (0.06)a | 0.08 (0.03)a | 0.08 (0.02)a | 0.08 (0.02)a |
| 30-45 | 0.11 (0.04)a | 0.14 (0.07)a | 0.08 (0.04)a | 0.10 (0.03)a | 0.09 (0.04)a |
| 45-60 | 0.09 (0.04)a | 0.10 (0.06)a | 0.07 (0.02)a | 0.08 (0.03)a | 0.08 (0.02)a |
| 60-75 | 0.08 (0.03)a | 0.08 (0.04)a | 0.05 (0.02)a | 0.07 (0.03)a | 0.07 (0.01)a |
| 75-90 | 0.08 (0.07)a | 0.06 (0.02)a | 0.05 (0.02)a | 0.10 (0.10)a | 0.06 (0.01)a |
| Profile Sum[§] | 0.67 (0.19)a | 0.73 (0.27)a | 0.54 (0.16)a | 0.69 (0.13)a | 0.61 (0.08)a |
| n[¶] | 7 | 4 | 9 | 6 | 3 |

[†] Standard deviation.

[‡]Means within soil depth rows that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean sequentially followed by letters with lower mean values.

[§]Soil profile sum is the average of all individual soil profile sums within a species richness treatment, across all fertilizer treatments.

[¶]n is the sample size of the treatment.

Table A13. Proportion of total organic carbon that is comprised of water soluble organic carbon (%WSOC) by soil depth increment as affected by species richness treatments across all fertilizer application treatments.

| | %WSOC | | | | |
|---|---|---|---|---|---|
| Soil Depth | 1 Species | 2 Species | 5 Species | 10 Species | 20 Species |
| ---cm--- | % | | | | |
| 0-10 | 4.51 (0.01†)a‡ | 4.34 (0.02)a | 4.07 (0.01)a | 4.32 (0.01)a | 4.97 (0.01)a |
| 10-20 | 5.75 (0.01)a | 5.35 (0.01)a | 5.64 (0.01)a | 7.14 (0.03)a | 6.47 (0.01)a |
| 20-30 | 5.24 (0.01)a | 5.47 (0.01)a | 5.42 (0.01)a | 5.51 (0.02)a | 6.04 (0.01)a |
| 30-45 | 5.05 (0.01)a | 6.00 (0.03)a | 4.73 (0.02)a | 4.61 (0.01)a | 5.16 (0.02)a |
| 45-60 | 4.85 (0.02)a | 5.69 (0.03)a | 5.40 (0.03)a | 5.37 (0.02)a | 5.03 (0.01)a |
| 60-75 | 5.54 (0.02)a | 5.77 (0.03)a | 5.06 (0.03)a | 5.24 (0.02)a | 6.86 (0.01)a |
| 75-90 | 5.20 (0.03)a | 5.33 (0.03)a | 5.10 (0.03)a | 10.41 (0.14)a | 6.32 (0.02)a |
| Profile Mean§ | 5.16 (0.01)a | 5.42 (0.02)a | 5.06 (0.01)a | 6.09 (0.02)a | 5.84 (0.01)a |
| n¶ | 7 | 4 | 9 | 6 | 3 |

†Standard deviation.

‡Means within soil depth rows that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean sequentially followed by letters with lower mean values.

§Soil profile mean is the average of all individual soil profile means within a species richness treatment, across all fertilizer treatments.

¶n is the sample size of the treatment.

Table A14. Dickinson mean water soluble organic carbon and total organic carbon by soil depth increment as affected by fertilizer application treatment across all species and species richness treatments.

| | Water Soluble Organic Carbon | | | Total Organic Carbon | | |
|---|---|---|---|---|---|---|
| Soil Depth | No Fertilizer | Nitrogen | Phosphorus | No Fertilizer | Nitrogen | Phosphorus |
| ---cm--- | ------------------------------kg $m^{-2}$ $depth^{-1}$------------------------------ | | | | | |
| 0-10 | 0.13 (0.04†)a‡ | 0.14 (0.05)a | 0.15 (0.04)a | 2.61 (0.50)a | 2.61 (0.67)a | 2.78 (0.54)a |
| 10-20 | 0.13 (0.04)a | 0.11 (0.03)a | 0.14 (0.05)a | 1.83 (0.43)a | 1.83 (0.32)a | 2.04 (0.50)a |
| 20-30 | 0.09 (0.03)a | 0.09 (0.04)a | 0.10 (0.03)a | 1.31 (0.18)a | 1.54 (0.50)a | 1.57 (0.49)a |
| 30-45 | 0.10 (0.03)a | 0.10 (0.04)a | 0.12 (0.04)a | 1.82 (0.40)a | 1.95 (0.48)a | 2.07 (0.53)a |
| 45-60 | 0.09 (0.03)a | 0.09 (0.03)a | 0.10 (0.03)a | 1.65 (0.65)a | 1.67 (0.51)a | 1.80 (0.44)a |
| 60-75 | 0.08 (0.04)a | 0.07 (0.03)a | 0.08 (0.02)a | 1.34 (0.78)a | 1.36 (0.43)a | 1.50 (0.63)a |
| 75-90 | 0.07 (0.06)a | 0.06 (0.04)a | 0.06 (0.02)a | 1.02 (0.73)a | 1.15 (0.60)a | 1.23 (0.54)a |
| Profile Sum§ | 0.68 (0.17)a | 0.67 (0.19)a | 0.75 (0.17)a | 11.58 (2.04)a | 12.11 (2.34)a | 13.00 (2.34)a |
| n¶ | 21 | 19 | 25 | 21 | 19 | 25 |

† Standard deviation.

‡Means within soil depth rows that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean sequentially followed by letters with lower mean values.

§Soil profile sum is the average of all individual soil profile sums within a fertilizer application treatment.

¶n is the sample size of the treatment.

Table A15. Proportion of total organic carbon that is comprised of water soluble organic carbon (%WSOC) by soil depth increment as affected by fertilizer application treatment across all species and species richness treatments.

| | %WSOC | | |
|---|---|---|---|
| Soil Depth | No Fertilizer | Nitrogen | Phosphorus |
| ---cm--- | ---------------------------- | % | ---------------------------- |
| 0-10 | 5.16 (0.01[†])a[‡] | 7.59 (0.12)a | 5.56 (0.02)a |
| 10-20 | 7.19 (0.02)a | 6.23 (0.02)a | 7.24 (0.03)a |
| 20-30 | 7.18 (0.02)a | 6.31 (0.03)a | 7.03 (0.03)a |
| 30-45 | 5.93 (0.03)a | 5.33 (0.02)a | 6.04 (0.02)a |
| 45-60 | 5.94 (0.03)a | 5.47 (0.02)a | 5.61 (0.02)a |
| 60-75 | 7.17 (0.05)a | 5.87 (0.03)a | 5.64 (0.02)a |
| 75-90 | 8.61 (0.08)a | 6.30 (0.03)a | 5.62 (0.03)a |
| Profile Mean[§] | 6.74 (0.02)a | 6.16 (0.03)a | 6.12 (0.01)a |
| n[¶] | 21 | 19 | 25 |

[†]Standard deviation.

[‡]Means within soil depth rows that are followed by the same letter are not significantly different according to Tukey-Kramer HSD ($p < 0.05$). Letters of statistical significance are in alphabetical order with 'a' representing the largest mean sequentially followed by letters with lower mean values.

[§]Soil profile mean is the average of all individual soil profile means within a species across all fertilizer application treatments.

[¶]n is the sample size of the treatment.

APPENDIX B

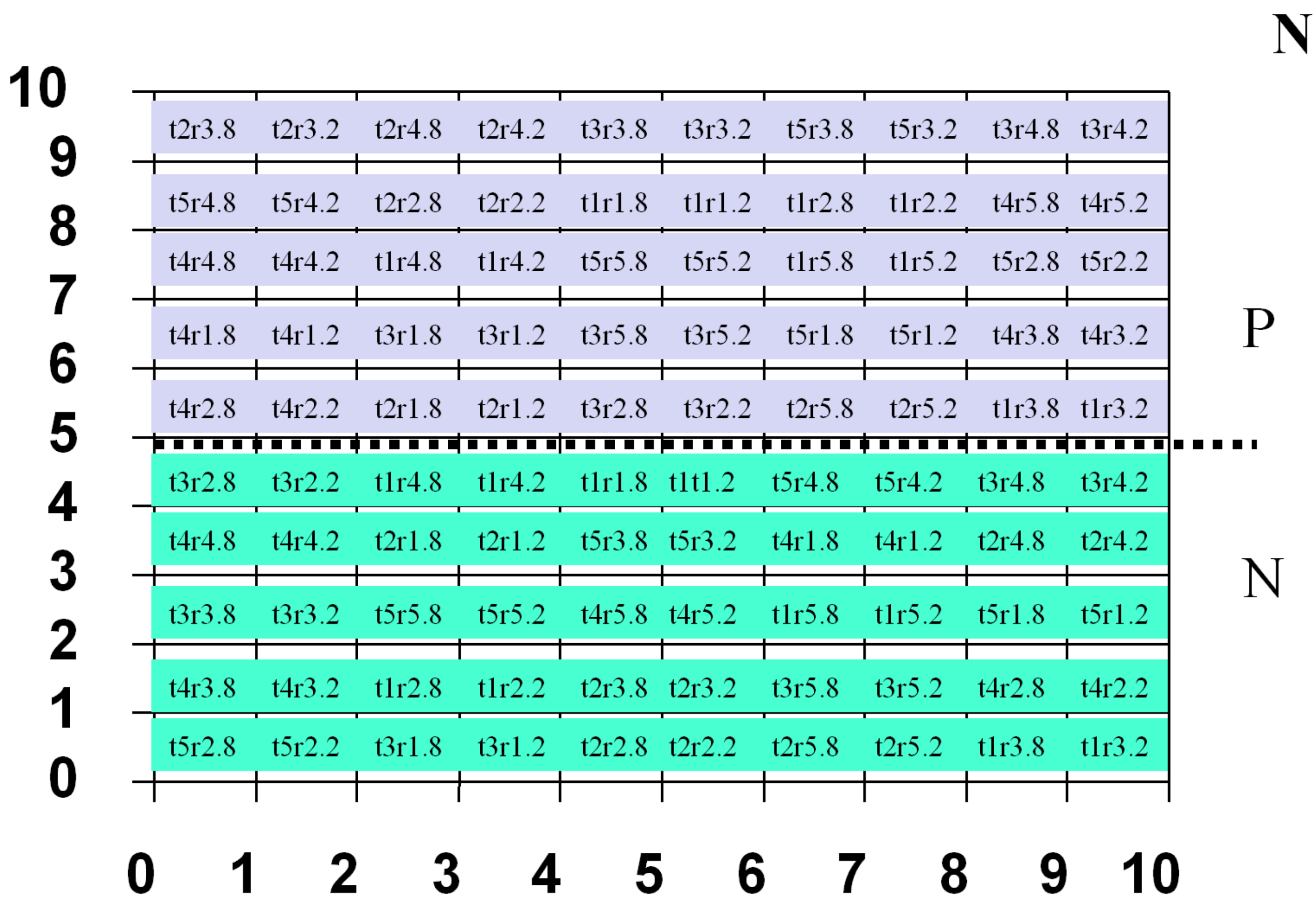


Figure B1. Ekre Ranch plot design layout for each replicate block, with “P” representing phosphorus on the North half of the block and “N” for nitrogen fertilizer application on the South half.

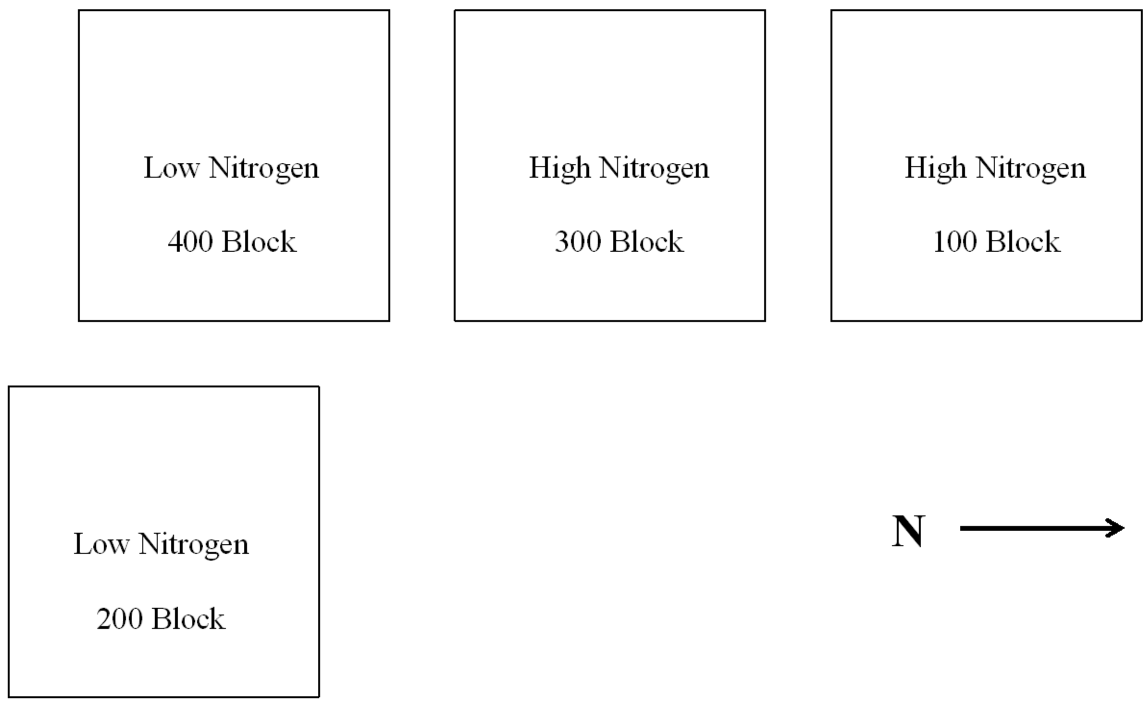


Figure B2. Ekre Ranch block design layout for high and low nitrogen fertilizer application rates.

| | Treatment | Harvest |
|---|---|---|
| 1 | Sunburst Switchgrass | Annual |
| 2 | Sunburst Switchgrass | Biennial |
| 3 | Trailblazer Switchgrass | Annual |
| 4 | Trailblazer Switchgrass | Biennial |
| 5 | Alkar Tall Wheatgrass | Annual |
| 6 | Alkar Tall Wheatgrass | Biennial |
| 7 | Haymaker Intermediate Wheatgrass | Annual |
| 8 | Haymaker Intermediate Wheatgrass | Biennial |
| 9 | CRP Mix (Intermediate & Tall Wheatgrass) | Annual |
| 10 | CRP Mix (Intermediate & Tall Wheatgrass) | Biennial |
| 11 | CRP Mix (Wheatgrasses +alfalfa+Swt.clover) | Annual |
| 12 | CRP Mix (Wheatgrasses +alfalfa+Swt.clover) | Biennial |
| 13 | Sunburst Switchgrass + Tall Wheatgrass | Annual |
| 14 | Sunburst Switchgrass + Tall Wheatgrass | Biennial |
| 15 | Sunburst Switchgrass + Sunnyview Big Bluestem | Annual |
| 16 | Sunburst Switchgrass + Sunnyview Big Bluestem | Biennial |
| 17 | Sunburst Switchgrass + Mustang Alti wildrye | Annual |
| 18 | Sunburst Switchgrass + Mustang Alti wildrye | Biennial |
| 19 | Magnar Basin + Mustang Alti wildrye | Annual |
| 20 | Magnar Basin + Mustang Alti wildrye | Biennial |

**Design & Layout**

**Split-Block Split Plot**

**E**

**Rep 1**

| 101 | 102 |
|---|---|
| 1 | 2 |
| 3 | 4 |
| 5 | 6 |
| 7 | 8 |
| 9 | 10 |
| 11 | 12 |
| 13 | 14 |
| 15 | 16 |
| 17 | 18 |
| 19 | 20 |
| 119 | 120 |

**Rep 3**

| 301 | 302 |
|---|---|
| 4 | 3 |
| 18 | 17 |
| 20 | 19 |
| 14 | 13 |
| 8 | 7 |
| 6 | 5 |
| 16 | 15 |
| 2 | 1 |
| 10 | 9 |
| 12 | 11 |
| 319 | 320 |

**N**

**Rep 2**

| 201 | 202 |
|---|---|
| 8 | 7 |
| 4 | 3 |
| 6 | 5 |
| 14 | 13 |
| 20 | 19 |
| 12 | 11 |
| 2 | 1 |
| 10 | 9 |
| 16 | 15 |
| 18 | 17 |
| 219 | 220 |

**Rep 4**

| 401 | 401 |
|---|---|
| 7 | 8 |
| 9 | 10 |
| 17 | 18 |
| 13 | 14 |
| 3 | 4 |
| 1 | 2 |
| 19 | 20 |
| 15 | 16 |
| 11 | 12 |
| 5 | 6 |
| 419 | 420 |

**S**

**W**

Figure B3. Carrington plot design layout shown with species or species mixtures for each plot with four replicate blocks.

Layout of treatments and fert patterns for the Dickinson experiment
P=phosphorus N=nitrogen 0=no fertilizer

N →

| | c1 | c2 | c3 | c4 | c5 | c6 | c7 | c8 | c9 | c10 | c11 | c12 | c13 | c14 | c15 | c16 | c17 | c18 | c19 | c20 | c21 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| r1 | PT2R7 | NT2R4 | 0T5R3 | NT6R4 | 0T5R2 | 0T1R10 | PT1R4 | NT5R4 | PT3R3 | PT6R9 | PT7R7 | 0T3R5 | 0T1R8 | NT3R10 | 0T1R1 | NT4R6 | PT2R4 | 0T4R3 | NT3R9 | 0T5R9 | PT6R1 |
| r2 | PT5R10 | PT7R5 | 0T7R9 | 0T7R6 | 0T3R6 | PT4R5 | NT1R4 | 0T3R4 | NT1R8 | 0T6R10 | PT2R3 | PT2R9 | 0T7R4 | PT5R2 | PT4R3 | NT5R2 | NT6R6 | 0T6R8 | 0T7R8 | NT5R5 | NT4R7 |
| r3 | NT1R2 | 0T1R7 | 0T6R3 | NT4R2 | NT6R2 | 0T4R4 | 0T5R5 | 0T6R7 | NT6R9 | NT1R5 | 0T2R4 | PT5R7 | 0T4R5 | PT6R10 | NT2R6 | NT5R8 | NT5R9 | 0T6R9 | 0T6R4 | 0T7R5 | NT5R1 |
| r4 | PT4R9 | PT6R4 | NT6R1 | PT4R2 | NT1R9 | NT3R8 | NT1R10 | 0T7R3 | PT2R5 | 0T2R7 | PT5R9 | PT7R1 | NT3R3 | PT4R8 | PT3R10 | 0T1R2 | 0T2R5 | 0T3R7 | PT6R2 | 0T2R2 | 0T1R6 |
| r5 | PT7R6 | PT7R9 | 0T1R3 | NT7R7 | 0T7R7 | PT3R5 | NT2R2 | NT2R7 | PT2R10 | PT3R7 | 0T5R8 | 0T7R2 | PT1R3 | 0T4R9 | 0T5R6 | NT7R10 | NT7R1 | 0T3R1 | NT6R3 | 0T6R1 | PT2R6 |
| r6 | PT7R8 | 0T3R8 | PT6R6 | PT3R2 | NT6R5 | PT1R8 | 0T2R9 | PT1R10 | NT4R10 | 0T1R4 | 0T4R2 | PT4R7 | 0T3R3 | 0T2R10 | NT2R9 | NT3R7 | NT3R2 | NT3R6 | PT6R7 | PT3R1 | PT5R1 |
| r7 | NT6R10 | PT6R3 | 0T3R2 | NT2R5 | NT7R8 | NT5R3 | PT7R2 | NT6R8 | PT5R8 | PT2R2 | NT7R3 | PT5R5 | PT6R8 | PT3R9 | PT2R1 | 0T4R1 | NT5R10 | 0T5R10 | PT6R5 | NT1R1 | 0T3R10 |
| r8 | 0T2R8 | PT1R6 | NT1R6 | PT3R8 | PT7R3 | NT3R4 | 0T4R7 | 0T4R6 | NT7R4 | NT4R1 | NT2R1 | PT7R10 | NT2R3 | PT3R6 | 0T4R10 | 0T2R1 | PT7R4 | PT1R1 | 0T3R9 | NT3R1 | 0T6R2 |
| r9 | 0T5R1 | NT4R9 | NT4R4 | NT4R5 | 0T7R1 | NT7R9 | PT1R2 | 0T1R9 | NT7R2 | NT3R5 | PT1R9 | 0T7R10 | NT4R3 | PT5R6 | PT5R4 | 0T2R6 | NT5R7 | 0T6R5 | PT2R8 | NT2R8 | NT1R7 |
| r10 | PT1R5 | PT3R4 | 0T2R3 | NT6R7 | 0T1R5 | PT4R10 | PT4R4 | NT7R5 | 0T5R4 | PT4R1 | 0T4R8 | NT4R8 | PT5R3 | NT2R10 | 0T5R7 | NT5R6 | NT7R6 | 0T6R6 | NT1R3 | PT1R7 | PT4R6 |

Figure B4. Dickinson plot design layout.

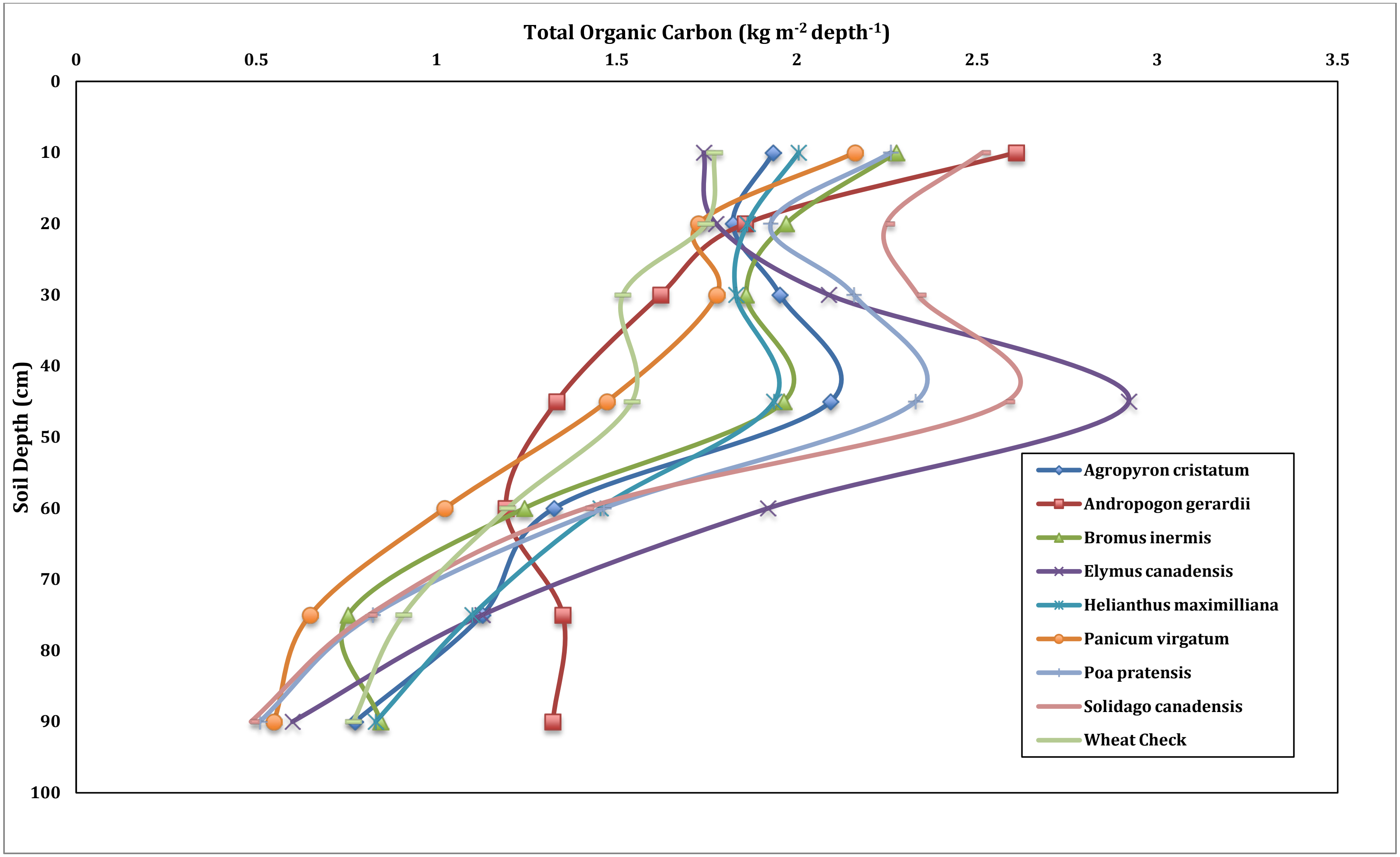


Figure B5. Ekre Ranch total organic carbon by soil depth increment as affected by species.

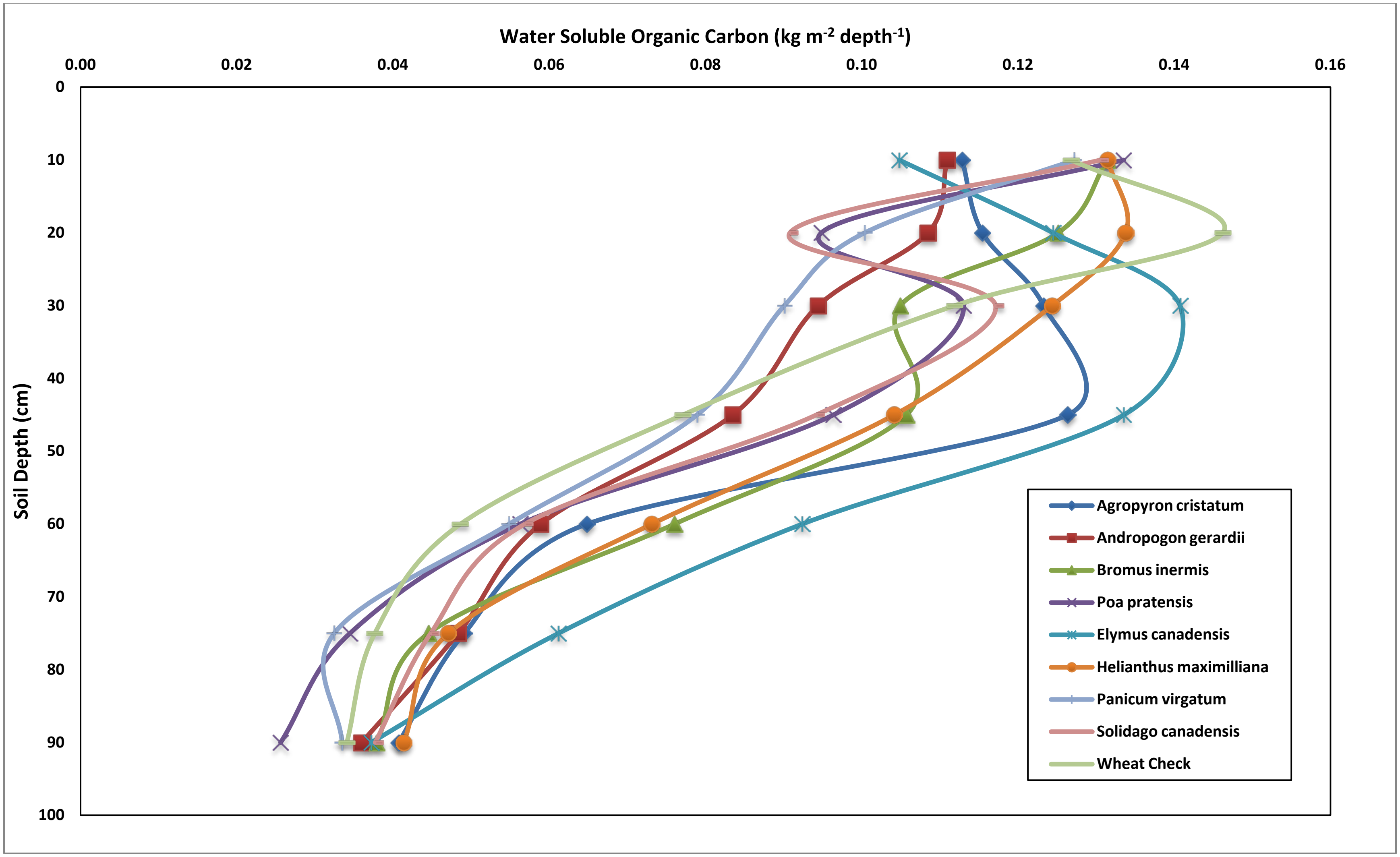


Figure B6. Ekre Ranch water soluble organic carbon by soil depth increment as affected by species.

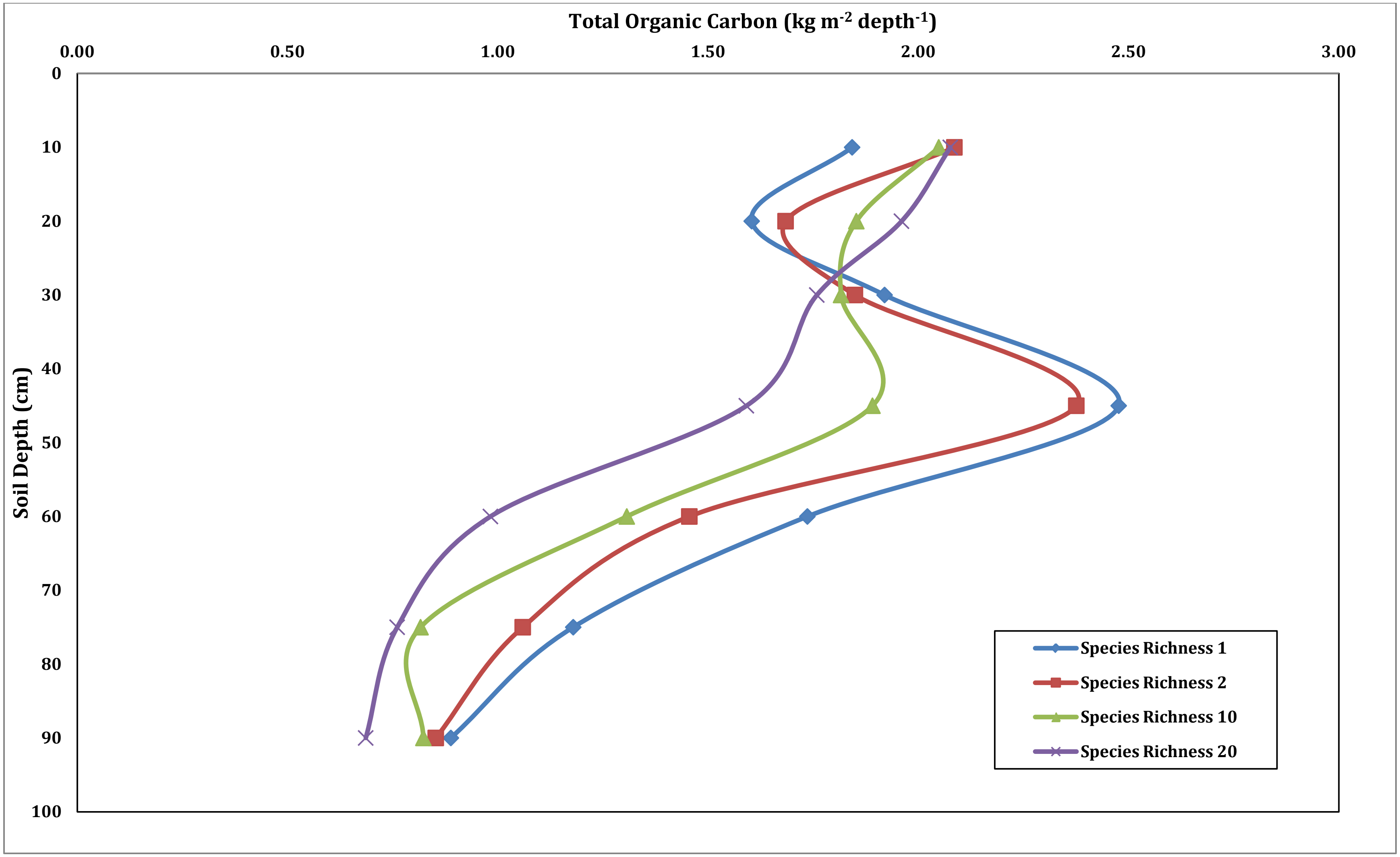


Figure B7. Ekre Ranch total organic carbon by soil depth increment as affected by species richness across all fertilizer treatments.

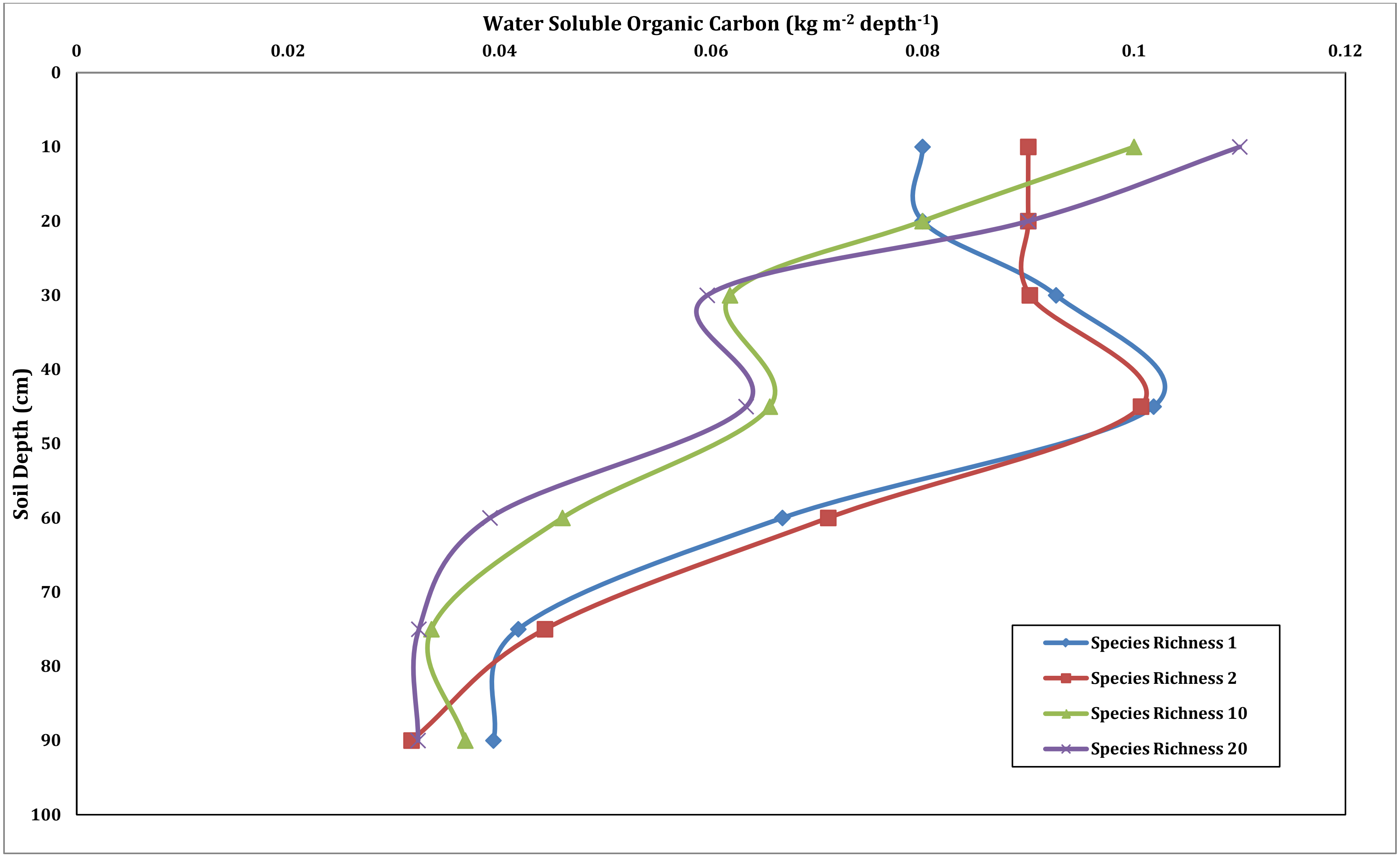


Figure B8. Ekre Ranch water soluble organic carbon by soil depth increment as affected by species richness across all fertilizer treatments.

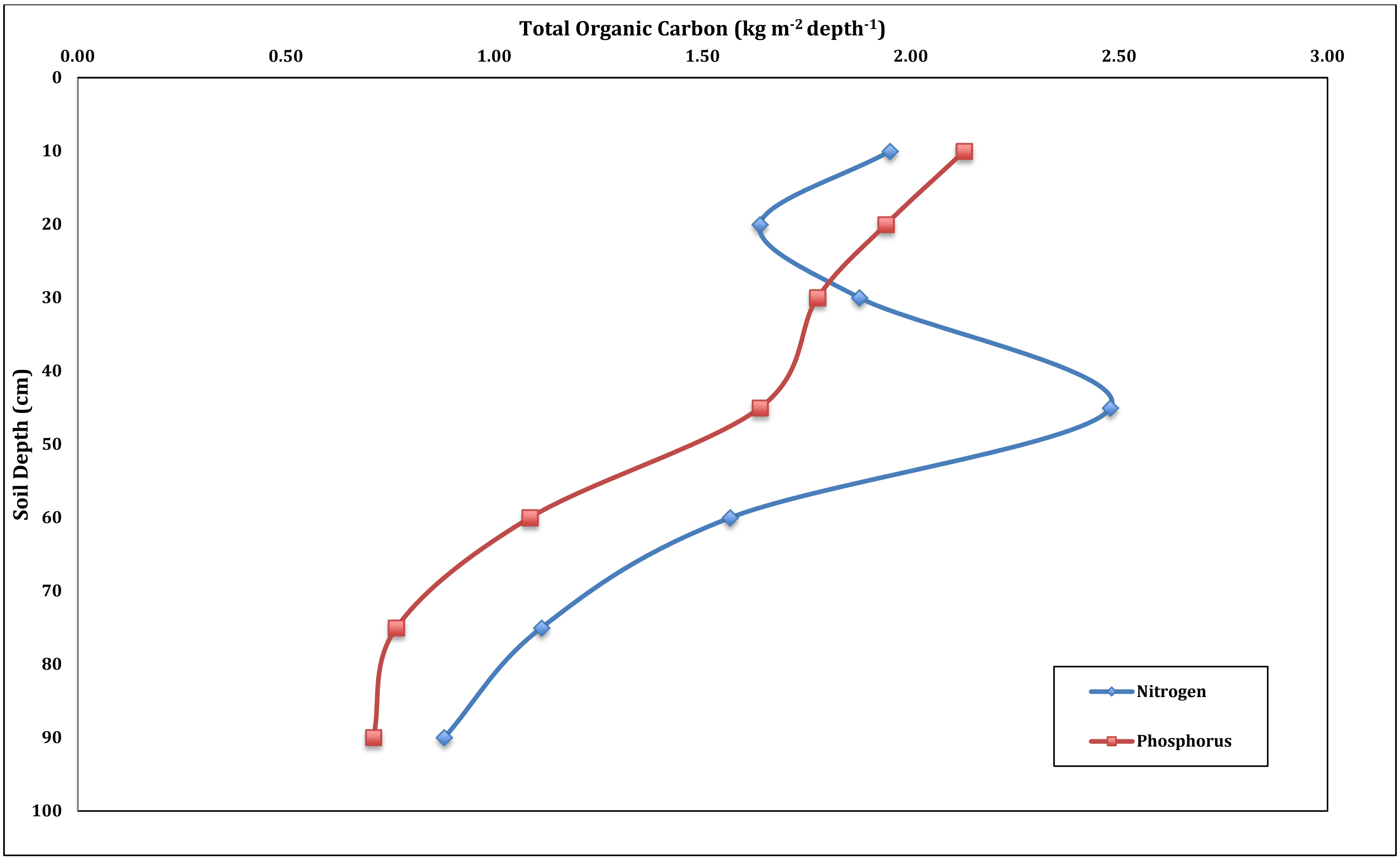


Figure B9. Ekre Ranch total organic carbon by soil depth increment as affected by type of fertilizer applied across all species richness samples.

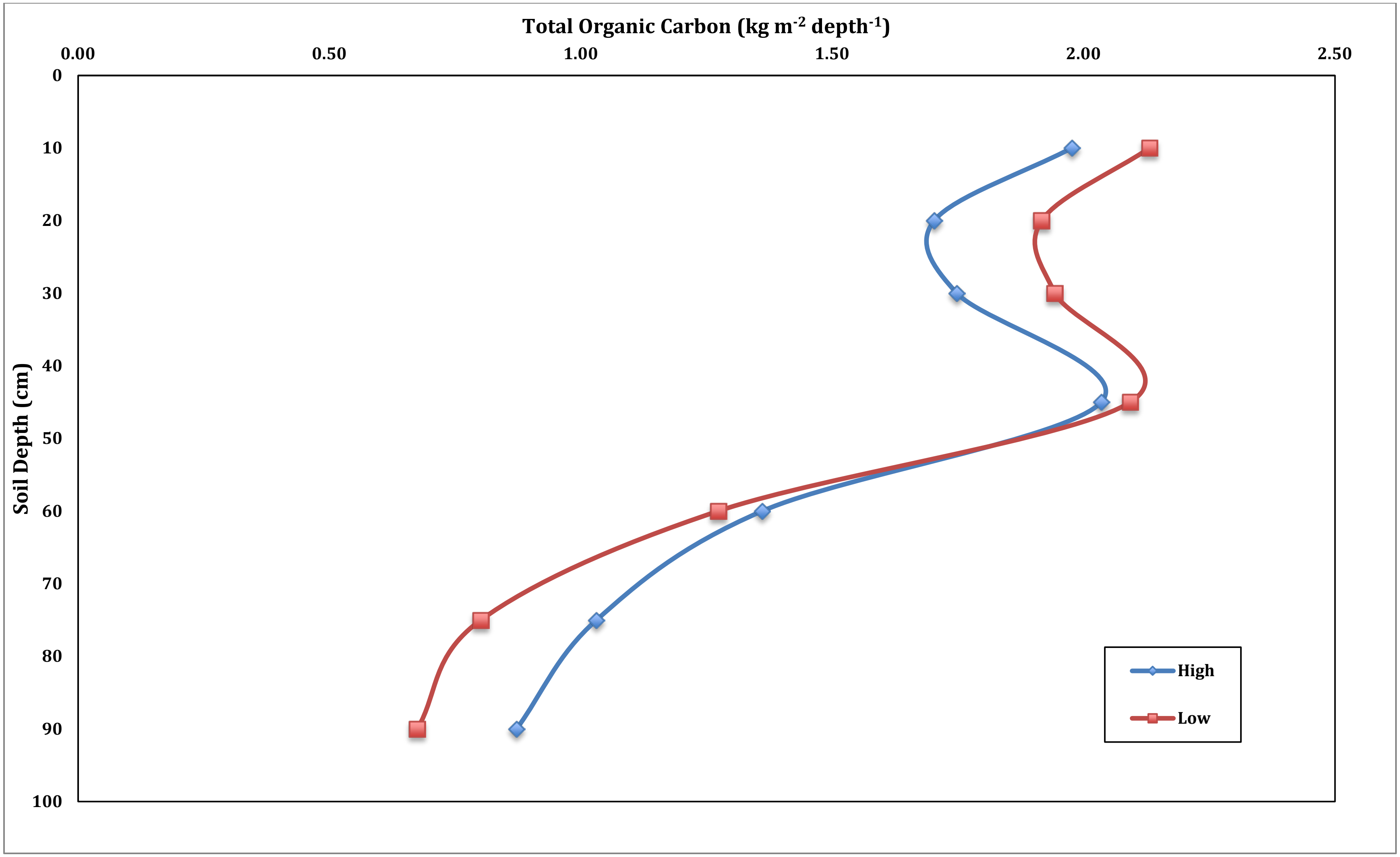


Figure B10. Ekre Ranch total organic carbon by soil depth increment as affected by fertilizer application rate across all species richness samples.

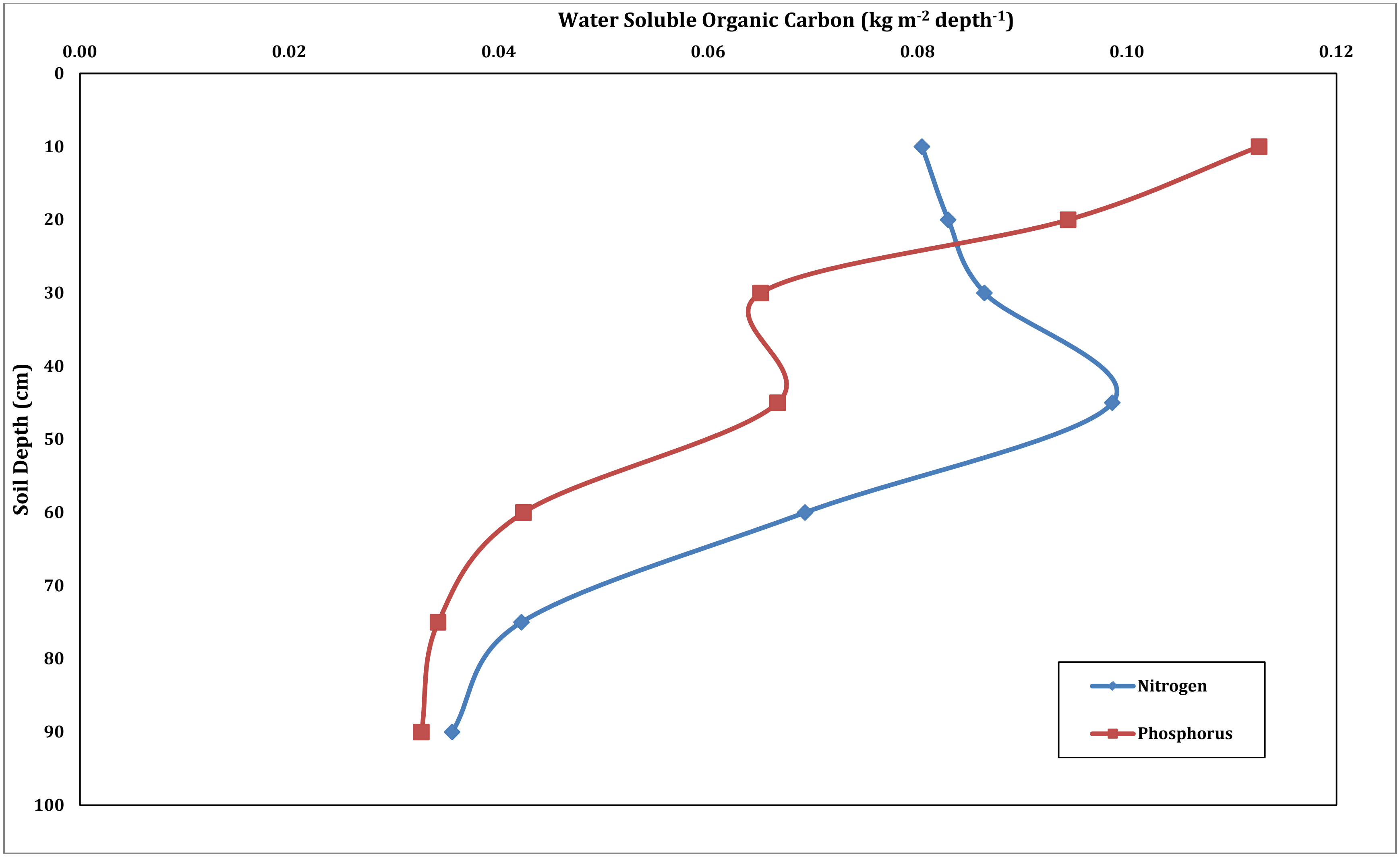


Figure B11. Ekre Ranch water soluble organic carbon by soil depth increment as affected by type of fertilizer applied across all species richness samples.

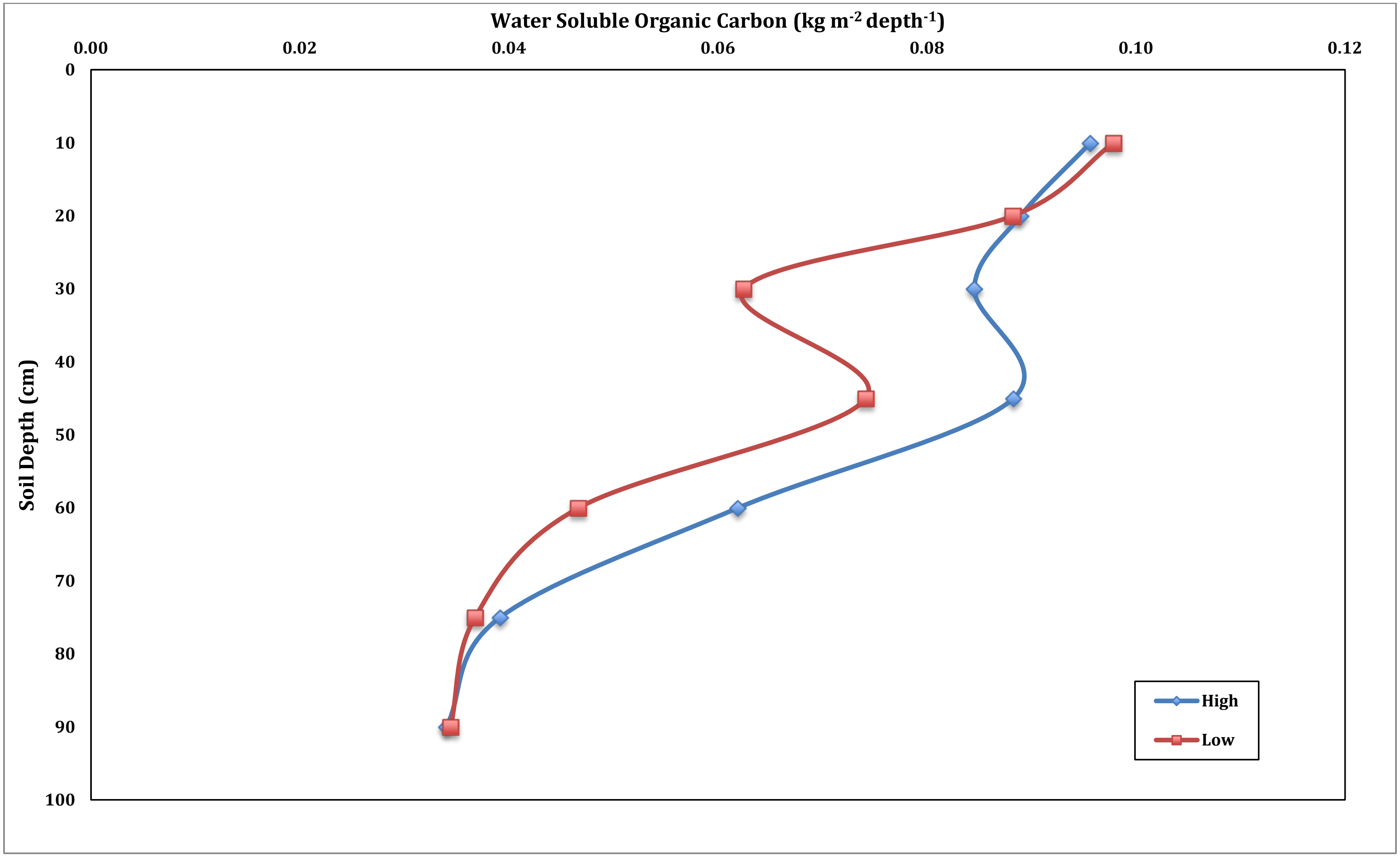


Figure B12. Ekre Ranch water soluble organic carbon by soil depth increment as affected by fertilizer application rate across all species richness samples.

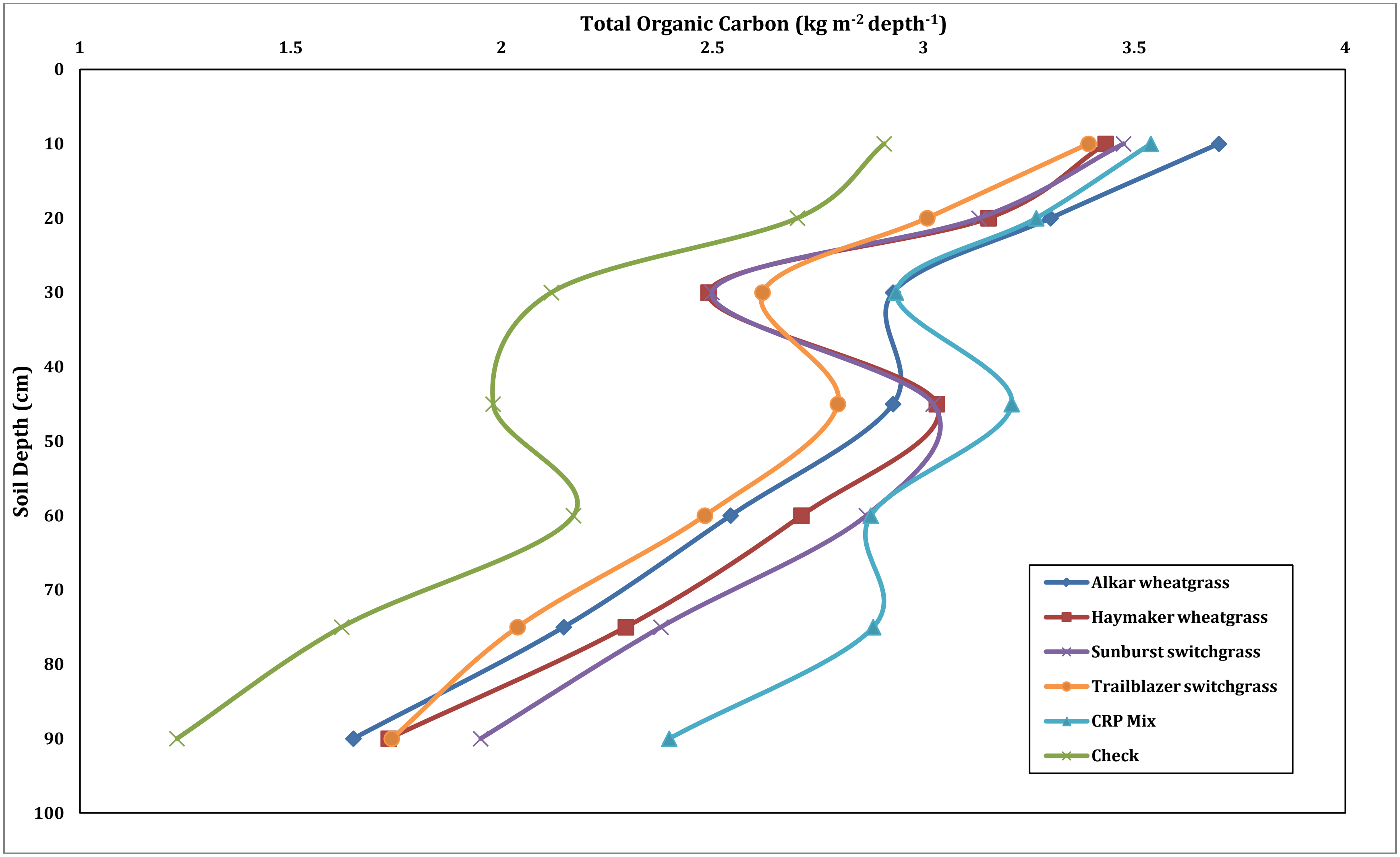


Figure B13. Carrington total organic carbon by soil depth increment as affected by species across all harvest treatments.

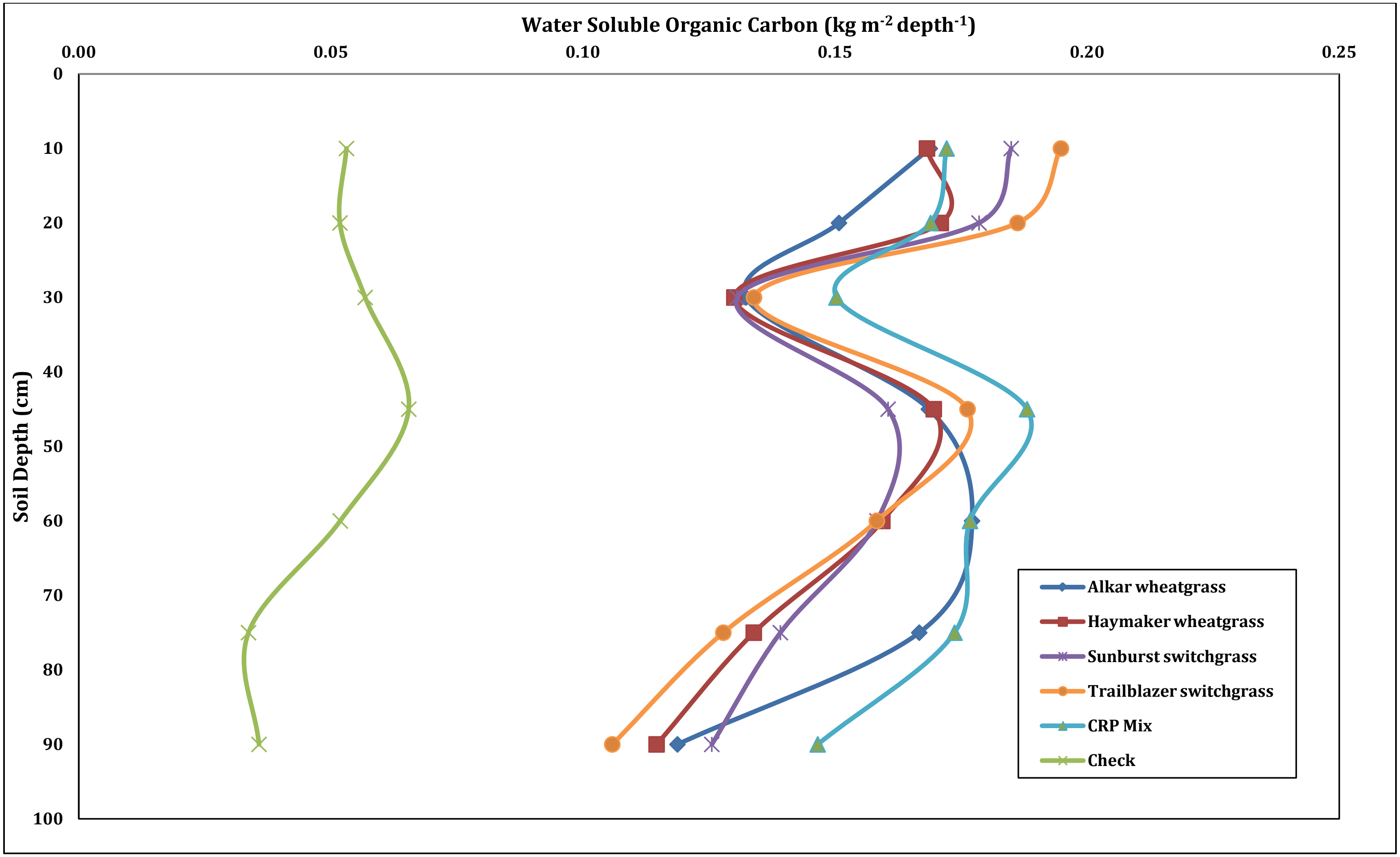


Figure B14. Carrington water soluble organic carbon by soil depth increment as affected by species across all harvest treatments.

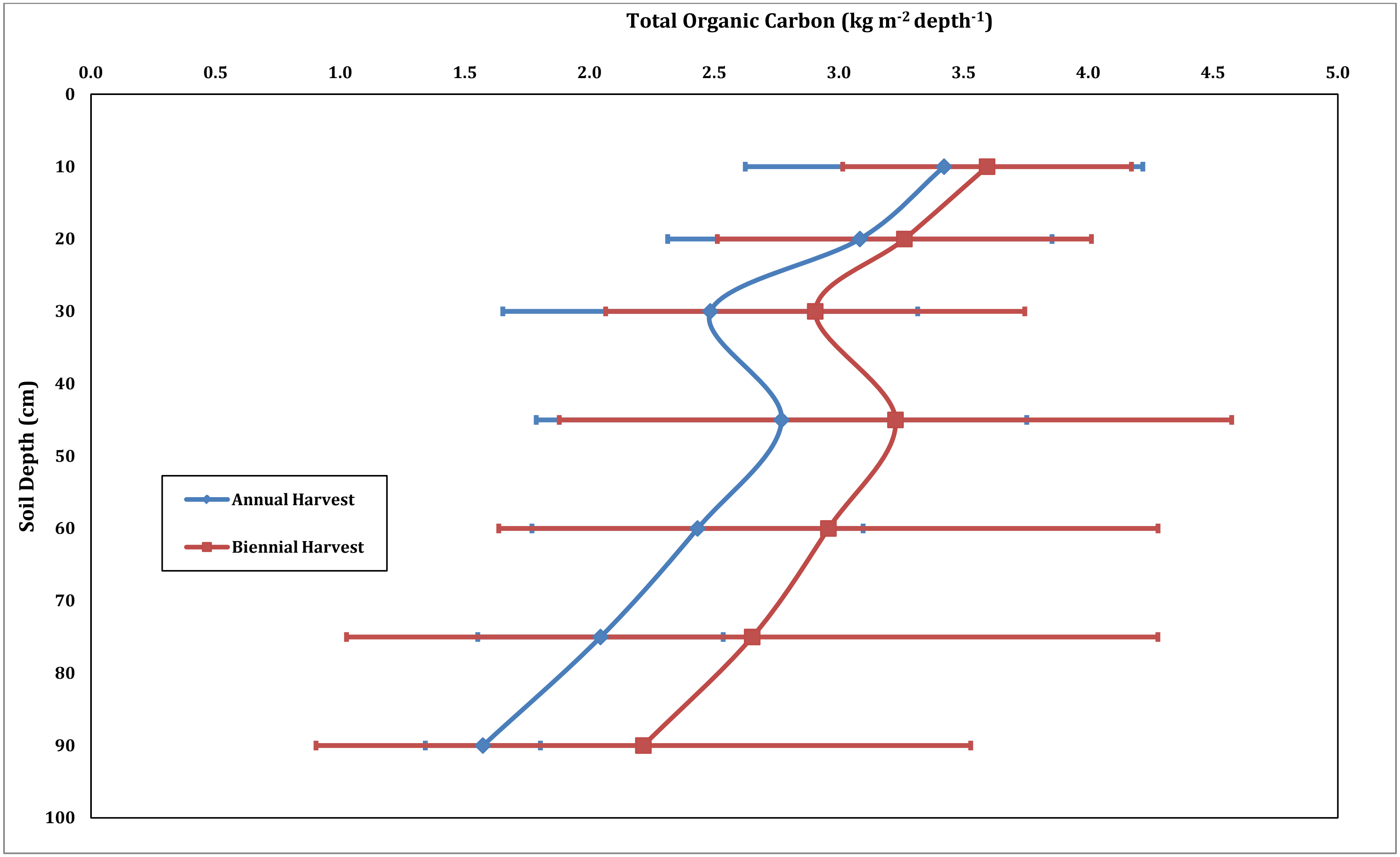


Figure B15. Carrington total organic carbon by soil depth increment as affected by harvest treatment across all species, with the exception of the check.

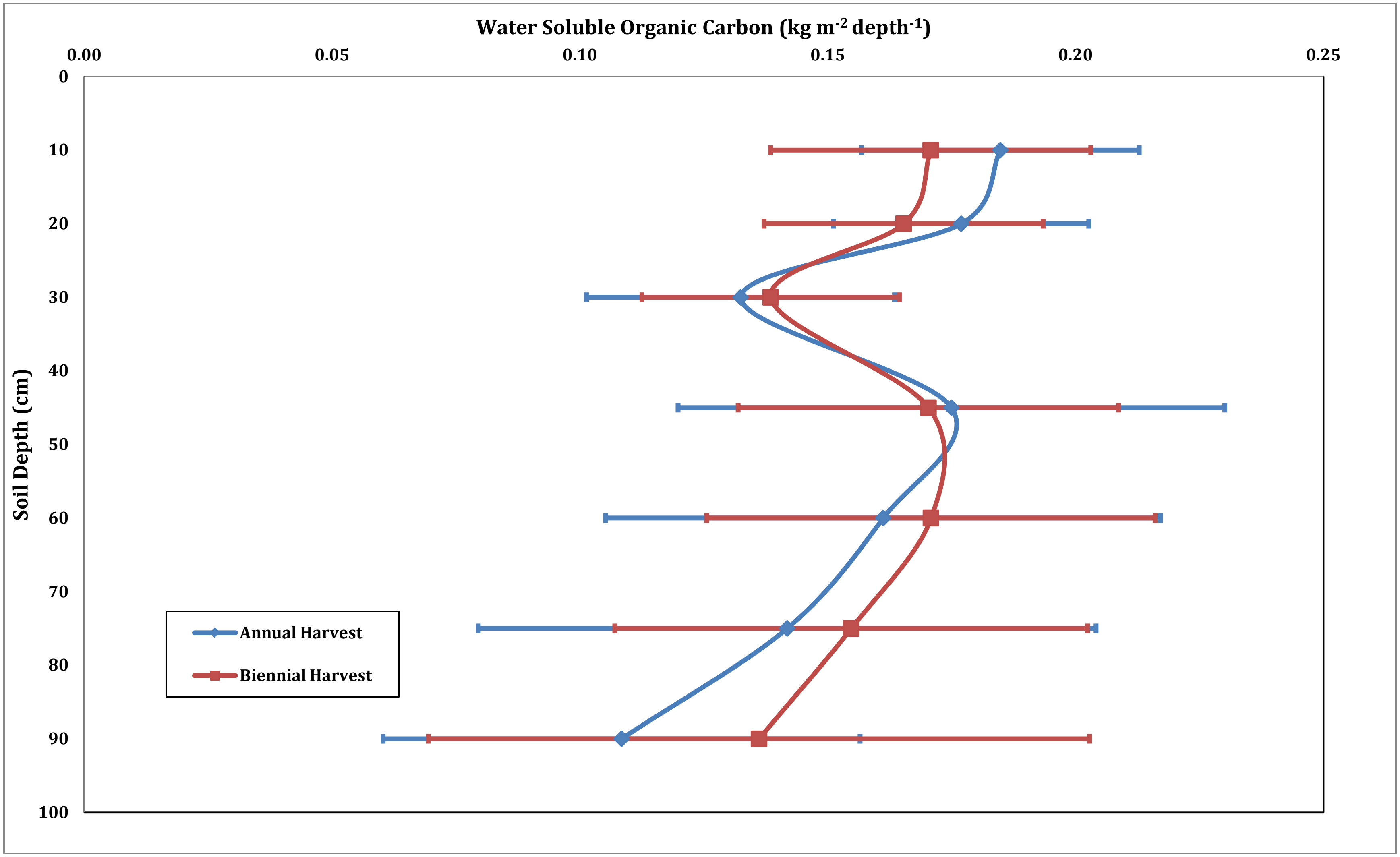


Figure B16. Carrington water soluble organic carbon by soil depth increment as affected by harvest treatment across all species, with the exception of the check.

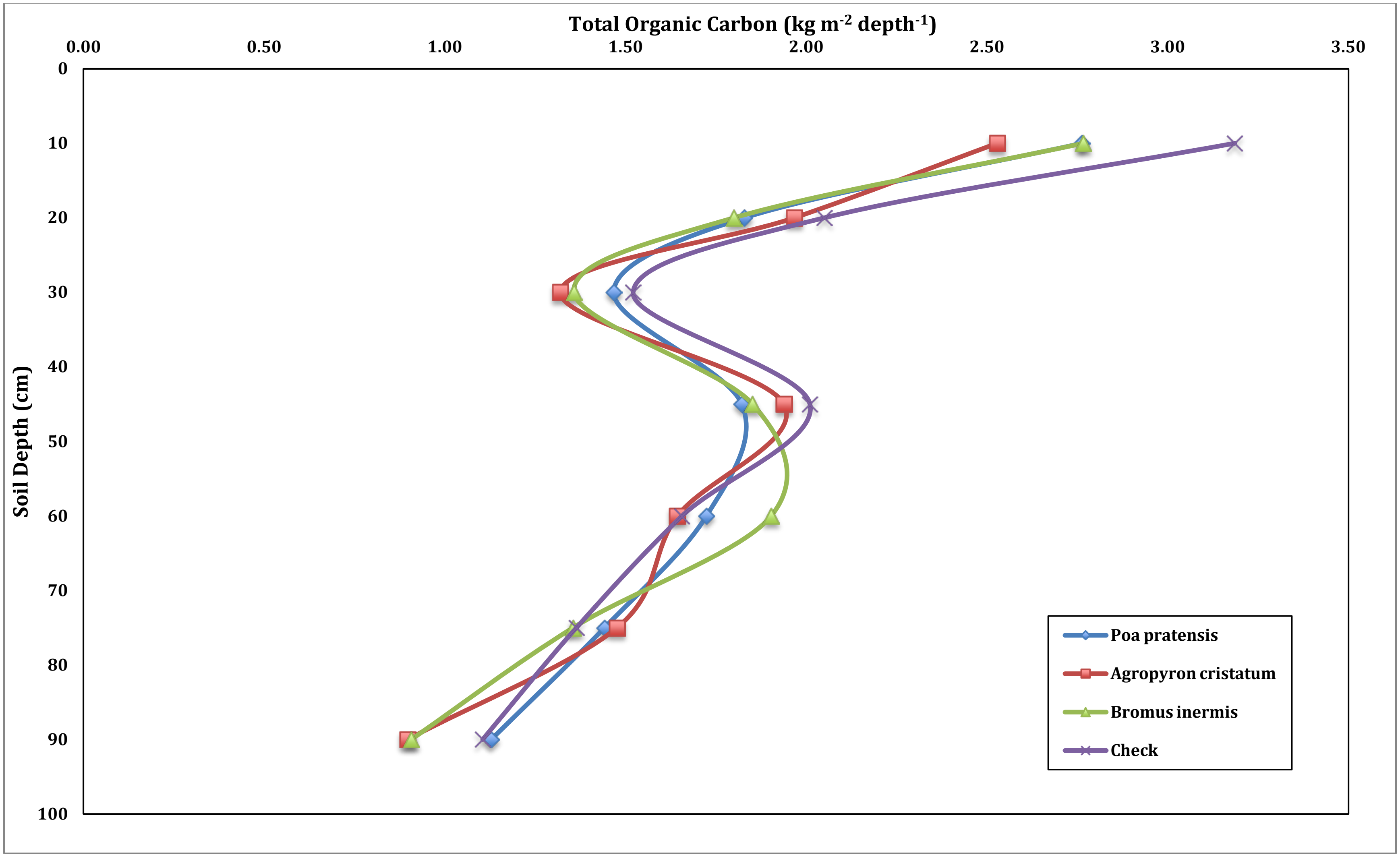


Figure B17. Dickinson total organic carbon by soil depth increment as affected by species across all fertilizer treatments.

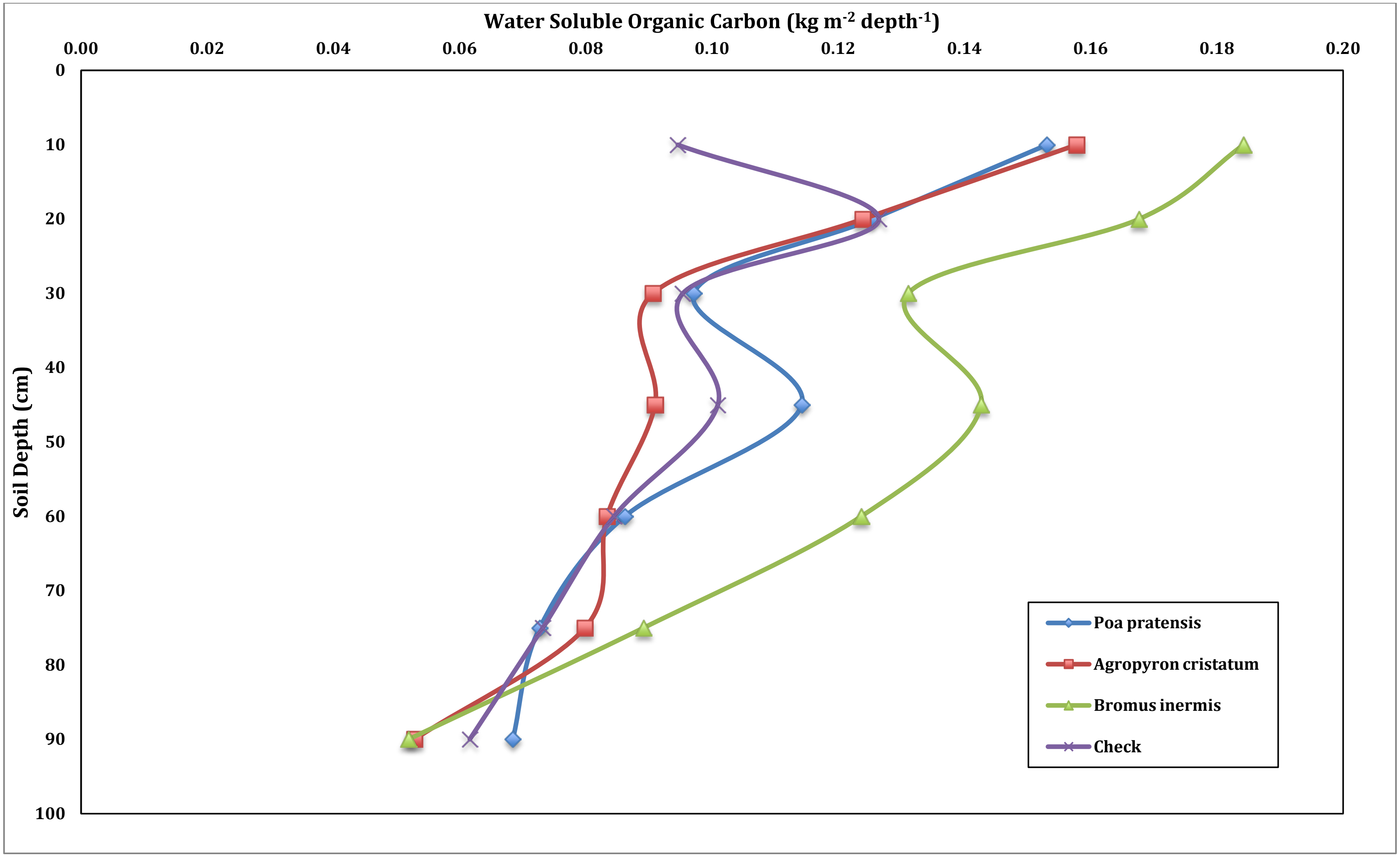


Figure B18. Dickinson water soluble organic carbon by soil depth increment as affected by species across all fertilizer treatments.

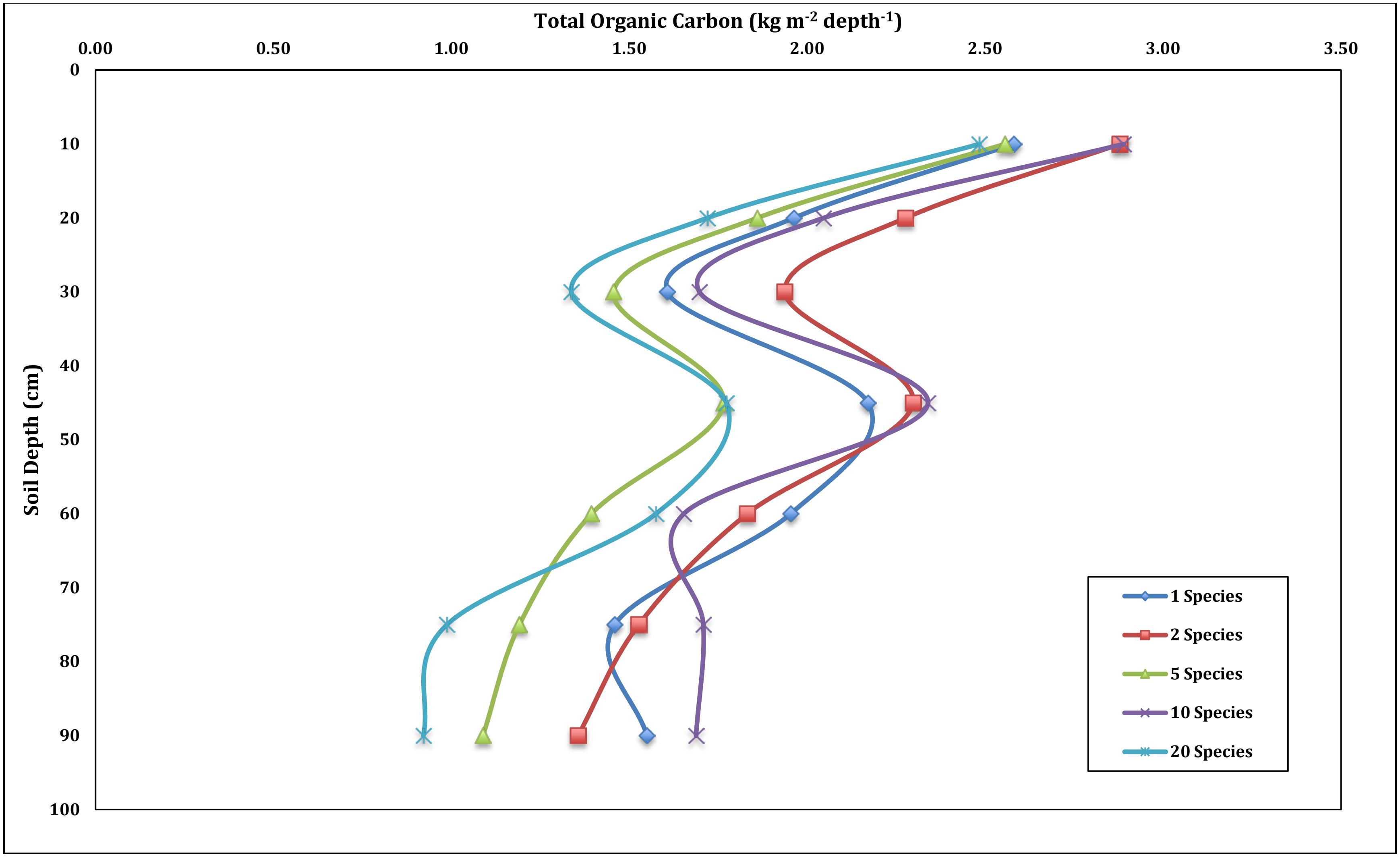


Figure B19. Dickinson total organic carbon by soil depth increment as affected by species richness across all fertilizer treatments.

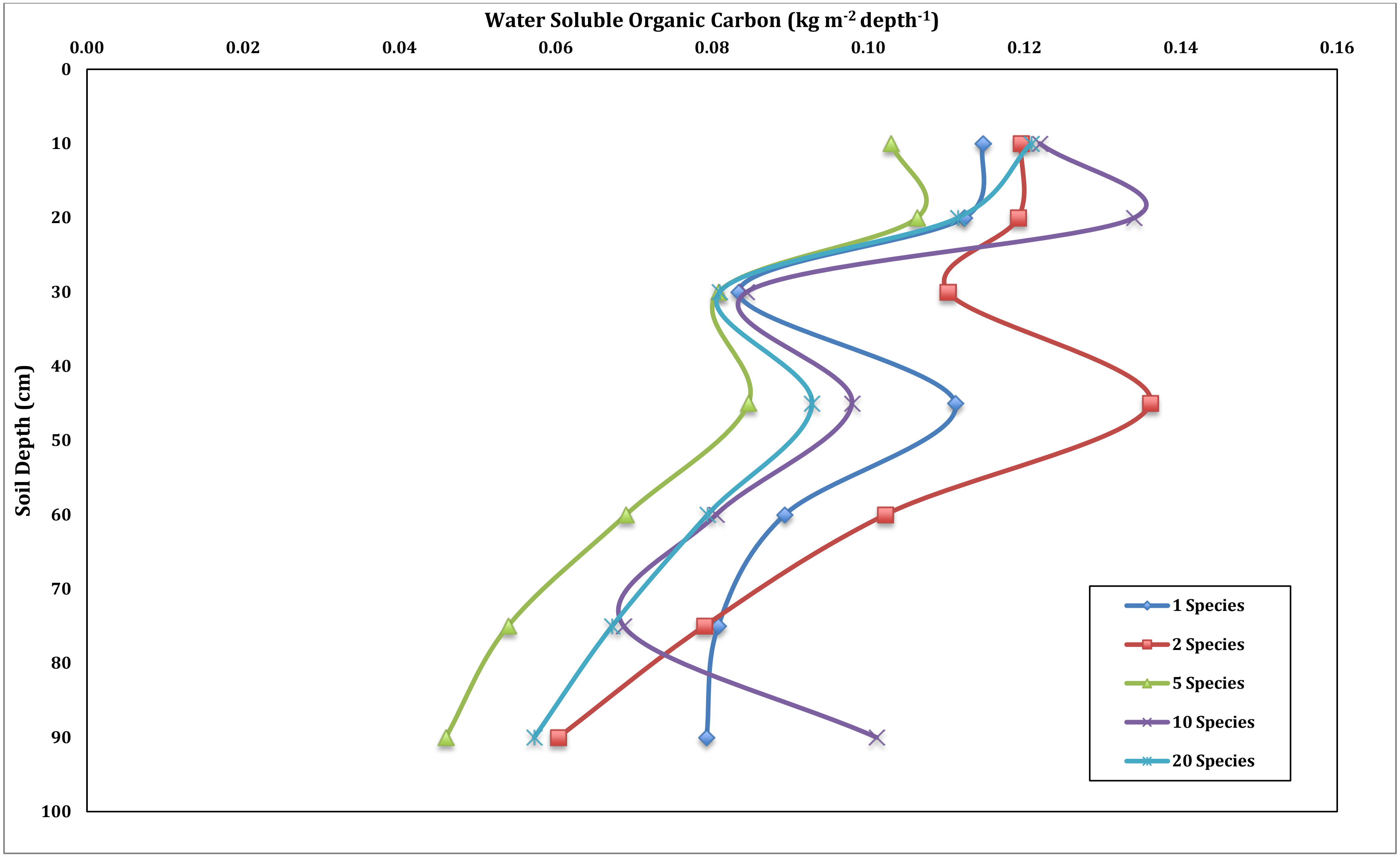


Figure B20. Dickinson water soluble organic carbon by soil depth increment as affected by species richness across all fertilizer treatments.

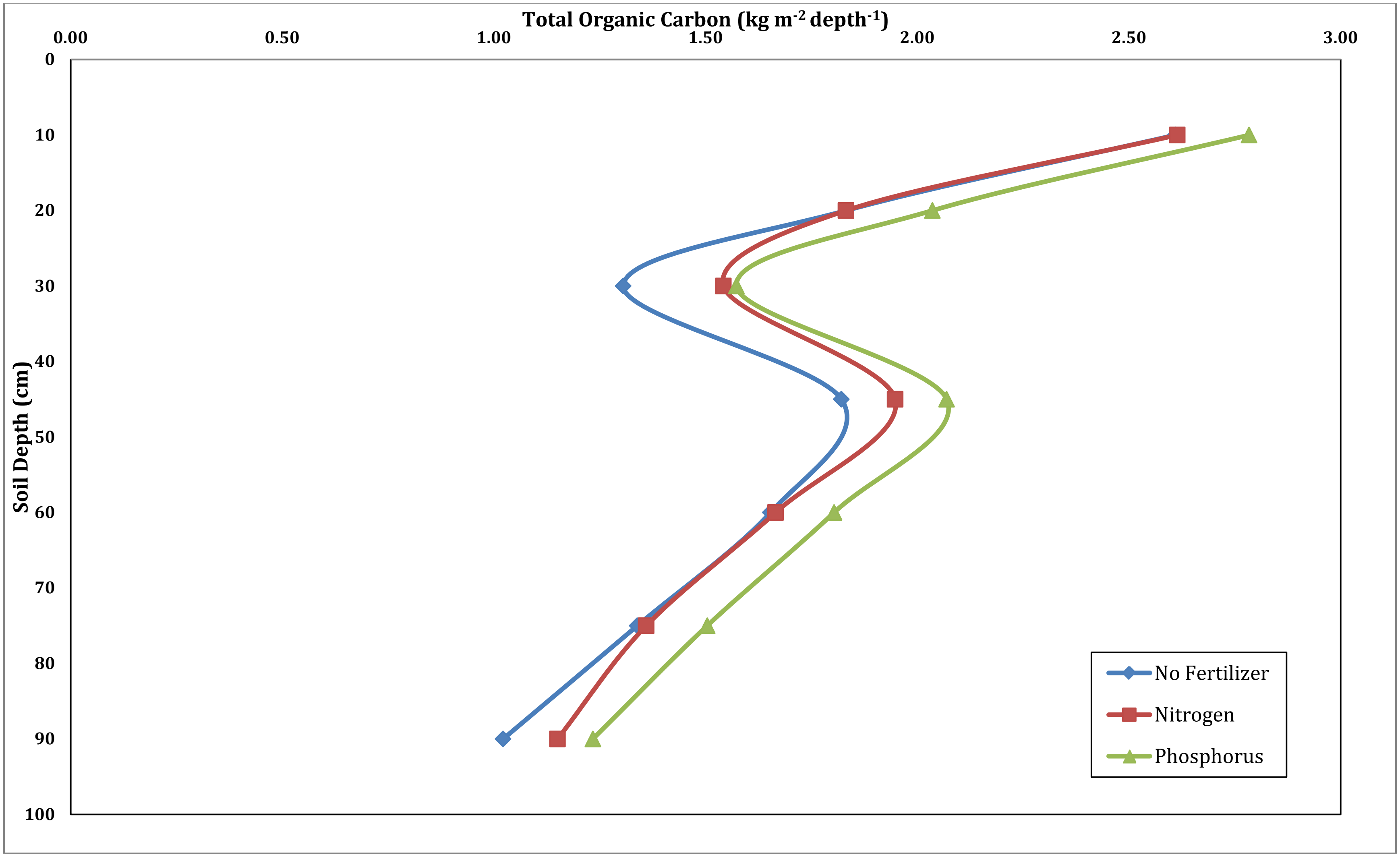


Figure B21. Dickinson total organic carbon by soil depth increment as affected by fertilizer application treatment across all species and species richness treatments.

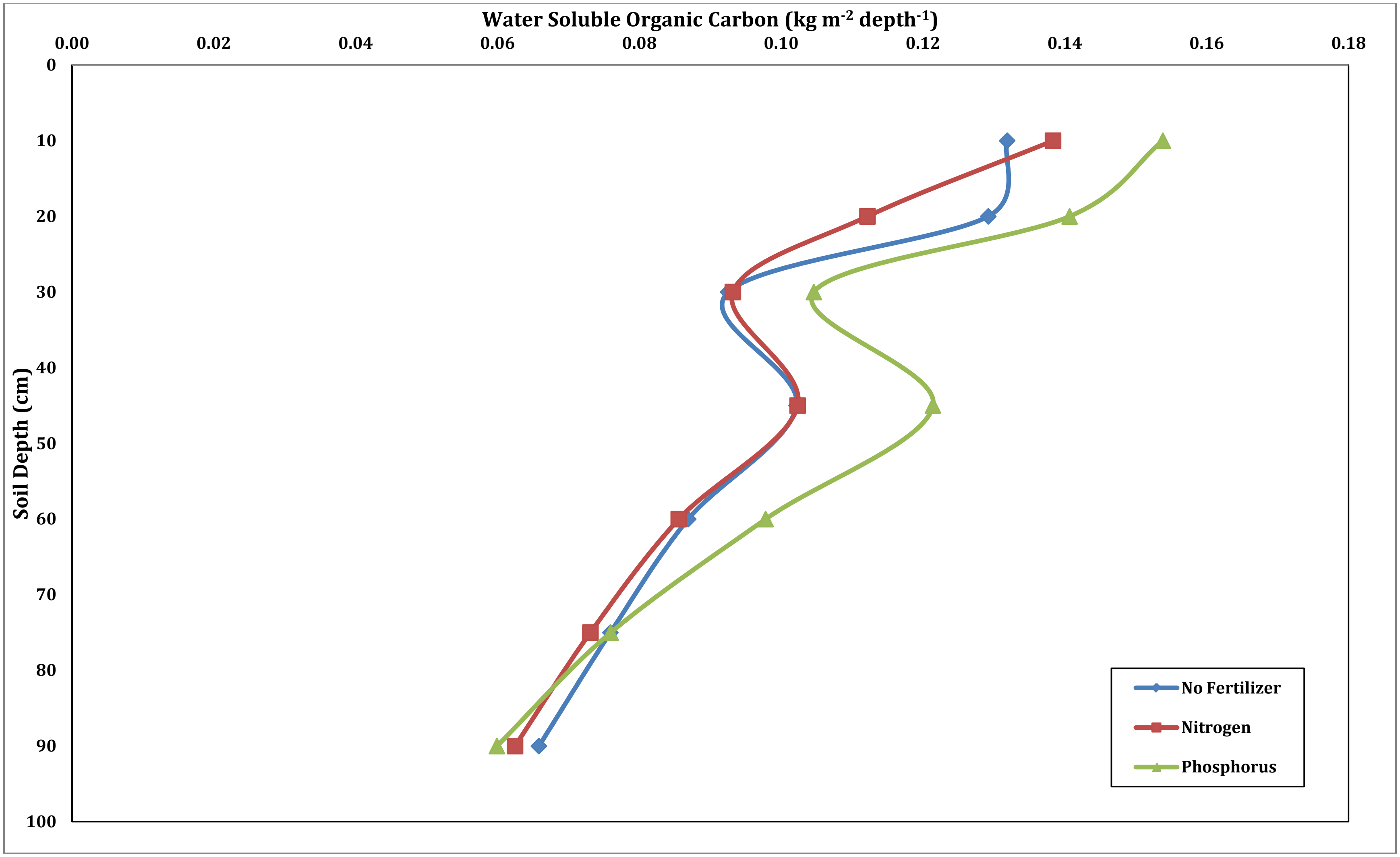


Figure B22. Dickinson water soluble organic carbon by soil depth increment as affected by fertilizer application treatment across all species and species richness treatments.

APPENDIX C

Table C1. Ekre Ranch total, inorganic, organic, and water soluble organic carbon concentration and mass by soil depth increment.

| Sample | | | Carbon Concentration | | | | Carbon Mass | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number | Depth | B.D. | TC | IC | OC | WSOC | TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | --------------------------------------kg m$^{-2}$ depth$^{-1}$-------------------------------------- | | | | | | | |
| MS-1† | 0-10 | 1.25 | 1.31 | 0.00 | 1.31 | 10.72 | 1.66 | 0.00 | 1.66 | 0.14 | 10.11 | 1.26 | 8.86 | 0.57 |
| | 10-20 | 1.38 | 1.18 | 0.00 | 1.18 | 7.89 | 1.66 | 0.00 | 1.66 | 0.11 | | | | |
| | 20-30 | 1.49 | 1.06 | 0.00 | 1.06 | 7.05 | 1.61 | 0.00 | 1.61 | 0.11 | | | | |
| | 30-45 | 1.26 | 0.76 | 0.14 | 0.62 | 4.27 | 1.46 | 0.27 | 1.19 | 0.08 | | | | |
| | 45-60 | 1.25 | 0.66 | 0.09 | 0.57 | 2.85 | 1.26 | 0.17 | 1.09 | 0.05 | | | | |
| | 60-75 | 1.24 | 0.56 | 0.11 | 0.45 | 2.06 | 1.05 | 0.21 | 0.85 | 0.04 | | | | |
| | 75-90 | 1.29 | 0.72 | 0.31 | 0.41 | 1.99 | 1.41 | 0.61 | 0.80 | 0.04 | | | | |
| MS-2 | 0-10 | 1.11 | 1.62 | 0.00 | 1.62 | 10.73 | 1.82 | 0.00 | 1.82 | 0.12 | 10.39 | 0.73 | 9.65 | 0.69 |
| | 10-20 | 1.38 | 1.30 | 0.00 | 1.30 | 10.65 | 1.82 | 0.00 | 1.82 | 0.15 | | | | |
| | 20-30 | 1.43 | 1.29 | 0.00 | 1.29 | 9.64 | 1.87 | 0.00 | 1.87 | 0.14 | | | | |
| | 30-45 | 1.26 | 0.95 | 0.00 | 0.95 | 5.97 | 1.83 | 0.00 | 1.83 | 0.11 | | | | |
| | 45-60 | 1.25 | 0.67 | 0.00 | 0.67 | 4.64 | 1.28 | 0.00 | 1.28 | 0.09 | | | | |
| | 60-75 | 1.24 | 0.44 | 0.13 | 0.31 | 2.54 | 0.83 | 0.24 | 0.58 | 0.05 | | | | |
| | 75-90 | 1.29 | 0.48 | 0.25 | 0.23 | 1.67 | 0.94 | 0.49 | 0.45 | 0.03 | | | | |
| MS-3 | 0-10 | 1.09 | 1.73 | 0.00 | 1.73 | 11.58 | 1.92 | 0.00 | 1.92 | 0.13 | 14.20 | 2.94 | 11.25 | 0.66 |
| | 10-20 | 1.30 | 1.38 | 0.00 | 1.38 | 10.85 | 1.83 | 0.00 | 1.83 | 0.14 | | | | |
| | 20-30 | 1.46 | 1.28 | 0.00 | 1.28 | 8.25 | 1.90 | 0.00 | 1.90 | 0.12 | | | | |
| | 30-45 | 1.26 | 1.02 | 0.00 | 1.02 | 5.24 | 1.96 | 0.00 | 1.96 | 0.10 | | | | |
| | 45-60 | 1.25 | 1.27 | 0.46 | 0.81 | 3.74 | 2.42 | 0.88 | 1.55 | 0.07 | | | | |
| | 60-75 | 1.24 | 1.11 | 0.41 | 0.70 | 2.40 | 2.09 | 0.77 | 1.32 | 0.05 | | | | |
| | 75-90 | 1.29 | 1.06 | 0.66 | 0.40 | 2.35 | 2.08 | 1.29 | 0.78 | 0.05 | | | | |
| MS-4 | 0-10 | 0.96 | 2.13 | 0.00 | 2.13 | 14.45 | 2.07 | 0.00 | 2.07 | 0.14 | 15.62 | 2.69 | 12.93 | 0.74 |
| | 10-20 | 1.22 | 1.56 | 0.00 | 1.56 | 10.72 | 1.93 | 0.00 | 1.93 | 0.13 | | | | |
| | 20-30 | 1.43 | 1.40 | 0.00 | 1.40 | 8.96 | 2.03 | 0.00 | 2.03 | 0.13 | | | | |
| | 30-45 | 1.26 | 1.23 | 0.00 | 1.23 | 6.63 | 2.37 | 0.00 | 2.37 | 0.13 | | | | |

Table C1. Continued.

| Sample | | | Carbon Concentration | | | | Carbon Mass | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number | Depth | B.D. | TC | IC | OC | WSOC | TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | --------------------------------------kg m$^{-2}$ depth$^{-1}$-------------------------------------- | | | | | | | |
| MS-4 (cont.) | 45-60 | 1.25 | 1.43 | 0.54 | 0.89 | 4.68 | 2.73 | 1.03 | 1.70 | 0.09 | | | | |
| | 60-75 | 1.24 | 1.20 | 0.32 | 0.88 | 3.63 | 2.26 | 0.60 | 1.66 | 0.07 | | | | |
| | 75-90 | 1.29 | 1.14 | 0.54 | 0.60 | 2.78 | 2.23 | 1.06 | 1.18 | 0.05 | | | | |
| MS-5 | 0-10 | 0.97 | 2.59 | 0.00 | 2.59 | 13.38 | 2.56 | 0.00 | 2.56 | 0.13 | 15.10 | 6.39 | 12.40 | 0.61 |
| | 10-20 | 1.32 | 1.55 | 0.00 | 1.55 | 9.89 | 2.08 | 0.00 | 2.08 | 0.13 | | | | |
| | 20-30 | 1.46 | 1.17 | 0.00 | 1.17 | 8.22 | 1.74 | 0.00 | 1.74 | 0.12 | | | | |
| | 30-45 | 1.26 | 1.21 | 0.00 | 1.21 | 4.96 | 2.33 | 0.00 | 2.33 | 0.10 | | | | |
| | 45-60 | 1.25 | 1.25 | 0.38 | 0.87 | 3.26 | 2.38 | 2.38 | 1.66 | 0.06 | | | | |
| | 60-75 | 1.24 | 1.17 | 0.59 | 0.58 | 1.88 | 2.20 | 2.20 | 1.09 | 0.04 | | | | |
| | 75-90 | 1.29 | 0.92 | 0.44 | 0.48 | 1.75 | 1.80 | 1.80 | 0.94 | 0.03 | | | | |
| CK-1 | 0-10 | 1.45 | 1.23 | 0.00 | 1.23 | 7.78 | 1.81 | 0.00 | 1.81 | 0.11 | 9.12 | 1.23 | 7.89 | 0.45 |
| | 10-20 | 1.55 | 1.04 | 0.00 | 1.04 | 9.24 | 1.64 | 0.00 | 1.64 | 0.15 | | | | |
| | 20-30 | 1.35 | 0.85 | 0.00 | 0.85 | | 1.17 | 0.00 | 1.17 | | | | | |
| | 30-45 | 1.26 | 0.45 | 0.00 | 0.45 | 3.19 | 0.87 | 0.00 | 0.87 | 0.06 | | | | |
| | 45-60 | 1.25 | 0.54 | 0.10 | 0.44 | 2.18 | 1.03 | 0.19 | 0.84 | 0.04 | | | | |
| | 60-75 | 1.24 | 0.74 | 0.29 | 0.45 | 2.93 | 1.39 | 0.55 | 0.85 | 0.06 | | | | |
| | 75-90 | 1.29 | 0.62 | 0.25 | 0.37 | 1.64 | 1.22 | 0.49 | 0.73 | 0.03 | | | | |
| CK-2 | 0-10 | 1.42 | 1.29 | 0.00 | 1.29 | 10.30 | 1.86 | 0.00 | 1.86 | 0.15 | 13.29 | 2.34 | 10.96 | 0.67 |
| | 10-20 | 1.49 | 1.18 | 0.00 | 1.18 | 10.65 | 1.78 | 0.00 | 1.78 | 0.16 | | | | |
| | 20-30 | 1.46 | 1.20 | 0.00 | 1.20 | 7.92 | 1.78 | 0.00 | 1.78 | 0.12 | | | | |
| | 30-45 | 1.26 | 1.05 | 0.00 | 1.05 | 5.40 | 2.02 | 0.00 | 2.02 | 0.10 | | | | |
| | 45-60 | 1.25 | 1.21 | 0.37 | 0.84 | 3.22 | 2.31 | 0.71 | 1.60 | 0.06 | | | | |
| | 60-75 | 1.24 | 1.01 | 0.47 | 0.54 | 2.28 | 1.90 | 0.88 | 1.02 | 0.04 | | | | |
| | 75-90 | 1.29 | 0.84 | 0.38 | 0.46 | 1.86 | 1.65 | 0.74 | 0.90 | 0.04 | | | | |
| CK-3 | 0-10 | 1.40 | 1.02 | 0.00 | 1.02 | 8.80 | 1.45 | 0.00 | 1.45 | 0.12 | 10.09 | 1.86 | 8.23 | 0.54 |
| | 10-20 | 1.56 | 1.01 | 0.00 | 1.01 | 8.76 | 1.60 | 0.00 | 1.60 | 0.14 | | | | |
| | 20-30 | 1.59 | 0.82 | 0.00 | 0.82 | 6.20 | 1.33 | 0.00 | 1.33 | 0.10 | | | | |

Table C1. Continued.

| Sample | | | Carbon Concentration | | | | Carbon Mass | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number | Depth | B.D. | TC | IC | OC | WSOC | TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | ---kg m$^{-2}$ depth$^{-1}$--- | | | | | | | |
| CK-3 (cont.) | 30-45 | 1.26 | 0.74 | 0.00 | 0.74 | 3.70 | 1.42 | 0.00 | 1.42 | 0.07 | | | | |
| | 45-60 | 1.25 | 0.83 | 0.21 | 0.62 | 2.21 | 1.58 | 0.40 | 1.18 | 0.04 | | | | |
| | 60-75 | 1.24 | 0.68 | 0.33 | 0.35 | 1.15 | 1.28 | 0.62 | 0.66 | 0.02 | | | | |
| | 75-90 | 1.29 | 0.73 | 0.43 | 0.30 | 2.00 | 1.43 | 0.84 | 0.59 | 0.04 | | | | |
| CK-4 | 0-10 | 1.36 | 1.43 | 0.00 | 1.43 | 8.69 | 1.97 | 0.00 | 1.97 | 0.12 | 12.96 | 2.23 | 10.73 | 0.56 |
| | 10-20 | 1.46 | 1.33 | 0.00 | 1.33 | 9.38 | 1.97 | 0.00 | 1.97 | 0.14 | | | | |
| | 20-30 | 1.54 | 1.15 | 0.00 | 1.15 | 7.57 | 1.79 | 0.00 | 1.79 | 0.12 | | | | |
| | 30-45 | 1.26 | 0.97 | 0.00 | 0.97 | 3.73 | 1.86 | 0.00 | 1.86 | 0.07 | | | | |
| | 45-60 | 1.25 | 0.74 | 0.13 | 0.61 | 2.58 | 1.41 | 0.25 | 1.16 | 0.05 | | | | |
| | 60-75 | 1.24 | 1.10 | 0.51 | 0.59 | 1.64 | 2.07 | 0.96 | 1.11 | 0.03 | | | | |
| | 75-90 | 1.29 | 0.96 | 0.52 | 0.44 | 1.46 | 1.88 | 1.02 | 0.86 | 0.03 | | | | |
| BB-1 | 0-10 | 1.12 | 2.82 | 0.00 | 2.82 | 11.23 | 3.22 | 0.00 | 3.22 | 0.13 | 16.46 | 4.51 | 11.95 | 0.58 |
| | 10-20 | 1.34 | 1.73 | 0.00 | 1.73 | 8.35 | 2.36 | 0.00 | 2.36 | 0.11 | | | | |
| | 20-30 | 1.42 | 1.42 | 0.22 | 1.20 | 6.41 | 2.04 | 0.32 | 1.73 | 0.09 | | | | |
| | 30-45 | 1.26 | 1.18 | 0.40 | 0.78 | 3.88 | 2.27 | 0.77 | 1.50 | 0.07 | | | | |
| | 45-60 | 1.25 | 1.26 | 0.61 | 0.65 | 3.02 | 2.40 | 1.16 | 1.24 | 0.06 | | | | |
| | 60-75 | 1.24 | 1.27 | 0.67 | 0.60 | 4.00 | 2.39 | 1.26 | 1.13 | 0.08 | | | | |
| | 75-90 | 1.29 | 0.90 | 0.51 | 0.39 | 1.94 | 1.76 | 1.00 | 0.76 | 0.04 | | | | |
| BB-2 | 0-10 | 1.12 | 1.75 | 0.00 | 1.75 | 10.40 | 1.99 | 0.00 | 1.99 | 0.12 | 11.38 | 1.26 | 10.12 | 0.69 |
| | 10-20 | 1.29 | 0.35 | 0.00 | 0.35 | 8.95 | 0.46 | 0.00 | 0.46 | 0.12 | | | | |
| | 20-30 | 1.43 | 0.42 | 0.00 | 0.42 | 8.84 | 0.61 | 0.00 | 0.61 | 0.13 | | | | |
| | 30-45 | 1.26 | 0.32 | 0.13 | 0.19 | 7.10 | 0.62 | 0.25 | 0.37 | 0.14 | | | | |
| | 45-60 | 1.25 | 0.77 | 0.53 | 0.24 | 3.79 | 1.47 | 1.01 | 0.46 | 0.07 | | | | |
| | 60-75 | 1.24 | 1.52 | 0.00 | 1.52 | 2.84 | 2.86 | 0.00 | 2.86 | 0.05 | | | | |
| | 75-90 | 1.29 | 1.72 | 0.00 | 1.72 | 2.97 | 3.37 | 0.00 | 3.37 | 0.06 | | | | |
| BB-3 | 0-10 | 1.16 | 2.21 | 0.00 | 2.21 | 9.30 | 2.61 | 0.00 | 2.61 | 0.11 | 16.02 | 3.27 | 12.75 | 0.58 |
| | 10-20 | 1.22 | 1.68 | 0.00 | 1.68 | 7.94 | 2.08 | 0.00 | 2.08 | 0.10 | | | | |

Table C1. Continued.

| Sample | | | Carbon Concentration | | | | Carbon Mass | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number | Depth | B.D. | TC | IC | OC | WSOC | TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
| | ---cm--- | ---g $cm^{-3}$--- | -------Percent------- | | | -mg/L- | --------------------------------------kg $m^{-2}$ $depth^{-1}$-------------------------------------- | | | | | | | |
| BB-3 (cont.) | 20-30 | 1.49 | 1.26 | 0.00 | 1.26 | 7.73 | 1.91 | 0.00 | 1.91 | 0.12 | | | | |
| | 30-45 | 1.26 | 1.08 | 0.18 | 0.90 | 5.26 | 2.08 | 0.35 | 1.73 | 0.10 | | | | |
| | 45-60 | 1.25 | 1.70 | 0.46 | 1.24 | 3.47 | 3.24 | 0.88 | 2.37 | 0.07 | | | | |
| | 60-75 | 1.24 | 1.23 | 0.64 | 0.59 | 2.46 | 2.32 | 1.20 | 1.11 | 0.05 | | | | |
| | 75-90 | 1.29 | 0.91 | 0.43 | 0.48 | 1.98 | 1.78 | 0.84 | 0.94 | 0.04 | | | | |
| BB-4 | 0-10 | 1.11 | 2.32 | 0.00 | 2.32 | 7.74 | 2.61 | 0.00 | 2.61 | 0.09 | 14.87 | 4.54 | 10.33 | 0.32 |
| | 10-20 | 1.33 | 1.86 | 0.00 | 1.86 | 7.65 | 2.52 | 0.00 | 2.52 | 0.10 | | | | |
| | 20-30 | 1.39 | 1.78 | 0.19 | 1.59 | 2.83 | 2.51 | 0.27 | 2.24 | 0.04 | | | | |
| | 30-45 | 1.26 | 1.69 | 0.79 | 0.90 | 1.11 | 3.25 | 1.52 | 1.73 | 0.02 | | | | |
| | 45-60 | 1.25 | 1.01 | 0.64 | 0.37 | 2.08 | 1.93 | 1.22 | 0.71 | 0.04 | | | | |
| | 60-75 | 1.24 | 0.59 | 0.43 | 0.16 | 0.98 | 1.11 | 0.81 | 0.30 | 0.02 | | | | |
| | 75-90 | 1.29 | 0.48 | 0.37 | 0.11 | 0.45 | 0.94 | 0.73 | 0.22 | 0.01 | | | | |
| CG-1 | 0-10 | 1.06 | 1.99 | 0.00 | 1.99 | 12.16 | 2.14 | 0.00 | 2.14 | 0.13 | 11.85 | 0.00 | 11.65 | 0.63 |
| | 10-20 | 1.34 | 1.53 | 0.00 | 1.53 | 8.57 | 2.09 | 0.00 | 2.09 | 0.12 | | | | |
| | 20-30 | 1.45 | 1.37 | 0.00 | 1.37 | 8.51 | 2.02 | 0.00 | 2.02 | 0.13 | | | | |
| | 30-45 | 1.26 | 1.36 | 0.00 | 1.36 | 4.53 | 2.62 | 0.00 | 2.62 | 0.09 | | | | |
| | 45-60 | 1.25 | 0.67 | 0.00 | 0.67 | 3.61 | 1.28 | 0.00 | 1.28 | 0.07 | | | | |
| | 60-75 | 1.24 | 0.44 | 0.00 | 0.44 | 3.37 | 0.83 | 0.00 | 0.83 | 0.06 | | | | |
| | 75-90 | 1.29 | 0.45 | 0.10 | 0.35 | 2.07 | 0.88 | 0.00 | 0.69 | 0.04 | | | | |
| CG-2 | 0-10 | 1.20 | 2.13 | 0.00 | 2.13 | 10.44 | 2.60 | 0.00 | 2.60 | 0.13 | 13.68 | 1.21 | 12.47 | 0.56 |
| | 10-20 | 1.34 | 1.49 | 0.00 | 1.49 | 8.14 | 2.03 | 0.00 | 2.03 | 0.11 | | | | |
| | 20-30 | 1.49 | 1.77 | 0.00 | 1.77 | 8.33 | 2.69 | 0.00 | 2.69 | 0.13 | | | | |
| | 30-45 | 1.26 | 1.18 | 0.00 | 1.18 | 3.63 | 2.26 | 0.00 | 2.26 | 0.07 | | | | |
| | 45-60 | 1.25 | 1.06 | 0.12 | 0.94 | 3.05 | 2.02 | 0.23 | 1.79 | 0.06 | | | | |
| | 60-75 | 1.24 | 0.60 | 0.21 | 0.39 | 2.06 | 1.13 | 0.40 | 0.73 | 0.04 | | | | |
| | 75-90 | 1.29 | 0.49 | 0.30 | 0.19 | 1.63 | 0.96 | 0.59 | 0.37 | 0.03 | | | | |
| CG-3 | 0-10 | 1.21 | 2.20 | 0.00 | 2.20 | 12.55 | 2.71 | 0.00 | 2.71 | 0.15 | 14.80 | 2.01 | 12.79 | 0.60 |

Table C1. Continued.

| Sample | | | Carbon Concentration | | | | Carbon Mass | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number | Depth | B.D. | TC | IC | OC | WSOC | TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | ---------------kg m$^{-2}$ depth$^{-1}$--------------- | | | | | | | |
| CG-3 (cont.) | 10-20 | 1.29 | 1.82 | 0.00 | 1.82 | 7.88 | 2.38 | 0.00 | 2.38 | 0.10 | | | | |
| | 20-30 | 1.34 | 1.68 | 0.00 | 1.68 | 8.15 | 2.30 | 0.00 | 2.30 | 0.11 | | | | |
| | 30-45 | 1.26 | 1.51 | 0.00 | 1.51 | 5.52 | 2.91 | 0.00 | 2.91 | 0.11 | | | | |
| | 45-60 | 1.25 | 1.21 | 0.44 | 0.77 | 3.04 | 2.30 | 0.84 | 1.46 | 0.06 | | | | |
| | 60-75 | 1.24 | 0.59 | 0.27 | 0.32 | 1.93 | 1.11 | 0.51 | 0.60 | 0.04 | | | | |
| | 75-90 | 1.29 | 0.56 | 0.34 | 0.22 | 1.55 | 1.10 | 0.67 | 0.43 | 0.03 | | | | |
| CG-4 | 0-10 | 1.14 | 2.25 | 0.00 | 2.25 | 9.44 | 2.61 | 0.00 | 2.61 | 0.11 | 14.70 | 2.06 | 12.65 | 0.49 |
| | 10-20 | 1.40 | 1.75 | 0.00 | 1.75 | 2.27 | 2.49 | 0.00 | 2.49 | 0.03 | | | | |
| | 20-30 | 1.42 | 1.62 | 0.00 | 1.62 | 7.30 | 2.34 | 0.00 | 2.34 | 0.11 | | | | |
| | 30-45 | 1.26 | 1.32 | 0.00 | 1.32 | 5.89 | 2.54 | 0.00 | 2.54 | 0.11 | | | | |
| | 45-60 | 1.25 | 0.71 | 0.12 | 0.59 | 2.22 | 1.35 | 0.23 | 1.13 | 0.04 | | | | |
| | 60-75 | 1.24 | 0.99 | 0.41 | 0.58 | 2.17 | 1.85 | 0.77 | 1.08 | 0.04 | | | | |
| | 75-90 | 1.29 | 0.77 | 0.54 | 0.23 | 2.45 | 1.51 | 1.06 | 0.45 | 0.05 | | | | |
| WR-1 | 0-10 | 1.08 | 1.68 | 0.00 | 1.68 | 8.59 | 1.85 | 0.00 | 1.85 | 0.09 | 13.17 | 0.24 | 12.93 | 0.69 |
| | 10-20 | 1.30 | 1.29 | 0.00 | 1.29 | 8.12 | 1.70 | 0.00 | 1.70 | 0.11 | | | | |
| | 20-30 | 1.44 | 1.29 | 0.00 | 1.29 | 8.84 | 1.89 | 0.00 | 1.89 | 0.13 | | | | |
| | 30-45 | 1.26 | 1.59 | 0.00 | 1.59 | 6.47 | 3.06 | 0.00 | 3.06 | 0.12 | | | | |
| | 45-60 | 1.25 | 1.26 | 0.00 | 1.26 | 6.19 | 2.39 | 0.00 | 2.39 | 0.12 | | | | |
| | 60-75 | 1.24 | 0.66 | 0.00 | 0.66 | 4.24 | 1.24 | 0.00 | 1.24 | 0.08 | | | | |
| | 75-90 | 1.29 | 0.53 | 0.12 | 0.41 | 2.03 | 1.04 | 0.24 | 0.80 | 0.04 | | | | |
| WR-2 | 0-10 | 1.13 | 1.65 | 0.00 | 1.65 | 8.29 | 1.90 | 0.00 | 1.90 | 0.10 | 13.65 | 0.65 | 13.00 | 0.69 |
| | 10-20 | 1.34 | 1.36 | 0.00 | 1.36 | 8.42 | 1.85 | 0.00 | 1.85 | 0.11 | | | | |
| | 20-30 | 1.45 | 1.34 | 0.00 | 1.34 | 8.91 | 1.97 | 0.00 | 1.97 | 0.13 | | | | |
| | 30-45 | 1.26 | 1.73 | 0.00 | 1.73 | 7.60 | 3.33 | 0.00 | 3.33 | 0.15 | | | | |
| | 45-60 | 1.25 | 1.08 | 0.00 | 1.08 | 4.27 | 2.06 | 0.00 | 2.06 | 0.08 | | | | |
| | 60-75 | 1.24 | 0.71 | 0.00 | 0.71 | 3.77 | 1.34 | 0.00 | 1.34 | 0.07 | | | | |
| | 75-90 | 1.29 | 0.61 | 0.33 | 0.28 | 2.37 | 1.20 | 0.65 | 0.55 | 0.05 | | | | |

Table C1. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | OC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | --------kg m$^{-2}$ depth$^{-1}$-------- | | | | | | | |
| WR-3 | 0-10 | 1.05 | 1.23 | 0.00 | 1.23 | 10.50 | 1.32 | 0.00 | 1.32 | 0.11 | 12.53 | 1.14 | 11.39 | 0.71 |
| | 10-20 | 1.32 | 1.17 | 0.00 | 1.17 | 9.86 | 1.57 | 0.00 | 1.57 | 0.13 | | | | |
| | 20-30 | 1.42 | 1.52 | 0.00 | 1.52 | 10.05 | 2.20 | 0.00 | 2.20 | 0.15 | | | | |
| | 30-45 | 1.26 | 1.40 | 0.00 | 1.40 | 7.27 | 2.69 | 0.00 | 2.69 | 0.14 | | | | |
| | 45-60 | 1.25 | 0.91 | 0.00 | 0.91 | 4.61 | 1.74 | 0.00 | 1.74 | 0.09 | | | | |
| | 60-75 | 1.24 | 0.91 | 0.22 | 0.69 | 3.08 | 1.70 | 0.41 | 1.29 | 0.06 | | | | |
| | 75-90 | 1.29 | 0.67 | 0.37 | 0.30 | 1.77 | 1.31 | 0.73 | 0.59 | 0.03 | | | | |
| WR-4 | 0-10 | 1.22 | 1.54 | 0.00 | 1.54 | 9.48 | 1.90 | 0.00 | 1.90 | 0.12 | 13.13 | 1.76 | 11.37 | 0.69 |
| | 10-20 | 1.39 | 1.40 | 0.00 | 1.40 | 10.18 | 1.98 | 0.00 | 1.98 | 0.14 | | | | |
| | 20-30 | 1.46 | 1.55 | 0.00 | 1.55 | 10.61 | 2.29 | 0.00 | 2.29 | 0.16 | | | | |
| | 30-45 | 1.26 | 1.35 | 0.00 | 1.35 | 6.42 | 2.60 | 0.00 | 2.60 | 0.12 | | | | |
| | 45-60 | 1.25 | 0.88 | 0.10 | 0.78 | 4.30 | 1.68 | 0.19 | 1.49 | 0.08 | | | | |
| | 60-75 | 1.24 | 0.71 | 0.37 | 0.34 | 1.91 | 1.34 | 0.70 | 0.64 | 0.04 | | | | |
| | 75-90 | 1.29 | 0.68 | 0.45 | 0.24 | 1.42 | 1.33 | 0.87 | 0.46 | 0.03 | | | | |
| KB-1 | 0-10 | 1.10 | 1.77 | 0.00 | 1.77 | 14.45 | 1.98 | 0.00 | 1.98 | 0.16 | 11.42 | 1.98 | 9.44 | 0.51 |
| | 10-20 | 1.38 | 1.27 | 0.00 | 1.27 | 6.78 | 1.78 | 0.00 | 1.78 | 0.10 | | | | |
| | 20-30 | 1.52 | 1.23 | 0.00 | 1.23 | 6.42 | 1.90 | 0.00 | 1.90 | 0.10 | | | | |
| | 30-45 | 1.26 | 1.16 | 0.14 | 1.02 | 3.93 | 2.23 | 0.27 | 1.96 | 0.08 | | | | |
| | 45-60 | 1.25 | 0.74 | 0.31 | 0.43 | 2.08 | 1.41 | 0.59 | 0.82 | 0.04 | | | | |
| | 60-75 | 1.24 | 0.58 | 0.28 | 0.30 | 1.30 | 1.09 | 0.53 | 0.56 | 0.02 | | | | |
| | 75-90 | 1.29 | 0.52 | 0.30 | 0.22 | 0.73 | 1.02 | 0.59 | 0.43 | 0.01 | | | | |
| KB-2 | 0-10 | 1.03 | 2.19 | 0.00 | 2.19 | 12.08 | 2.29 | 0.00 | 2.29 | 0.13 | 12.35 | 1.50 | 10.86 | 0.51 |
| | 10-20 | 1.30 | 1.49 | 0.00 | 1.49 | 6.62 | 1.97 | 0.00 | 1.97 | 0.09 | | | | |
| | 20-30 | 1.49 | 1.29 | 0.00 | 1.29 | 6.95 | 1.96 | 0.00 | 1.96 | 0.11 | | | | |
| | 30-45 | 1.26 | 1.34 | 0.09 | 1.25 | 4.43 | 2.58 | 0.17 | 2.41 | 0.09 | | | | |
| | 45-60 | 1.25 | 0.72 | 0.17 | 0.55 | 2.65 | 1.37 | 0.32 | 1.05 | 0.05 | | | | |
| | 60-75 | 1.24 | 0.55 | 0.25 | 0.30 | 1.56 | 1.04 | 0.47 | 0.56 | 0.03 | | | | |

Table C1. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | OC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | ---kg m$^{-2}$ depth$^{-1}$--- | | | | | | | |
| KB-2 (cont.) | 75-90 | 1.29 | 0.59 | 0.27 | 0.32 | 1.16 | 1.16 | 0.53 | 0.63 | 0.02 | | | | |
| KB-3 | 0-10 | 1.04 | 2.47 | 0.00 | 2.47 | 11.37 | 2.62 | 0.00 | 2.62 | 0.12 | 13.82 | 0.87 | 12.94 | 0.62 |
| | 10-20 | 1.25 | 1.52 | 0.00 | 1.52 | 7.43 | 1.94 | 0.00 | 1.94 | 0.09 | | | | |
| | 20-30 | 1.49 | 1.57 | 0.00 | 1.57 | 8.32 | 2.37 | 0.00 | 2.37 | 0.13 | | | | |
| | 30-45 | 1.26 | 1.40 | 0.00 | 1.40 | 6.56 | 2.69 | 0.00 | 2.69 | 0.13 | | | | |
| | 45-60 | 1.25 | 1.03 | 0.00 | 1.03 | 3.93 | 1.97 | 0.00 | 1.97 | 0.08 | | | | |
| | 60-75 | 1.24 | 0.55 | 0.10 | 0.45 | 2.08 | 1.04 | 0.19 | 0.85 | 0.04 | | | | |
| | 75-90 | 1.29 | 0.61 | 0.35 | 0.26 | 1.72 | 1.20 | 0.69 | 0.51 | 0.03 | | | | |
| KB-4 | 0-10 | 1.12 | 1.89 | 0.00 | 1.89 | 10.98 | 2.16 | 0.00 | 2.16 | 0.13 | 14.35 | 1.71 | 12.65 | 0.58 |
| | 10-20 | 1.33 | 1.50 | 0.00 | 1.50 | 7.55 | 2.02 | 0.00 | 2.02 | 0.10 | | | | |
| | 20-30 | 1.41 | 1.68 | 0.00 | 1.68 | 8.49 | 2.41 | 0.00 | 2.41 | 0.12 | | | | |
| | 30-45 | 1.26 | 1.17 | 0.00 | 1.17 | 5.11 | 2.25 | 0.00 | 2.25 | 0.10 | | | | |
| | 45-60 | 1.25 | 1.17 | 0.11 | 1.06 | 3.14 | 2.23 | 0.21 | 2.02 | 0.06 | | | | |
| | 60-75 | 1.24 | 1.11 | 0.41 | 0.70 | 2.39 | 2.09 | 0.77 | 1.32 | 0.05 | | | | |
| | 75-90 | 1.29 | 0.61 | 0.37 | 0.24 | 1.62 | 1.20 | 0.73 | 0.47 | 0.03 | | | | |
| SW-1 | 0-10 | 1.01 | 2.34 | 0.00 | 2.34 | 13.80 | 2.40 | 0.00 | 2.40 | 0.14 | 9.72 | 0.94 | 8.78 | 0.51 |
| | 10-20 | 1.33 | 1.26 | 0.00 | 1.26 | 7.67 | 1.70 | 0.00 | 1.70 | 0.10 | | | | |
| | 20-30 | 1.51 | 1.13 | 0.00 | 1.13 | 5.39 | 1.73 | 0.00 | 1.73 | 0.08 | | | | |
| | 30-45 | 1.26 | 0.58 | 0.00 | 0.58 | 3.86 | 1.12 | 0.00 | 1.12 | 0.07 | | | | |
| | 45-60 | 1.25 | 0.46 | 0.00 | 0.46 | 2.42 | 0.87 | 0.00 | 0.87 | 0.05 | | | | |
| | 60-75 | 1.24 | 0.51 | 0.22 | 0.29 | 1.76 | 0.96 | 0.41 | 0.55 | 0.03 | | | | |
| | 75-90 | 1.29 | 0.48 | 0.27 | 0.21 | 1.61 | 0.94 | 0.53 | 0.41 | 0.03 | | | | |
| SW-2 | 0-10 | 1.18 | 1.76 | 0.00 | 1.76 | 11.15 | 2.11 | 0.00 | 2.11 | 0.13 | 11.64 | 2.62 | 9.02 | 0.52 |
| | 10-20 | 1.31 | 1.26 | 0.00 | 1.26 | 8.01 | 1.67 | 0.00 | 1.67 | 0.11 | | | | |
| | 20-30 | 1.50 | 1.18 | 0.00 | 1.18 | 6.76 | 1.79 | 0.00 | 1.79 | 0.10 | | | | |
| | 30-45 | 1.26 | 1.26 | 0.35 | 0.91 | 3.18 | 2.43 | 0.67 | 1.75 | 0.06 | | | | |
| | 45-60 | 1.25 | 0.66 | 0.27 | 0.39 | 2.20 | 1.26 | 0.52 | 0.74 | 0.04 | | | | |

Table C1. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | OC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | ---kg m$^{-2}$ depth$^{-1}$--- | | | | | | | |
| SW-2 (cont.) | 60-75 | 1.24 | 0.72 | 0.34 | 0.38 | 2.02 | 1.35 | 0.63 | 0.72 | 0.04 | | | | |
| | 75-90 | 1.29 | 0.53 | 0.41 | 0.12 | 1.91 | 1.04 | 0.80 | 0.24 | 0.04 | | | | |
| SW-3 | 0-10 | 1.14 | 1.52 | 0.09 | 1.43 | 10.51 | 1.76 | 0.10 | 1.66 | 0.12 | 10.48 | 1.96 | 8.52 | 0.56 |
| | 10-20 | 1.36 | 1.18 | 0.00 | 1.18 | 8.22 | 1.63 | 0.00 | 1.63 | 0.11 | | | | |
| | 20-30 | 1.46 | 1.01 | 0.00 | 1.01 | 6.61 | 1.50 | 0.00 | 1.50 | 0.10 | | | | |
| | 30-45 | 1.26 | 0.87 | 0.16 | 0.71 | 4.14 | 1.67 | 0.31 | 1.37 | 0.08 | | | | |
| | 45-60 | 1.25 | 0.89 | 0.25 | 0.64 | 3.53 | 1.70 | 0.48 | 1.22 | 0.07 | | | | |
| | 60-75 | 1.24 | 0.62 | 0.34 | 0.28 | 2.04 | 1.17 | 0.64 | 0.53 | 0.04 | | | | |
| | 75-90 | 1.29 | 0.54 | 0.22 | 0.32 | 1.91 | 1.06 | 0.43 | 0.63 | 0.04 | | | | |
| SW-4 | 0-10 | 1.14 | 2.14 | 0.00 | 2.14 | 9.66 | 2.48 | 0.00 | 2.48 | 0.11 | 13.60 | 2.49 | 11.11 | 0.48 |
| | 10-20 | 1.29 | 1.45 | 0.00 | 1.45 | 5.96 | 1.90 | 0.00 | 1.90 | 0.08 | | | | |
| | 20-30 | 1.46 | 1.41 | 0.00 | 1.41 | 5.22 | 2.09 | 0.00 | 2.09 | 0.08 | | | | |
| | 30-45 | 1.26 | 0.98 | 0.12 | 0.86 | 5.22 | 1.89 | 0.23 | 1.66 | 0.10 | | | | |
| | 45-60 | 1.25 | 1.11 | 0.45 | 0.66 | 3.35 | 2.12 | 0.86 | 1.26 | 0.06 | | | | |
| | 60-75 | 1.24 | 0.83 | 0.40 | 0.43 | 1.07 | 1.56 | 0.75 | 0.81 | 0.02 | | | | |
| | 75-90 | 1.29 | 0.80 | 0.33 | 0.47 | 1.41 | 1.57 | 0.65 | 0.92 | 0.03 | | | | |
| SB-1 | 0-10 | 1.16 | 1.59 | 0.00 | 1.59 | 9.05 | 1.87 | 0.00 | 1.87 | 0.11 | 9.85 | 1.29 | 8.56 | 0.48 |
| | 10-20 | 1.40 | 1.25 | 0.00 | 1.25 | 7.67 | 1.77 | 0.00 | 1.77 | 0.11 | | | | |
| | 20-30 | 1.51 | 1.01 | 0.00 | 1.01 | 6.42 | 1.54 | 0.00 | 1.54 | 0.10 | | | | |
| | 30-45 | 1.26 | 0.67 | 0.10 | 0.57 | 3.40 | 1.29 | 0.19 | 1.10 | 0.07 | | | | |
| | 45-60 | 1.25 | 0.55 | 0.14 | 0.41 | 2.33 | 1.05 | 0.27 | 0.78 | 0.04 | | | | |
| | 60-75 | 1.24 | 0.62 | 0.19 | 0.43 | 1.69 | 1.17 | 0.36 | 0.81 | 0.03 | | | | |
| | 75-90 | 1.29 | 0.59 | 0.24 | 0.35 | 1.49 | 1.16 | 0.47 | 0.69 | 0.03 | | | | |
| SB-2 | 0-10 | 1.18 | 1.54 | 0.00 | 1.54 | 10.07 | 1.84 | 0.00 | 1.84 | 0.12 | 12.40 | 0.81 | 11.59 | 0.75 |
| | 10-20 | 1.37 | 1.35 | 0.00 | 1.35 | 10.66 | 1.88 | 0.00 | 1.88 | 0.15 | | | | |
| | 20-30 | 1.53 | 1.43 | 0.00 | 1.43 | 10.46 | 2.22 | 0.00 | 2.22 | 0.16 | | | | |
| | 30-45 | 1.26 | 1.41 | 0.00 | 1.41 | 7.42 | 2.71 | 0.00 | 2.71 | 0.14 | | | | |

Table C1. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | OC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g $cm^{-3}$--- | -------Percent------- | | | -mg/L- | ---------------------------------------kg $m^{-2}$ $depth^{-1}$--------------------------------------- | | | | | | | |
| SB-2 (Cont.) | 45-60 | 1.25 | 0.89 | 0.12 | 0.77 | 4.35 | 1.70 | 0.23 | 1.47 | 0.08 | | | | |
| | 60-75 | 1.24 | 0.53 | 0.14 | 0.39 | 2.76 | 1.00 | 0.26 | 0.73 | 0.05 | | | | |
| | 75-90 | 1.29 | 0.53 | 0.16 | 0.37 | 1.88 | 1.04 | 0.31 | 0.73 | 0.04 | | | | |
| SB-3 | 0-10 | 1.18 | 2.05 | 0.00 | 2.05 | | 2.45 | 0.00 | 2.45 | | 11.81 | 1.86 | 9.95 | 0.36 |
| | 10-20 | 1.34 | 1.38 | 0.00 | 1.38 | 7.40 | 1.88 | 0.00 | 1.88 | 0.10 | | | | |
| | 20-30 | 1.44 | 1.32 | 0.00 | 1.32 | 4.33 | 1.93 | 0.00 | 1.93 | 0.06 | | | | |
| | 30-45 | 1.26 | 1.01 | 0.00 | 1.01 | 4.10 | 1.94 | 0.00 | 1.94 | 0.08 | | | | |
| | 45-60 | 1.25 | 0.85 | 0.27 | 0.58 | 3.02 | 1.62 | 0.52 | 1.11 | 0.06 | | | | |
| | 60-75 | 1.24 | 0.49 | 0.34 | 0.15 | 1.70 | 0.92 | 0.64 | 0.28 | 0.03 | | | | |
| | 75-90 | 1.29 | 0.54 | 0.36 | 0.18 | 1.60 | 1.06 | 0.71 | 0.35 | 0.03 | | | | |
| SB-4 | 0-10 | 1.18 | 2.28 | 0.00 | 2.28 | 8.48 | 2.74 | 0.00 | 2.74 | 0.10 | 15.15 | 3.74 | 11.41 | 0.58 |
| | 10-20 | 1.36 | 1.36 | 0.00 | 1.36 | 9.52 | 1.87 | 0.00 | 1.87 | 0.13 | | | | |
| | 20-30 | 1.38 | 1.39 | 0.11 | 1.28 | 6.63 | 1.94 | 0.15 | 1.79 | 0.09 | | | | |
| | 30-45 | 1.26 | 1.27 | 0.29 | 0.98 | 4.28 | 2.44 | 0.56 | 1.89 | 0.08 | | | | |
| | 45-60 | 1.25 | 0.76 | 0.35 | 0.41 | 4.12 | 1.45 | 0.67 | 0.78 | 0.08 | | | | |
| | 60-75 | 1.24 | 0.68 | 0.34 | 0.34 | 2.55 | 1.27 | 0.64 | 0.63 | 0.05 | | | | |
| | 75-90 | 1.29 | 1.75 | 0.88 | 0.87 | 2.21 | 3.43 | 1.72 | 1.70 | 0.04 | | | | |
| SB-5 | 0-10 | 1.10 | 2.21 | 0.00 | 2.21 | 17.56 | 2.48 | 0.00 | 2.48 | 0.20 | 15.34 | 2.29 | 13.05 | 0.82 |
| | 10-20 | 1.39 | 1.73 | 0.00 | 1.73 | 9.64 | 2.44 | 0.00 | 2.44 | 0.14 | | | | |
| | 20-30 | 1.37 | 1.30 | 0.00 | 1.30 | 7.76 | 1.81 | 0.00 | 1.81 | 0.11 | | | | |
| | 30-45 | 1.26 | 1.13 | 0.00 | 1.13 | 8.27 | 2.17 | 0.00 | 2.17 | 0.16 | | | | |
| | 45-60 | 1.25 | 1.54 | 0.45 | 1.09 | 6.11 | 2.94 | 0.86 | 2.08 | 0.12 | | | | |
| | 60-75 | 1.24 | 0.99 | 0.29 | 0.70 | 3.13 | 1.86 | 0.55 | 1.32 | 0.06 | | | | |
| | 75-90 | 1.29 | 0.84 | 0.45 | 0.39 | 2.50 | 1.64 | 0.88 | 0.75 | 0.05 | | | | |
| CW-1 | 0-10 | 1.25 | 1.73 | 0.00 | 1.73 | 9.59 | 2.21 | 0.00 | 2.21 | 0.12 | 10.80 | 0.20 | 10.61 | 0.70 |
| | 10-20 | 1.38 | 1.22 | 0.00 | 1.22 | 9.64 | 1.72 | 0.00 | 1.72 | 0.14 | | | | |
| | 20-30 | 1.49 | 1.27 | 0.00 | 1.27 | 8.78 | 1.92 | 0.00 | 1.92 | 0.13 | | | | |

Table C1. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | OC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | ---kg m$^{-2}$ depth$^{-1}$--- | | | | | | | |
| CW-1 (Cont.) | 30-45 | 1.26 | 0.86 | 0.00 | 0.86 | 8.47 | 1.66 | 0.00 | 1.66 | 0.16 | | | | |
| | 45-60 | 1.25 | 0.63 | 0.00 | 0.63 | 3.02 | 1.20 | 0.00 | 1.20 | 0.06 | | | | |
| | 60-75 | 1.24 | 0.52 | 0.00 | 0.52 | 1.96 | 0.97 | 0.00 | 0.97 | 0.04 | | | | |
| | 75-90 | 1.29 | 0.58 | 0.10 | 0.48 | 2.91 | 1.14 | 0.20 | 0.94 | 0.06 | | | | |
| CW-2 | 0-10 | 1.17 | 1.44 | 0.00 | 1.44 | 9.25 | 1.72 | 0.00 | 1.72 | 0.11 | 11.41 | 0.22 | 11.20 | 0.71 |
| | 10-20 | 1.32 | 1.22 | 0.00 | 1.22 | 8.14 | 1.63 | 0.00 | 1.63 | 0.11 | | | | |
| | 20-30 | 1.45 | 1.20 | 0.00 | 1.20 | 10.07 | 1.77 | 0.00 | 1.77 | 0.15 | | | | |
| | 30-45 | 1.26 | 1.29 | 0.00 | 1.29 | 7.93 | 2.48 | 0.00 | 2.48 | 0.15 | | | | |
| | 45-60 | 1.25 | 0.76 | 0.00 | 0.76 | 4.48 | 1.45 | 0.00 | 1.45 | 0.09 | | | | |
| | 60-75 | 1.24 | 0.67 | 0.00 | 0.67 | 3.58 | 1.26 | 0.00 | 1.26 | 0.07 | | | | |
| | 75-90 | 1.29 | 0.56 | 0.11 | 0.45 | 1.78 | 1.10 | 0.22 | 0.88 | 0.03 | | | | |
| CW-3 | 0-10 | 1.16 | 1.51 | 0.00 | 1.51 | 9.63 | 1.79 | 0.00 | 1.79 | 0.11 | 12.65 | 1.84 | 10.82 | 0.56 |
| | 10-20 | 1.33 | 1.35 | 0.00 | 1.35 | 7.71 | 1.83 | 0.00 | 1.83 | 0.10 | | | | |
| | 20-30 | 1.41 | 1.36 | 0.00 | 1.36 | 6.67 | 1.95 | 0.00 | 1.95 | 0.10 | | | | |
| | 30-45 | 1.26 | 1.32 | 0.13 | 1.19 | 5.48 | 2.54 | 0.25 | 2.29 | 0.11 | | | | |
| | 45-60 | 1.25 | 0.84 | 0.25 | 0.59 | 3.06 | 1.60 | 0.48 | 1.13 | 0.06 | | | | |
| | 60-75 | 1.24 | 0.86 | 0.23 | 0.63 | 2.71 | 1.62 | 0.43 | 1.19 | 0.05 | | | | |
| | 75-90 | 1.29 | 0.68 | 0.35 | 0.33 | 1.70 | 1.32 | 0.68 | 0.65 | 0.03 | | | | |
| CW-4 | 0-10 | 1.04 | 1.92 | 0.00 | 1.92 | 9.95 | 2.03 | 0.00 | 2.03 | 0.11 | 12.92 | 1.42 | 11.50 | 0.56 |
| | 10-20 | 1.31 | 1.59 | 0.00 | 1.59 | 8.50 | 2.11 | 0.00 | 2.11 | 0.11 | | | | |
| | 20-30 | 1.38 | 1.55 | 0.00 | 1.55 | 8.29 | 2.17 | 0.00 | 2.17 | 0.12 | | | | |
| | 30-45 | 1.26 | 1.01 | 0.00 | 1.01 | 4.39 | 1.94 | 0.00 | 1.94 | 0.08 | | | | |
| | 45-60 | 1.25 | 1.02 | 0.22 | 0.80 | 3.03 | 1.95 | 0.42 | 1.53 | 0.06 | | | | |
| | 60-75 | 1.24 | 0.82 | 0.24 | 0.58 | 2.18 | 1.54 | 0.45 | 1.09 | 0.04 | | | | |
| | 75-90 | 1.29 | 0.60 | 0.28 | 0.32 | 1.92 | 1.18 | 0.55 | 0.63 | 0.04 | | | | |
| MX-T1R2.2-300‡ | 0-10 | 0.92 | 1.94 | 0.00 | 1.94 | 8.56 | 1.82 | 0.00 | 1.82 | 0.08 | 13.33 | 1.38 | 11.94 | 0.45 |
| | 10-20 | 1.01 | 1.42 | 0.00 | 1.42 | 6.58 | 1.46 | 0.00 | 1.46 | 0.07 | | | | |

Table C1. Continued.

| Sample | | | Carbon Concentration | | | | Carbon Mass | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number | Depth | B.D. | TC | IC | OC | WSOC | TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | --------kg m$^{-2}$ depth$^{-1}$-------- | | | | | | | |
| MX-T1R2.2-300 (Cont.) | 20-30 | 1.12 | 1.48 | 0.00 | 1.48 | 6.17 | 1.68 | 0.00 | 1.68 | 0.07 | | | | |
| | 30-45 | 1.26 | 1.57 | 0.00 | 1.57 | 5.09 | 3.02 | 0.00 | 3.02 | 0.10 | | | | |
| | 45-60 | 1.25 | 1.05 | 0.09 | 0.96 | 3.45 | 2.00 | 0.17 | 1.83 | 0.07 | | | | |
| | 60-75 | 1.24 | 0.90 | 0.28 | 0.62 | 2.12 | 1.69 | 0.53 | 1.17 | 0.04 | | | | |
| | 75-90 | 1.29 | 0.84 | 0.35 | 0.49 | 1.67 | 1.65 | 0.69 | 0.96 | 0.03 | | | | |
| MX-T1R2.8-300 | 0-10 | 1.08 | 1.78 | 0.00 | 1.78 | 6.87 | 1.95 | 0.00 | 1.95 | 0.08 | 13.84 | 1.27 | 12.57 | 0.53 |
| | 10-20 | 1.29 | 1.32 | 0.00 | 1.32 | 7.20 | 1.73 | 0.00 | 1.73 | 0.09 | | | | |
| | 20-30 | 1.36 | 1.41 | 0.00 | 1.41 | 7.62 | 1.95 | 0.00 | 1.95 | 0.11 | | | | |
| | 30-45 | 1.26 | 1.38 | 0.00 | 1.38 | 5.15 | 2.66 | 0.00 | 2.66 | 0.10 | | | | |
| | 45-60 | 1.25 | 1.07 | 0.11 | 0.96 | 3.58 | 2.04 | 0.21 | 1.83 | 0.07 | | | | |
| | 60-75 | 1.24 | 1.02 | 0.28 | 0.74 | 2.30 | 1.92 | 0.53 | 1.39 | 0.04 | | | | |
| | 75-90 | 1.29 | 0.81 | 0.27 | 0.54 | 2.04 | 1.59 | 0.53 | 1.06 | 0.04 | | | | |
| MX-T1R4.8-300 | 0-10 | 1.09 | 1.59 | 0.00 | 1.59 | 8.84 | 1.76 | 0.00 | 1.76 | 0.10 | 12.10 | 1.67 | 10.43 | 0.55 |
| | 10-20 | 1.22 | 1.30 | 0.00 | 1.30 | 6.81 | 1.62 | 0.00 | 1.62 | 0.08 | | | | |
| | 20-30 | 1.40 | 1.50 | 0.00 | 1.50 | 7.21 | 2.13 | 0.00 | 2.13 | 0.10 | | | | |
| | 30-45 | 1.26 | 0.91 | 0.00 | 0.91 | 5.63 | 1.75 | 0.00 | 1.75 | 0.11 | | | | |
| | 45-60 | 1.25 | 1.03 | 0.22 | 0.81 | 3.47 | 1.97 | 0.42 | 1.55 | 0.07 | | | | |
| | 60-75 | 1.24 | 0.86 | 0.34 | 0.52 | 2.23 | 1.62 | 0.64 | 0.98 | 0.04 | | | | |
| | 75-90 | 1.29 | 0.64 | 0.31 | 0.33 | 2.33 | 1.25 | 0.61 | 0.65 | 0.05 | | | | |
| MX-T2R1.2-100 | 0-10 | 1.11 | 1.76 | 0.00 | 1.76 | 6.51 | 1.99 | 0.00 | 1.99 | 0.07 | 11.89 | 0.90 | 10.99 | 0.50 |
| | 10-20 | 1.28 | 1.24 | 0.00 | 1.24 | 7.40 | 1.61 | 0.00 | 1.61 | 0.10 | | | | |
| | 20-30 | 1.42 | 1.31 | 0.00 | 1.31 | 6.91 | 1.89 | 0.00 | 1.89 | 0.10 | | | | |
| | 30-45 | 1.26 | 1.05 | 0.00 | 1.05 | 5.63 | 2.02 | 0.00 | 2.02 | 0.11 | | | | |
| | 45-60 | 1.25 | 0.60 | 0.00 | 0.60 | 3.37 | 1.14 | 0.00 | 1.14 | 0.06 | | | | |
| | 60-75 | 1.24 | 0.93 | 0.24 | 0.69 | 2.01 | 1.75 | 0.45 | 1.30 | 0.04 | | | | |
| | 75-90 | 1.29 | 0.76 | 0.23 | 0.53 | 1.26 | 1.49 | 0.45 | 1.04 | 0.02 | | | | |
| MX-T2R1.2-300 | 0-10 | 1.14 | 1.54 | 0.00 | 1.54 | 5.78 | 1.79 | 0.00 | 1.79 | 0.07 | 9.60 | 0.52 | 9.08 | 0.46 |

Table C1. Continued.

| Sample | | | Carbon Concentration | | | | Carbon Mass | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number | Depth | B.D. | TC | IC | OC | WSOC | TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | --------------------------------------kg m$^{-2}$ depth$^{-1}$-------------------------------------- | | | | | | | |
| MX-T2R1.2-300 (Cont.) | 10-20 | 1.33 | 1.08 | 0.00 | 1.08 | 6.01 | 1.46 | 0.00 | 1.46 | 0.08 | | | | |
| | 20-30 | 1.40 | 1.12 | 0.00 | 1.12 | 6.41 | 1.59 | 0.00 | 1.59 | 0.09 | | | | |
| | 30-45 | 1.26 | 0.82 | 0.00 | 0.82 | 5.24 | 1.58 | 0.00 | 1.58 | 0.10 | | | | |
| | 45-60 | 1.25 | 0.39 | 0.00 | 0.39 | 2.63 | 0.74 | 0.00 | 0.74 | 0.05 | | | | |
| | 60-75 | 1.24 | 0.66 | 0.09 | 0.57 | 1.85 | 1.24 | 0.17 | 1.07 | 0.03 | | | | |
| | 75-90 | 1.29 | 0.61 | 0.18 | 0.43 | 1.60 | 1.20 | 0.35 | 0.84 | 0.03 | | | | |
| MX-T2R1.8-100 | 0-10 | 1.10 | 1.82 | 0.00 | 1.82 | 5.56 | 2.03 | 0.00 | 2.03 | 0.06 | 9.10 | 0.56 | 8.54 | 0.38 |
| | 10-20 | 1.34 | 1.01 | 0.00 | 1.01 | 5.78 | 1.38 | 0.00 | 1.38 | 0.08 | | | | |
| | 20-30 | 1.43 | 0.94 | 0.00 | 0.94 | 5.30 | 1.37 | 0.00 | 1.37 | 0.08 | | | | |
| | 30-45 | 1.26 | 0.58 | 0.00 | 0.58 | 3.14 | 1.12 | 0.00 | 1.12 | 0.06 | | | | |
| | 45-60 | 1.25 | 0.30 | 0.00 | 0.30 | 2.47 | 0.57 | 0.00 | 0.57 | 0.05 | | | | |
| | 60-75 | 1.24 | 0.67 | 0.10 | 0.57 | 1.75 | 1.26 | 0.19 | 1.07 | 0.03 | | | | |
| | 75-90 | 1.29 | 0.70 | 0.19 | 0.51 | 1.29 | 1.37 | 0.37 | 1.00 | 0.03 | | | | |
| MX-T2R3.2-300 | 0-10 | 1.05 | 2.25 | 0.00 | 2.25 | 11.82 | 2.41 | 0.00 | 2.41 | 0.13 | 16.79 | 0.42 | 16.37 | 0.76 |
| | 10-20 | 1.27 | 1.41 | 0.00 | 1.41 | 8.69 | 1.82 | 0.00 | 1.82 | 0.11 | | | | |
| | 20-30 | 1.33 | 1.66 | 0.00 | 1.66 | 8.07 | 2.24 | 0.00 | 2.24 | 0.11 | | | | |
| | 30-45 | 1.26 | 2.11 | 0.00 | 2.11 | 7.42 | 4.06 | 0.00 | 4.06 | 0.14 | | | | |
| | 45-60 | 1.25 | 1.61 | 0.00 | 1.61 | 6.94 | 3.07 | 0.00 | 3.07 | 0.13 | | | | |
| | 60-75 | 1.24 | 1.02 | 0.08 | 0.94 | 4.81 | 1.92 | 0.15 | 1.77 | 0.09 | | | | |
| | 75-90 | 1.29 | 0.65 | 0.14 | 0.51 | 2.37 | 1.27 | 0.27 | 1.00 | 0.05 | | | | |
| MX-T2R3.8-300 | 0-10 | 0.82 | 2.16 | 0.00 | 2.16 | 8.81 | 1.81 | 0.00 | 1.81 | 0.07 | 14.01 | 0.88 | 13.13 | 0.55 |
| | 10-20 | 1.07 | 1.42 | 0.00 | 1.42 | 7.43 | 1.54 | 0.00 | 1.54 | 0.08 | | | | |
| | 20-30 | 1.14 | 1.69 | 0.00 | 1.69 | 7.86 | 1.96 | 0.00 | 1.96 | 0.09 | | | | |
| | 30-45 | 1.26 | 2.07 | 0.00 | 2.07 | 7.19 | 3.98 | 0.00 | 3.98 | 0.14 | | | | |
| | 45-60 | 1.25 | 1.25 | 0.10 | 1.15 | 5.30 | 2.39 | 0.19 | 2.19 | 0.10 | | | | |
| | 60-75 | 1.24 | 0.63 | 0.16 | 0.47 | 1.79 | 1.19 | 0.30 | 0.88 | 0.03 | | | | |
| | 75-90 | 1.29 | 0.58 | 0.20 | 0.38 | 1.32 | 1.14 | 0.39 | 0.74 | 0.03 | | | | |

Table C1. Continued.

| Sample | | | Carbon Concentration | | | | Carbon Mass | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number | Depth | B.D. | TC | IC | OC | WSOC | TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | --------------------------------------kg m$^{-2}$ depth$^{-1}$-------------------------------------- | | | | | | | |
| MX-T2R5.8-200 | 0-10 | 1.13 | 2.03 | 0.00 | 2.03 | 9.24 | 2.33 | 0.00 | 2.33 | 0.11 | 14.21 | 4.10 | 10.11 | 0.46 |
| | 10-20 | 1.26 | 1.61 | 0.00 | 1.61 | 7.27 | 2.06 | 0.00 | 2.06 | 0.09 | | | | |
| | 20-30 | 1.35 | 1.82 | 0.62 | 1.20 | 6.52 | 2.50 | 0.85 | 1.65 | 0.09 | | | | |
| | 30-45 | 1.26 | 1.88 | 0.86 | 1.02 | 4.44 | 3.62 | 1.66 | 1.96 | 0.09 | | | | |
| | 45-60 | 1.25 | 1.03 | 0.40 | 0.63 | 2.44 | 1.97 | 0.76 | 1.20 | 0.05 | | | | |
| | 60-75 | 1.24 | 0.92 | 0.44 | 0.48 | 2.27 | 1.73 | 0.83 | 0.90 | 0.04 | | | | |
| | 75-90 | | | | | | | | | | | | | |
| MX-T2R5.8-446 | 0-10 | 1.21 | 1.96 | 0.13 | 1.83 | 8.45 | 2.40 | 0.16 | 2.24 | 0.10 | 13.85 | 3.38 | 10.48 | 0.48 |
| | 10-20 | 1.31 | 1.53 | 0.09 | 1.44 | 7.65 | 2.04 | 0.12 | 1.92 | 0.10 | | | | |
| | 20-30 | 1.42 | 1.55 | 0.00 | 1.55 | 5.07 | 2.24 | 0.00 | 2.24 | 0.07 | | | | |
| | 30-45 | 1.26 | 1.28 | 0.29 | 0.99 | 3.54 | 2.46 | 0.56 | 1.91 | 0.07 | | | | |
| | 45-60 | 1.25 | 1.03 | 0.37 | 0.66 | 2.93 | 1.96 | 0.70 | 1.26 | 0.06 | | | | |
| | 60-75 | 1.24 | 0.71 | 0.49 | 0.22 | 1.98 | 1.34 | 0.92 | 0.41 | 0.04 | | | | |
| | 75-90 | 1.29 | 0.72 | 0.47 | 0.25 | 1.85 | 1.41 | 0.92 | 0.49 | 0.04 | | | | |
| MX-T4R3.2-481 | 0-10 | 1.11 | 1.74 | 0.00 | 1.74 | 5.70 | 1.96 | 0.00 | 1.96 | 0.06 | 15.43 | 3.67 | 11.77 | 0.38 |
| | 10-20 | 1.27 | 1.55 | 0.00 | 1.55 | 5.27 | 2.00 | 0.00 | 2.00 | 0.07 | | | | |
| | 20-30 | 1.36 | 1.88 | 0.45 | 1.43 | 4.04 | 2.60 | 0.62 | 1.98 | 0.06 | | | | |
| | 30-45 | 1.26 | 1.68 | 0.30 | 1.38 | 3.39 | 3.23 | 0.58 | 2.66 | 0.07 | | | | |
| | 45-60 | 1.25 | 1.52 | 0.49 | 1.03 | 3.10 | 2.90 | 0.93 | 1.97 | 0.06 | | | | |
| | 60-75 | 1.24 | 0.80 | 0.46 | 0.34 | 1.66 | 1.51 | 0.87 | 0.64 | 0.03 | | | | |
| | 75-90 | 1.29 | 0.63 | 0.34 | 0.29 | 2.03 | 1.23 | 0.67 | 0.57 | 0.04 | | | | |
| MX-T4R3.8-480 | 0-10 | 1.03 | 2.01 | 0.12 | 1.89 | 7.97 | 2.11 | 0.13 | 1.98 | 0.08 | 12.86 | 2.65 | 10.22 | 0.39 |
| | 10-20 | 1.18 | 1.57 | 0.10 | 1.47 | 5.48 | 1.88 | 0.12 | 1.76 | 0.07 | | | | |
| | 20-30 | 1.38 | 1.41 | 0.00 | 1.41 | 4.43 | 1.97 | 0.00 | 1.97 | 0.06 | | | | |
| | 30-45 | 1.26 | 1.16 | 0.15 | 1.01 | 3.34 | 2.23 | 0.29 | 1.94 | 0.06 | | | | |
| | 45-60 | 1.25 | 0.70 | 0.30 | 0.40 | 1.99 | 1.34 | 0.57 | 0.76 | 0.04 | | | | |
| | 60-75 | 1.24 | 0.92 | 0.47 | 0.46 | 1.87 | 1.73 | 0.88 | 0.86 | 0.04 | | | | |

Table C1. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | OC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | --------kg m$^{-2}$ depth$^{-1}$-------- | | | | | | | |
| MX-T4R3.8-480 (cont.) | 75-90 | 1.29 | 0.82 | 0.34 | 0.48 | 2.23 | 1.61 | 0.67 | 0.94 | 0.04 | | | | |
| MX-T4R5.2-419 | 0-10 | 1.22 | 1.66 | 0.00 | 1.66 | 9.04 | 2.06 | 0.00 | 2.06 | 0.11 | 13.73 | 2.21 | 11.52 | 0.50 |
| | 10-20 | 1.38 | 1.34 | 0.10 | 1.24 | 7.28 | 1.88 | 0.14 | 1.74 | 0.10 | | | | |
| | 20-30 | 1.45 | 1.39 | 0.00 | 1.39 | 4.92 | 2.05 | 0.00 | 2.05 | 0.07 | | | | |
| | 30-45 | 1.26 | 1.08 | 0.00 | 1.08 | 4.73 | 2.08 | 0.00 | 2.08 | 0.09 | | | | |
| | 45-60 | 1.25 | 1.14 | 0.24 | 0.90 | 2.84 | 2.17 | 0.46 | 1.72 | 0.05 | | | | |
| | 60-75 | 1.24 | 1.01 | 0.43 | 0.58 | 2.16 | 1.90 | 0.81 | 1.09 | 0.04 | | | | |
| | 75-90 | 1.29 | 0.81 | 0.41 | 0.40 | 1.48 | 1.59 | 0.80 | 0.78 | 0.03 | | | | |
| MX-T4R5.8-118 | 0-10 | 1.20 | 1.90 | 0.11 | 1.79 | 12.31 | 2.33 | 0.13 | 2.19 | 0.15 | 11.89 | 3.17 | 8.72 | 0.43 |
| | 10-20 | 1.41 | 1.43 | 0.09 | 1.34 | 6.27 | 2.04 | 0.12 | 1.92 | 0.09 | | | | |
| | 20-30 | 1.35 | 1.21 | 0.29 | 0.92 | 4.13 | 1.66 | 0.40 | 1.27 | 0.06 | | | | |
| | 30-45 | 1.26 | 0.92 | 0.46 | 0.46 | 2.16 | 1.77 | 0.89 | 0.89 | 0.04 | | | | |
| | 45-60 | 1.25 | 0.69 | 0.28 | 0.41 | 1.71 | 1.32 | 0.53 | 0.78 | 0.03 | | | | |
| | 60-75 | 1.24 | 0.65 | 0.29 | 0.36 | 1.44 | 1.22 | 0.55 | 0.68 | 0.03 | | | | |
| | 75-90 | 1.29 | 0.79 | 0.28 | 0.51 | 1.77 | 1.55 | 0.55 | 1.00 | 0.03 | | | | |
| MX-T5R1.8-236 | 0-10 | 1.07 | 2.31 | 0.16 | 2.15 | 9.94 | 2.51 | 0.17 | 2.33 | 0.11 | 16.30 | 4.93 | 11.37 | 0.47 |
| | 10-20 | 1.30 | 1.81 | 0.11 | 1.70 | 8.48 | 2.40 | 0.15 | 2.25 | 0.11 | | | | |
| | 20-30 | 1.41 | 2.10 | 0.51 | 1.59 | 5.34 | 3.01 | 0.73 | 2.28 | 0.08 | | | | |
| | 30-45 | 1.26 | 1.75 | 0.61 | 1.14 | 3.20 | 3.37 | 1.17 | 2.19 | 0.06 | | | | |
| | 45-60 | 1.25 | 0.99 | 0.48 | 0.51 | 2.27 | 1.89 | 0.92 | 0.97 | 0.04 | | | | |
| | 60-75 | 1.24 | 0.82 | 0.49 | 0.33 | 1.94 | 1.54 | 0.92 | 0.62 | 0.04 | | | | |
| | 75-90 | 1.29 | 0.81 | 0.44 | 0.37 | 1.88 | 1.59 | 0.86 | 0.73 | 0.04 | | | | |
| MX-T5R2.2-129 | 0-10 | 1.12 | 1.94 | 0.18 | 1.76 | 9.32 | 2.22 | 0.21 | 2.01 | 0.11 | 12.94 | 3.28 | 9.66 | 0.45 |
| | 10-20 | 1.34 | 1.62 | 0.00 | 1.62 | 7.96 | 2.20 | 0.00 | 2.20 | 0.11 | | | | |
| | 20-30 | 1.48 | 1.42 | 0.21 | 1.21 | 4.76 | 2.13 | 0.31 | 1.81 | 0.07 | | | | |
| | 30-45 | 1.26 | 1.06 | 0.36 | 0.70 | 2.99 | 2.04 | 0.69 | 1.35 | 0.06 | | | | |
| | 45-60 | 1.25 | 0.92 | 0.42 | 0.50 | 2.27 | 1.76 | 0.80 | 0.95 | 0.04 | | | | |

Table C1. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | OC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | --------------------------------------kg m$^{-2}$ depth$^{-1}$-------------------------------------- | | | | | | | |
| MX-T5R2.2-129 (cont.) | 60-75 | 1.24 | 0.77 | 0.35 | 0.42 | 1.65 | 1.44 | 0.66 | 0.78 | 0.03 | | | | |
| | 75-90 | 1.29 | 0.59 | 0.31 | 0.28 | 1.56 | 1.16 | 0.61 | 0.55 | 0.03 | | | | |
| MX-T5R2.8-128 | 0-10 | 1.20 | 1.65 | 0.10 | 1.55 | 7.43 | 2.01 | 0.12 | 1.89 | 0.09 | 10.89 | 3.28 | 7.62 | 0.38 |
| | 10-20 | 1.42 | 1.36 | 0.07 | 1.29 | 5.83 | 1.96 | 0.10 | 1.86 | 0.08 | | | | |
| | 20-30 | 1.35 | 1.03 | 0.13 | 0.90 | 3.98 | 1.42 | 0.18 | 1.24 | 0.05 | | | | |
| | 30-45 | 1.26 | 0.69 | 0.38 | 0.31 | 2.37 | 1.32 | 0.72 | 0.60 | 0.05 | | | | |
| | 45-60 | 1.25 | 0.63 | 0.36 | 0.27 | 1.66 | 1.20 | 0.69 | 0.52 | 0.03 | | | | |
| | 60-75 | 1.24 | 0.66 | 0.31 | 0.35 | 1.46 | 1.24 | 0.58 | 0.66 | 0.03 | | | | |
| | 75-90 | 1.29 | 0.89 | 0.45 | 0.44 | 2.18 | 1.74 | 0.88 | 0.86 | 0.04 | | | | |
| MX-T5R3.8-106 | 0-10 | 1.35 | 1.65 | 0.13 | 1.52 | 10.47 | 2.26 | 0.18 | 2.08 | 0.14 | 12.21 | 2.51 | 9.71 | 0.47 |
| | 10-20 | 1.40 | 1.38 | 0.09 | 1.29 | 6.28 | 1.97 | 0.13 | 1.84 | 0.09 | | | | |
| | 20-30 | 1.49 | 1.22 | 0.00 | 1.22 | 5.64 | 1.85 | 0.00 | 1.85 | 0.09 | | | | |
| | 30-45 | 1.26 | 0.95 | 0.22 | 0.73 | 3.01 | 1.83 | 0.42 | 1.41 | 0.06 | | | | |
| | 45-60 | 1.25 | 0.89 | 0.29 | 0.60 | 2.10 | 1.70 | 0.55 | 1.14 | 0.04 | | | | |
| | 60-75 | 1.24 | 0.69 | 0.36 | 0.33 | 1.53 | 1.30 | 0.68 | 0.62 | 0.03 | | | | |
| | 75-90 | 1.29 | 0.67 | 0.28 | 0.39 | 1.44 | 1.31 | 0.55 | 0.76 | 0.03 | | | | |
| MX-T5R3.8-206 | 0-10 | 1.09 | 1.78 | 0.09 | 1.69 | 10.38 | 1.98 | 0.10 | 1.88 | 0.12 | 16.35 | 5.53 | 10.82 | 0.49 |
| | 10-20 | 1.27 | 1.42 | 0.16 | 1.26 | 6.77 | 1.84 | 0.21 | 1.63 | 0.09 | | | | |
| | 20-30 | 1.38 | 1.33 | 0.20 | 1.13 | 4.96 | 1.86 | 0.28 | 1.58 | 0.07 | | | | |
| | 30-45 | 1.26 | 2.12 | 0.98 | 1.14 | 5.00 | 4.08 | 1.89 | 2.19 | 0.10 | | | | |
| | 45-60 | 1.25 | 1.37 | 0.69 | 0.68 | 2.31 | 2.61 | 1.32 | 1.30 | 0.04 | | | | |
| | 60-75 | 1.24 | 1.30 | 0.52 | 0.78 | 2.42 | 2.45 | 0.98 | 1.47 | 0.05 | | | | |
| | 75-90 | 1.29 | 0.78 | 0.39 | 0.39 | 1.47 | 1.53 | 0.76 | 0.76 | 0.03 | | | | |
| MX-T5R5.2-225 | 0-10 | 1.20 | 1.93 | 0.08 | 1.85 | 7.30 | 2.36 | 0.09 | 2.26 | 0.09 | 14.67 | 4.95 | 9.72 | 0.31 |
| | 10-20 | 1.33 | 1.68 | 0.22 | 1.46 | 5.55 | 2.28 | 0.30 | 1.98 | 0.08 | | | | |
| | 20-30 | 1.41 | 1.67 | 0.42 | 1.25 | 0.00 | 2.40 | 0.60 | 1.79 | 0.00 | | | | |
| | 30-45 | 1.26 | 1.69 | 0.75 | 0.94 | 3.17 | 3.25 | 1.44 | 1.81 | 0.06 | | | | |

Table C1. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration | | | | Carbon Mass | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | TC | IC | OC | WSOC | TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
| | ---cm--- | ---g $cm^{-3}$--- | -------Percent------- | | | -mg/L- | ---------kg $m^{-2}$ $depth^{-1}$--------- | | | | | | | |
| MX-T5R5.2-225 (cont.) | 45-60 | 1.25 | 0.96 | 0.43 | 0.53 | 1.69 | 1.83 | 0.82 | 1.01 | 0.03 | | | | |
| | 60-75 | 1.24 | 0.63 | 0.41 | 0.22 | 1.30 | 1.19 | 0.77 | 0.41 | 0.02 | | | | |
| | 75-90 | 1.29 | 0.70 | 0.47 | 0.23 | 1.36 | 1.37 | 0.92 | 0.45 | 0.03 | | | | |

†MS-1 represents*Helianthus maximilliana,* repetition 1 of 4, CK: cropland check, BB: *Andropogon gerardii,* CG: *Solidago canadensis/missouriensis,* WR: *Elymus Canadensis*, KB: *Poa pratensis*, SW: *Panicum virgatum,* SB: *Bromus inermis,* CW: *Agropyron cristatum*.

‡MX-T1R2.2-300 represents species richness (MX) at a level of 1 species (T1), repetition 2 (R2.2), within the high nitrogen application block (300). Treatments (T1-T5) indicate level of species richness: T1=1 species, T2=2 species, T3=5 species, T4=10 species and T5=20 species per plot. Blocks 100 and 300 indicate high fertilizer application, while blocks 200 and 400 indicate low fertilizer application as shown in Figure 6 of Appendix B.

Table C2. Carrington total, inorganic, organic, and water soluble organic carbon concentration and mass by soil depth increment.

| Sample | | | Carbon Concentration | | | | Carbon Mass | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number | Depth | B.D. | TC | IC | TOC | WSOC | TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
| | ---cm--- | ---g $cm^{-3}$--- | -------Percent------- | | | -mg/L- | --------------------------------------kg $m^{-2}$ $depth^{-1}$-------------------------------------- | | | | | | | |
| Alkar 105† | 0-10 | 1.27 | 1.93 | 0.27 | 1.66 | 9.55 | 2.49 | 0.35 | 2.14 | 0.12 | 16.21 | 3.64 | 12.57 | 0.71 |
| | 10-20 | 1.43 | 1.47 | 0.00 | 1.47 | 9.35 | 2.14 | 0.00 | 2.14 | 0.14 | | | | |
| | 20-30 | 1.43 | 1.11 | 0.21 | 0.90 | 4.60 | 1.62 | 0.31 | 1.31 | 0.07 | | | | |
| | 30-45 | 1.34 | 0.95 | 0.00 | 0.95 | 4.92 | 1.94 | 0.00 | 1.94 | 0.10 | | | | |
| | 45-60 | 1.33 | 0.85 | 0.00 | 0.85 | 5.48 | 1.72 | 0.00 | 1.72 | 0.11 | | | | |
| | 60-75 | 1.26 | 1.04 | 0.25 | 0.79 | 4.82 | 1.99 | 0.48 | 1.51 | 0.09 | | | | |
| | 75-90 | 1.37 | 2.06 | 1.20 | 0.86 | 3.73 | 4.31 | 2.51 | 1.80 | 0.08 | | | | |
| Alkar 106 | 0-10 | 1.30 | 2.34 | 0.17 | 2.17 | 11.69 | 3.10 | 0.23 | 2.87 | 0.15 | 17.55 | 0.69 | 16.82 | 0.92 |
| | 10-20 | 1.44 | | | | 8.44 | 3.30 | 0.00 | 3.30 | 0.12 | | | | |
| | 20-30 | 1.36 | | | | 7.87 | 2.97 | 0.00 | 2.93 | 0.11 | | | | |
| | 30-45 | 1.29 | 1.09 | 0.00 | 1.09 | 6.30 | 2.14 | 0.00 | 2.14 | 0.12 | | | | |
| | 45-60 | 1.32 | 1.00 | 0.00 | 1.00 | 8.05 | 2.00 | 0.00 | 2.00 | 0.16 | | | | |
| | 60-75 | 1.29 | 0.98 | 0.00 | 0.98 | 7.53 | 1.93 | 0.00 | 1.93 | 0.15 | | | | |
| | 75-90 | 1.32 | | | | 4.92 | 2.11 | 0.46 | 1.65 | 0.10 | | | | |
| Alkar 205 | 0-10 | 1.27 | 2.73 | 0.00 | 2.73 | 14.68 | 3.54 | 0.00 | 3.54 | 0.19 | 16.69 | 0.21 | 16.48 | 1.03 |
| | 10-20 | 1.31 | 2.04 | 0.00 | 2.04 | 12.43 | 2.72 | 0.00 | 2.72 | 0.17 | | | | |
| | 20-30 | 1.32 | 1.62 | 0.00 | 1.62 | 11.27 | 2.18 | 0.00 | 2.18 | 0.15 | | | | |
| | 30-45 | 1.37 | 1.16 | 0.00 | 1.16 | 7.66 | 2.42 | 0.00 | 2.42 | 0.16 | | | | |
| | 45-60 | 1.28 | 1.08 | 0.00 | 1.08 | 7.09 | 2.10 | 0.00 | 2.10 | 0.14 | | | | |
| | 60-75 | 1.32 | 0.94 | 0.00 | 0.94 | 6.92 | 1.90 | 0.00 | 1.90 | 0.14 | | | | |
| | 75-90 | 1.15 | 1.05 | 0.12 | 0.93 | 4.85 | 1.84 | 0.21 | 1.63 | 0.08 | | | | |
| Alkar 206 | 0-10 | 1.27 | 2.71 | 0.00 | 2.71 | 14.21 | 3.51 | 0.00 | 3.51 | 0.18 | 17.69 | 0.52 | 17.17 | 1.06 |
| | 10-20 | 1.15 | 2.13 | 0.00 | 2.13 | 14.95 | 2.49 | 0.00 | 2.49 | 0.17 | | | | |
| | 20-30 | 1.28 | 1.78 | 0.00 | 1.78 | 10.71 | 2.32 | 0.00 | 2.32 | 0.14 | | | | |
| | 30-45 | 1.24 | 1.16 | 0.00 | 1.16 | 6.89 | 2.19 | 0.00 | 2.19 | 0.13 | | | | |
| | 45-60 | 1.38 | 1.25 | 0.00 | 1.25 | 6.45 | 2.62 | 0.00 | 2.62 | 0.14 | | | | |
| | 60-75 | 1.26 | 1.08 | 0.00 | 1.08 | 8.04 | 2.07 | 0.00 | 2.07 | 0.15 | | | | |

Table C2. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | TOC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | --------kg m$^{-2}$ depth$^{-1}$-------- | | | | | | | |
| Alkar 206 (cont.) | 75-90 | 1.27 | 1.29 | 0.27 | 1.02 | 7.40 | 2.50 | 0.52 | 1.98 | 0.14 | | | | |
| Alkar 311 | 0-10 | 1.22 | 3.66 | 0.00 | 3.66 | 18.24 | 4.54 | 0.00 | 4.54 | 0.23 | 23.26 | 0.00 | 23.26 | 1.34 |
| | 10-20 | 1.21 | 2.92 | 0.00 | 2.92 | 16.12 | 3.60 | 0.00 | 3.60 | 0.20 | | | | |
| | 20-30 | 1.18 | 3.28 | 0.00 | 3.28 | 14.21 | 3.92 | 0.00 | 3.92 | 0.17 | | | | |
| | 30-45 | 1.18 | 2.26 | 0.00 | 2.26 | 12.58 | 4.07 | 0.00 | 4.07 | 0.23 | | | | |
| | 45-60 | 1.30 | 1.58 | 0.00 | 1.58 | 9.96 | 3.13 | 0.00 | 3.13 | 0.20 | | | | |
| | 60-75 | 1.33 | 1.19 | 0.00 | 1.19 | 9.13 | 2.41 | 0.00 | 2.41 | 0.18 | | | | |
| | 75-90 | 1.28 | 0.82 | 0.00 | 0.82 | 7.04 | 1.60 | 0.00 | 1.60 | 0.14 | | | | |
| Alkar 312 | 0-10 | 1.08 | 3.67 | 0.00 | 3.67 | 13.09 | 4.03 | 0.00 | 4.03 | 0.14 | 22.64 | 0.00 | 22.64 | 1.35 |
| | 10-20 | 1.26 | 3.22 | 0.00 | 3.22 | 11.15 | 4.11 | 0.00 | 4.11 | 0.14 | | | | |
| | 20-30 | 1.25 | 3.07 | 0.00 | 3.07 | 14.55 | 3.91 | 0.00 | 3.91 | 0.19 | | | | |
| | 30-45 | 1.29 | 1.69 | 0.00 | 1.69 | 14.55 | 3.31 | 0.00 | 3.31 | 0.28 | | | | |
| | 45-60 | 1.20 | 1.61 | 0.00 | 1.61 | 11.52 | 2.94 | 0.00 | 2.94 | 0.21 | | | | |
| | 60-75 | 1.44 | 1.24 | 0.00 | 1.24 | 9.35 | 2.73 | 0.00 | 2.73 | 0.21 | | | | |
| | 75-90 | 1.28 | 0.82 | 0.00 | 0.82 | 8.95 | 1.60 | 0.00 | 1.60 | 0.18 | | | | |
| Alkar 419 | 0-10 | 1.17 | 4.06 | 0.00 | 4.06 | 16.33 | 4.81 | 0.00 | 4.81 | 0.19 | 23.27 | 0.00 | 23.27 | 1.25 |
| | 10-20 | 1.22 | 3.34 | 0.00 | 3.34 | 13.84 | 4.13 | 0.00 | 4.13 | 0.17 | | | | |
| | 20-30 | 1.14 | 2.92 | 0.00 | 2.92 | 13.11 | 3.39 | 0.00 | 3.39 | 0.15 | | | | |
| | 30-45 | 1.12 | 2.12 | 0.00 | 2.12 | 8.54 | 3.63 | 0.00 | 3.63 | 0.15 | | | | |
| | 45-60 | 1.32 | 1.66 | 0.00 | 1.66 | 12.86 | 3.34 | 0.00 | 3.34 | 0.26 | | | | |
| | 60-75 | 1.41 | 1.21 | 0.00 | 1.21 | 9.13 | 2.60 | 0.00 | 2.60 | 0.20 | | | | |
| | 75-90 | 1.28 | 0.70 | 0.00 | 0.70 | 6.88 | 1.37 | 0.00 | 1.37 | 0.13 | | | | |
| Alkar 420 | 0-10 | 1.15 | 3.58 | 0.00 | 3.58 | 11.60 | 4.17 | 0.00 | 4.17 | 0.13 | 21.38 | 0.00 | 21.38 | 1.01 |
| | 10-20 | 1.27 | 3.03 | 0.00 | 3.03 | 7.29 | 3.92 | 0.00 | 3.92 | 0.09 | | | | |
| | 20-30 | 1.13 | 3.02 | 0.00 | 3.02 | 7.38 | 3.47 | 0.00 | 3.47 | 0.08 | | | | |
| | 30-45 | 1.16 | 2.12 | 0.00 | 2.12 | 10.08 | 3.73 | 0.00 | 3.73 | 0.18 | | | | |
| | 45-60 | 1.26 | 1.29 | 0.00 | 1.29 | 10.64 | 2.48 | 0.00 | 2.48 | 0.20 | | | | |

Table C2. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | TOC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | ---kg m$^{-2}$ depth$^{-1}$--- | | | | | | | |
| Alkar 420 (cont.) | 60-75 | 1.31 | 1.02 | 0.00 | 1.02 | 10.64 | 2.04 | 0.00 | 2.04 | 0.21 | | | | |
| | 75-90 | 0.86 | 1.20 | 0.00 | 1.20 | 7.48 | 1.57 | 0.00 | 1.57 | 0.10 | | | | |
| Haymaker 107 | 0-10 | 1.32 | 1.89 | 0.00 | 1.89 | 13.85 | 2.54 | 0.00 | 2.54 | 0.19 | 16.84 | 3.62 | 13.22 | 0.89 |
| | 10-20 | 1.52 | 1.45 | 0.00 | 1.45 | 10.33 | 2.24 | 0.00 | 2.24 | 0.16 | | | | |
| | 20-30 | 1.52 | 0.89 | 0.00 | 0.89 | 7.98 | 1.37 | 0.00 | 1.37 | 0.12 | | | | |
| | 30-45 | 1.32 | 0.92 | 0.00 | 0.92 | 6.17 | 1.85 | 0.00 | 1.85 | 0.12 | | | | |
| | 45-60 | 1.35 | 0.79 | 0.00 | 0.79 | 6.09 | 1.63 | 0.00 | 1.63 | 0.13 | | | | |
| | 60-75 | 1.32 | 1.43 | 0.40 | 1.03 | 4.49 | 2.87 | 0.80 | 2.07 | 0.09 | | | | |
| | 75-90 | 1.34 | 2.12 | 1.38 | 0.74 | 3.79 | 4.33 | 2.82 | 1.51 | 0.08 | | | | |
| Haymaker 108 | 0-10 | 1.14 | 2.31 | 0.00 | 2.31 | 14.85 | 2.67 | 0.00 | 2.67 | 0.17 | 14.13 | 0.28 | 13.85 | 0.93 |
| | 10-20 | 1.38 | 1.45 | 0.00 | 1.45 | 9.28 | 2.03 | 0.00 | 2.03 | 0.13 | | | | |
| | 20-30 | 1.26 | 1.86 | 0.22 | 1.64 | 10.74 | 2.39 | 0.28 | 2.11 | 0.14 | | | | |
| | 30-45 | 1.28 | 0.98 | 0.00 | 0.98 | 8.34 | 1.91 | 0.00 | 1.91 | 0.16 | | | | |
| | 45-60 | 1.28 | 1.01 | 0.00 | 1.01 | 6.55 | 1.98 | 0.00 | 1.98 | 0.13 | | | | |
| | 60-75 | 1.25 | 0.87 | 0.00 | 0.87 | 5.63 | 1.66 | 0.00 | 1.66 | 0.11 | | | | |
| | 75-90 | 1.26 | 0.77 | 0.00 | 0.77 | 4.89 | 1.48 | 0.00 | 1.48 | 0.09 | | | | |
| Haymaker 201 | 0-10 | 1.14 | 2.33 | 0.00 | 2.33 | 13.31 | 2.71 | 0.00 | 2.71 | 0.15 | 15.03 | 0.00 | 20.84 | 0.91 |
| | 10-20 | 1.38 | 1.96 | 0.00 | 1.96 | 11.34 | 2.75 | 0.00 | 2.75 | 0.16 | | | | |
| | 20-30 | 1.38 | 1.44 | 0.00 | 1.44 | 10.11 | 2.02 | 0.00 | 2.02 | 0.14 | | | | |
| | 30-45 | 1.29 | 1.06 | 0.00 | 1.06 | 7.87 | 2.08 | 0.00 | 4.58 | 0.15 | | | | |
| | 45-60 | 1.14 | 1.02 | 0.00 | 1.02 | 6.76 | 1.77 | 0.00 | 3.40 | 0.12 | | | | |
| | 60-75 | 1.45 | 0.98 | 0.00 | 0.98 | 5.00 | 2.16 | 0.00 | 3.18 | 0.11 | | | | |
| | 75-90 | 1.37 | 0.74 | 0.00 | 0.74 | 3.57 | 1.54 | 0.00 | 2.21 | 0.07 | | | | |
| Haymaker 202 | 0-10 | 1.17 | 2.80 | 0.00 | 2.80 | 10.18 | 3.34 | 0.00 | 3.34 | 0.12 | 17.79 | 0.14 | 17.65 | 1.07 |
| | 10-20 | 1.24 | 2.54 | 0.00 | 2.54 | 14.73 | 3.20 | 0.00 | 3.20 | 0.19 | | | | |
| | 20-30 | 1.25 | 1.73 | 0.00 | 1.73 | 10.11 | 2.20 | 0.00 | 2.20 | 0.13 | | | | |
| | 30-45 | 1.28 | 1.19 | 0.00 | 1.19 | 9.63 | 2.33 | 0.00 | 2.33 | 0.19 | | | | |

Table C2. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | TOC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g $cm^{-3}$--- | -------Percent------- | | | -mg/L- | ---------kg $m^{-2}$ $depth^{-1}$--------- | | | | | | | |
| Haymaker 202 (cont.) | 45-60 | 1.32 | 1.23 | 0.00 | 1.23 | 9.79 | 2.48 | 0.00 | 2.48 | 0.20 | | | | |
| | 60-75 | 1.27 | 1.10 | 0.00 | 1.10 | 7.93 | 2.12 | 0.00 | 2.12 | 0.15 | | | | |
| | 75-90 | 1.33 | 1.04 | 0.07 | 0.97 | 4.57 | 2.11 | 0.14 | 1.97 | 0.09 | | | | |
| Haymaker 309 | 0-10 | 1.20 | 2.71 | 0.00 | 2.71 | 12.18 | 3.31 | 0.00 | 3.31 | 0.15 | 19.19 | 0.00 | 19.19 | 1.07 |
| | 10-20 | 1.32 | 2.75 | 0.00 | 2.75 | 14.75 | 3.67 | 0.00 | 3.67 | 0.20 | | | | |
| | 20-30 | 1.23 | 2.26 | 0.00 | 2.26 | 10.30 | 2.83 | 0.00 | 2.83 | 0.13 | | | | |
| | 30-45 | 1.22 | 1.58 | 0.00 | 1.58 | 8.47 | 2.93 | 0.00 | 2.93 | 0.16 | | | | |
| | 45-60 | 1.24 | 1.37 | 0.00 | 1.37 | 7.60 | 2.60 | 0.00 | 2.60 | 0.14 | | | | |
| | 60-75 | 1.25 | 1.22 | 0.00 | 1.22 | 8.14 | 2.32 | 0.00 | 2.32 | 0.16 | | | | |
| | 75-90 | 1.36 | 0.74 | 0.00 | 0.74 | 6.89 | 1.53 | 0.00 | 1.53 | 0.14 | | | | |
| Haymaker 310 | 0-10 | 1.14 | 3.56 | 0.00 | 3.56 | 15.23 | 4.14 | 0.00 | 4.14 | 0.18 | 20.39 | 0.00 | 20.39 | 1.07 |
| | 10-20 | 1.23 | 2.66 | 0.00 | 2.66 | 12.21 | 3.33 | 0.00 | 3.33 | 0.15 | | | | |
| | 20-30 | 1.19 | 2.29 | 0.00 | 2.29 | 9.78 | 2.76 | 0.00 | 2.76 | 0.12 | | | | |
| | 30-45 | 1.18 | 1.74 | 0.00 | 1.74 | 8.88 | 3.14 | 0.00 | 3.14 | 0.16 | | | | |
| | 45-60 | 1.15 | 1.67 | 0.00 | 1.67 | 7.25 | 2.92 | 0.00 | 2.92 | 0.13 | | | | |
| | 60-75 | 1.20 | 1.29 | 0.00 | 1.29 | 8.67 | 2.36 | 0.00 | 2.36 | 0.16 | | | | |
| | 75-90 | 1.38 | 0.83 | 0.00 | 0.83 | 8.31 | 1.74 | 0.00 | 1.74 | 0.17 | | | | |
| Haymaker 401 | 0-10 | 1.13 | 3.70 | 0.00 | 3.70 | 17.04 | 4.25 | 0.00 | 4.25 | 0.20 | 20.22 | 0.00 | 20.22 | 1.35 |
| | 10-20 | 1.28 | 2.95 | 0.00 | 2.95 | 16.67 | 3.83 | 0.00 | 3.83 | 0.22 | | | | |
| | 20-30 | 1.24 | 2.14 | 0.00 | 2.14 | 11.22 | 2.69 | 0.00 | 2.69 | 0.14 | | | | |
| | 30-45 | 1.20 | 1.55 | 0.00 | 1.55 | 13.76 | 2.83 | 0.00 | 2.83 | 0.25 | | | | |
| | 45-60 | 1.32 | 1.56 | 0.00 | 1.56 | 11.94 | 3.15 | 0.00 | 3.15 | 0.24 | | | | |
| | 60-75 | 1.29 | 1.07 | 0.00 | 1.07 | 8.24 | 2.11 | 0.00 | 2.11 | 0.16 | | | | |
| | 75-90 | 1.31 | 0.68 | 0.00 | 0.68 | 6.88 | 1.36 | 0.00 | 1.36 | 0.14 | | | | |
| Haymaker 402 | 0-10 | 1.12 | 3.95 | 0.00 | 3.95 | 16.72 | 4.49 | 0.00 | 4.49 | 0.19 | 25.42 | 0.00 | 25.42 | 1.09 |
| | 10-20 | 1.34 | 3.08 | 0.00 | 3.08 | 12.30 | 4.18 | 0.00 | 4.18 | 0.17 | | | | |
| | 20-30 | 1.22 | 3.19 | 0.00 | 3.19 | 9.78 | 3.95 | 0.00 | 3.95 | 0.12 | | | | |

Table C2. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | TOC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | ---kg m$^{-2}$ depth$^{-1}$--- | | | | | | | |
| Haymaker 402 (cont.) | 30-45 | 1.19 | 2.57 | 0.00 | 2.57 | 8.65 | 4.68 | 0.00 | 4.68 | 0.16 | | | | |
| | 45-60 | 1.26 | 1.84 | 0.00 | 1.84 | 10.15 | 3.53 | 0.00 | 3.53 | 0.19 | | | | |
| | 60-75 | 1.29 | 1.29 | 0.00 | 1.29 | 6.80 | 2.54 | 0.00 | 2.54 | 0.13 | | | | |
| | 75-90 | 1.34 | 1.01 | 0.00 | 1.01 | 6.06 | 2.06 | 0.00 | 2.06 | 0.12 | | | | |
| Sunburst 101 | 0-10 | 1.35 | 1.88 | 0.00 | 1.88 | 13.75 | 2.59 | 0.00 | 2.59 | 0.19 | 13.81 | 1.75 | 12.06 | 0.82 |
| | 10-20 | 1.52 | 1.63 | 0.00 | 1.63 | 12.17 | 2.51 | 0.00 | 2.51 | 0.19 | | | | |
| | 20-30 | 1.51 | 0.95 | 0.00 | 0.95 | 6.48 | 1.46 | 0.00 | 1.46 | 0.10 | | | | |
| | 30-45 | 1.16 | 0.78 | 0.00 | 0.78 | 6.45 | 1.38 | 0.00 | 1.38 | 0.11 | | | | |
| | 45-60 | 1.33 | 0.72 | 0.00 | 0.72 | 6.04 | 1.46 | 0.00 | 1.46 | 0.12 | | | | |
| | 60-75 | 1.34 | 0.76 | 0.12 | 0.64 | 3.15 | 1.55 | 0.25 | 1.31 | 0.06 | | | | |
| | 75-90 | 1.43 | 1.31 | 0.69 | 0.62 | 2.18 | 2.86 | 1.51 | 1.35 | 0.05 | | | | |
| Sunburst 102 | 0-10 | 1.37 | 2.26 | 0.00 | 2.26 | 13.71 | 3.14 | 0.00 | 3.14 | 0.19 | 16.20 | 0.78 | 15.42 | 0.80 |
| | 10-20 | 1.45 | 1.74 | 0.00 | 1.74 | 11.23 | 2.57 | 0.00 | 2.57 | 0.17 | | | | |
| | 20-30 | 1.32 | 1.27 | 0.00 | 1.27 | 9.20 | 1.70 | 0.00 | 1.70 | 0.12 | | | | |
| | 30-45 | 1.32 | 0.94 | 0.00 | 0.94 | 4.99 | 1.88 | 0.00 | 1.88 | 0.10 | | | | |
| | 45-60 | 1.38 | 1.02 | 0.00 | 1.02 | 4.81 | 2.14 | 0.00 | 2.14 | 0.10 | | | | |
| | 60-75 | 1.22 | 0.94 | 0.00 | 0.94 | 4.17 | 1.74 | 0.00 | 1.74 | 0.08 | | | | |
| | 75-90 | 1.31 | 1.51 | 0.39 | 1.12 | 2.15 | 3.03 | 0.78 | 2.24 | 0.04 | | | | |
| Sunburst 213 | 0-10 | 1.29 | 2.20 | 0.00 | 2.20 | 11.10 | 2.88 | 0.00 | 2.88 | 0.15 | 18.79 | 3.69 | 15.11 | 0.65 |
| | 10-20 | 1.36 | 1.78 | 0.00 | 1.78 | 10.94 | 2.45 | 0.00 | 2.45 | 0.15 | | | | |
| | 20-30 | 1.25 | 1.27 | 0.00 | 1.27 | 5.29 | 1.60 | 0.00 | 1.60 | 0.07 | | | | |
| | 30-45 | 1.31 | 0.98 | 0.00 | 0.98 | 4.94 | 1.95 | 0.00 | 1.95 | 0.10 | | | | |
| | 45-60 | 1.34 | 1.17 | 0.00 | 1.17 | 3.83 | 2.40 | 0.00 | 2.40 | 0.08 | | | | |
| | 60-75 | 1.18 | 1.49 | 0.18 | 1.31 | 3.63 | 2.67 | 0.32 | 2.35 | 0.07 | | | | |
| | 75-90 | 1.35 | 2.34 | 1.63 | 0.71 | 2.33 | 4.83 | 3.36 | 1.46 | 0.05 | | | | |
| Sunburst 214 | 0-10 | 1.19 | 2.63 | 0.00 | 2.63 | 9.50 | 3.17 | 0.00 | 3.17 | 0.11 | 18.88 | 2.35 | 16.53 | 0.87 |
| | 10-20 | 1.34 | 2.09 | 0.00 | 2.09 | 11.99 | 2.84 | 0.00 | 2.84 | 0.16 | | | | |

Table C2. Continued.

| Sample | | | Carbon Concentration | | | | Carbon Mass | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number | Depth | B.D. | TC | IC | TOC | WSOC | TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | -------------------------------------kg m$^{-2}$ depth$^{-1}$------------------------------------- | | | | | | | |
| Sunburst 214 (cont.) | 20-30 | 1.30 | 1.65 | 0.00 | 1.65 | 10.75 | 2.18 | 0.00 | 2.18 | 0.14 | | | | |
| | 30-45 | 1.26 | 1.14 | 0.00 | 1.14 | 8.08 | 2.18 | 0.00 | 2.18 | 0.15 | | | | |
| | 45-60 | 1.28 | 1.07 | 0.00 | 1.07 | 6.01 | 2.09 | 0.00 | 2.09 | 0.12 | | | | |
| | 60-75 | 1.25 | 1.01 | 0.00 | 1.01 | 5.26 | 1.92 | 0.00 | 1.92 | 0.10 | | | | |
| | 75-90 | 1.36 | 2.16 | 1.13 | 1.03 | 3.91 | 4.49 | 2.35 | 2.14 | 0.08 | | | | |
| Sunburst 315 | 0-10 | 1.18 | 3.53 | 0.00 | 3.53 | 16.79 | 4.24 | 0.00 | 4.24 | 0.20 | 22.84 | 0.00 | 22.84 | 1.44 |
| | 10-20 | 1.25 | 3.12 | 0.00 | 3.12 | 14.67 | 3.97 | 0.00 | 3.97 | 0.19 | | | | |
| | 20-30 | 1.21 | 2.79 | 0.00 | 2.79 | 10.88 | 3.42 | 0.00 | 3.42 | 0.13 | | | | |
| | 30-45 | 1.26 | 2.16 | 0.00 | 2.16 | 12.59 | 4.15 | 0.00 | 4.15 | 0.24 | | | | |
| | 45-60 | 1.34 | 1.45 | 0.00 | 1.45 | 11.60 | 2.97 | 0.00 | 2.97 | 0.24 | | | | |
| | 60-75 | 1.29 | 1.29 | 0.00 | 1.29 | 12.71 | 2.53 | 0.00 | 2.53 | 0.25 | | | | |
| | 75-90 | 1.40 | 0.73 | 0.00 | 0.73 | 8.78 | 1.56 | 0.00 | 1.56 | 0.19 | | | | |
| Sunburst 316 | 0-10 | 1.15 | 3.72 | 0.00 | 3.72 | 18.04 | 4.35 | 0.00 | 4.35 | 0.21 | 32.17 | 0.00 | 32.17 | 1.44 |
| | 10-20 | 1.26 | 3.07 | 0.00 | 3.07 | 14.24 | 3.92 | 0.00 | 3.92 | 0.18 | | | | |
| | 20-30 | 1.32 | 2.61 | 0.00 | 2.61 | 9.84 | 3.51 | 0.00 | 3.51 | 0.13 | | | | |
| | 30-45 | 1.08 | 3.45 | 0.00 | 3.45 | 11.79 | 5.70 | 0.00 | 5.70 | 0.19 | | | | |
| | 45-60 | 1.03 | 3.82 | 0.00 | 3.82 | 13.77 | 6.01 | 0.00 | 6.01 | 0.22 | | | | |
| | 60-75 | 1.12 | 2.90 | 0.00 | 2.90 | 12.49 | 4.94 | 0.00 | 4.94 | 0.21 | | | | |
| | 75-90 | 1.28 | 1.91 | 0.00 | 1.91 | 14.61 | 3.74 | 0.00 | 3.74 | 0.29 | | | | |
| Sunburst 411 | 0-10 | 1.07 | 3.63 | 0.00 | 3.63 | 21.41 | 3.95 | 0.00 | 3.95 | 0.23 | 20.39 | 0.00 | 20.39 | 1.28 |
| | 10-20 | 1.31 | 3.14 | 0.00 | 3.14 | 15.97 | 4.17 | 0.00 | 4.17 | 0.21 | | | | |
| | 20-30 | 1.11 | 2.51 | 0.00 | 2.51 | 14.32 | 2.82 | 0.00 | 2.82 | 0.16 | | | | |
| | 30-45 | 1.18 | 1.85 | 0.00 | 1.85 | 12.17 | 3.34 | 0.00 | 3.34 | 0.22 | | | | |
| | 45-60 | 1.29 | 1.46 | 0.00 | 1.46 | 7.03 | 2.87 | 0.00 | 2.87 | 0.14 | | | | |
| | 60-75 | 1.29 | 0.97 | 0.00 | 0.97 | 9.45 | 1.90 | 0.00 | 1.90 | 0.19 | | | | |
| | 75-90 | 1.43 | 0.61 | 0.00 | 0.61 | 6.05 | 1.33 | 0.00 | 1.33 | 0.13 | | | | |
| Sunburst 412 | 0-10 | 1.19 | | | | 15.99 | 0.00 | | 0.00 | 0.19 | 16.57 | 0.00 | 16.57 | 1.31 |

Table C2. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | TOC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | --------------------------------------kg m$^{-2}$ depth$^{-1}$-------------------------------------- | | | | | | | |
| Sunburst 412 (cont.) | 10-20 | 1.30 | 1.99 | 0.00 | 1.99 | 13.69 | 2.63 | 0.00 | 2.63 | 0.18 | | | | |
| | 20-30 | 1.26 | 2.57 | 0.00 | 2.57 | 14.53 | 3.29 | 0.00 | 3.29 | 0.19 | | | | |
| | 30-45 | 1.19 | 1.98 | 0.00 | 1.98 | 8.83 | 3.58 | 0.00 | 3.58 | 0.16 | | | | |
| | 45-60 | 1.26 | 1.55 | 0.00 | 1.55 | 13.27 | 2.97 | 0.00 | 2.97 | 0.25 | | | | |
| | 60-75 | 1.31 | 1.17 | 0.00 | 1.17 | 8.00 | 2.33 | 0.00 | 2.33 | 0.16 | | | | |
| | 75-90 | 1.32 | 0.88 | 0.00 | 0.88 | 8.89 | 1.77 | 0.00 | 1.77 | 0.18 | | | | |
| Trailblazer 103 | 0-10 | 1.40 | 1.66 | 0.00 | 1.66 | 13.61 | 2.36 | 0.00 | 2.36 | 0.19 | 8.63 | 0.00 | 8.63 | 0.90 |
| | 10-20 | 1.46 | 1.37 | 0.00 | 1.37 | 12.40 | 2.03 | 0.00 | 2.03 | 0.18 | | | | |
| | 20-30 | 1.40 | | | | 9.23 | 0.00 | 0.00 | 0.00 | 0.13 | | | | |
| | 30-45 | 1.42 | 0.76 | 0.00 | 0.76 | 7.13 | 1.65 | 0.00 | 1.65 | 0.15 | | | | |
| | 45-60 | 1.25 | 0.63 | 0.00 | 0.63 | 6.09 | 1.20 | 0.00 | 1.20 | 0.12 | | | | |
| | 60-75 | 1.30 | 0.70 | 0.00 | 0.70 | 3.49 | 1.39 | 0.00 | 1.39 | 0.07 | | | | |
| | 75-90 | 1.41 | | | | 2.58 | 0.00 | 0.00 | 0.00 | 0.06 | | | | |
| Trailblazer 104 | 0-10 | 1.34 | 2.39 | 0.00 | 2.39 | 13.77 | 3.24 | 0.00 | 3.24 | 0.19 | 15.86 | 0.78 | 15.08 | 0.89 |
| | 10-20 | 1.31 | 1.89 | 0.00 | 1.89 | 14.60 | 2.51 | 0.00 | 2.51 | 0.19 | | | | |
| | 20-30 | 1.30 | 1.21 | 0.00 | 1.21 | 8.79 | 1.60 | 0.00 | 1.60 | 0.12 | | | | |
| | 30-45 | 1.25 | 1.04 | 0.00 | 1.04 | 8.02 | 1.98 | 0.00 | 1.98 | 0.15 | | | | |
| | 45-60 | 1.28 | 0.98 | 0.00 | 0.98 | 5.23 | 1.91 | 0.00 | 1.91 | 0.10 | | | | |
| | 60-75 | 1.28 | 0.94 | 0.00 | 0.94 | 4.60 | 1.83 | 0.00 | 1.83 | 0.09 | | | | |
| | 75-90 | 1.27 | 1.43 | 0.40 | 1.03 | 2.71 | 2.78 | 0.78 | 2.00 | 0.05 | | | | |
| Trailblazer 203 | 0-10 | 1.38 | 2.19 | 0.00 | 2.19 | 13.71 | 3.07 | 0.00 | 3.07 | 0.19 | 14.79 | 0.28 | 14.51 | 0.86 |
| | 10-20 | 1.45 | 1.59 | 0.00 | 1.59 | 10.36 | 2.34 | 0.00 | 2.34 | 0.15 | | | | |
| | 20-30 | 1.54 | 1.32 | 0.00 | 1.32 | 9.23 | 2.06 | 0.00 | 2.06 | 0.14 | | | | |
| | 30-45 | 1.27 | 0.97 | 0.00 | 0.97 | 6.50 | 1.88 | 0.00 | 1.88 | 0.13 | | | | |
| | 45-60 | 1.32 | 0.94 | 0.00 | 0.94 | 5.84 | 1.88 | 0.00 | 1.88 | 0.12 | | | | |
| | 60-75 | 1.29 | 0.78 | 0.00 | 0.78 | 4.39 | 1.53 | 0.00 | 1.53 | 0.09 | | | | |
| | 75-90 | 1.32 | 1.01 | 0.14 | 0.87 | 2.34 | 2.03 | 0.28 | 1.74 | 0.05 | | | | |

Table C2. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | TOC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | --------------------------------------kg m$^{-2}$ depth$^{-1}$-------------------------------------- | | | | | | | |
| Trailblazer 204 | 0-10 | 1.26 | 2.01 | 0.00 | 2.01 | 16.25 | 2.57 | 0.00 | 2.57 | 0.21 | 14.25 | 0.65 | 13.60 | 1.15 |
| | 10-20 | 1.33 | 1.39 | 0.00 | 1.39 | 14.64 | 1.88 | 0.00 | 1.88 | 0.20 | | | | |
| | 20-30 | 1.21 | 1.58 | 0.00 | 1.58 | 10.79 | 1.94 | 0.00 | 1.94 | 0.13 | | | | |
| | 30-45 | 1.22 | 1.37 | 0.35 | 1.02 | 10.56 | 2.55 | 0.65 | 1.90 | 0.20 | | | | |
| | 45-60 | 1.24 | 1.06 | 0.00 | 1.06 | 8.03 | 2.01 | 0.00 | 2.01 | 0.15 | | | | |
| | 60-75 | 1.26 | 0.97 | 0.00 | 0.97 | 6.76 | 1.86 | 0.00 | 1.86 | 0.13 | | | | |
| | 75-90 | 1.22 | 0.77 | 0.00 | 0.77 | 7.22 | 1.43 | 0.00 | 1.43 | 0.13 | | | | |
| Trailblazer 301 | 0-10 | 1.27 | 2.88 | 0.00 | 2.88 | 16.48 | 3.71 | 0.00 | 3.71 | 0.21 | 18.32 | 0.00 | 18.32 | 1.10 |
| | 10-20 | 1.24 | 2.51 | 0.00 | 2.51 | 15.19 | 3.16 | 0.00 | 3.16 | 0.19 | | | | |
| | 20-30 | 1.26 | 1.72 | 0.00 | 1.72 | 9.50 | 2.21 | 0.00 | 2.21 | 0.12 | | | | |
| | 30-45 | 1.31 | 1.40 | 0.00 | 1.40 | 9.31 | 2.80 | 0.00 | 2.80 | 0.19 | | | | |
| | 45-60 | 1.30 | 1.31 | 0.00 | 1.31 | 6.97 | 2.59 | 0.00 | 2.59 | 0.14 | | | | |
| | 60-75 | 1.37 | 1.10 | 0.00 | 1.10 | 6.78 | 2.30 | 0.00 | 2.30 | 0.14 | | | | |
| | 75-90 | 1.51 | 0.68 | 0.00 | 0.68 | 4.69 | 1.56 | 0.00 | 1.56 | 0.11 | | | | |
| Trailblazer 302 | 0-10 | 1.19 | 3.41 | 0.00 | 3.41 | 15.40 | 4.11 | 0.00 | 4.11 | 0.19 | 27.64 | 0.00 | 27.64 | 1.27 |
| | 10-20 | 1.32 | 3.17 | 0.00 | 3.17 | 13.23 | 4.24 | 0.00 | 4.24 | 0.18 | | | | |
| | 20-30 | 1.23 | 2.96 | 0.00 | 2.96 | 11.04 | 3.69 | 0.00 | 3.69 | 0.14 | | | | |
| | 30-45 | 1.10 | 3.27 | 0.00 | 3.27 | 8.63 | 5.48 | 0.00 | 5.48 | 0.14 | | | | |
| | 45-60 | 1.28 | 2.32 | 0.00 | 2.32 | 12.40 | 4.51 | 0.00 | 4.51 | 0.24 | | | | |
| | 60-75 | 1.30 | 1.75 | 0.00 | 1.75 | 7.77 | 3.48 | 0.00 | 3.48 | 0.15 | | | | |
| | 75-90 | 1.35 | 1.03 | 0.00 | 1.03 | 11.12 | 2.12 | 0.00 | 2.12 | 0.23 | | | | |
| Trailblazer 409 | 0-10 | 1.18 | 3.27 | 0.00 | 3.27 | 17.44 | 3.91 | 0.00 | 3.91 | 0.21 | 20.01 | 0.00 | 20.01 | 1.31 |
| | 10-20 | 1.28 | 2.97 | 0.00 | 2.97 | 16.79 | 3.88 | 0.00 | 3.88 | 0.22 | | | | |
| | 20-30 | 1.21 | 2.37 | 0.00 | 2.37 | 10.18 | 2.92 | 0.00 | 2.92 | 0.13 | | | | |
| | 30-45 | 1.22 | 1.74 | 0.00 | 1.74 | 13.24 | 3.24 | 0.00 | 3.24 | 0.25 | | | | |
| | 45-60 | 1.25 | 1.54 | 0.00 | 1.54 | 11.17 | 2.93 | 0.00 | 2.93 | 0.21 | | | | |
| | 60-75 | 1.30 | 0.89 | 0.00 | 0.89 | 7.97 | 1.75 | 0.00 | 1.75 | 0.16 | | | | |

Table C2.  Continued.

| Sample | | | Carbon Concentration | | | | Carbon Mass | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number | Depth | B.D. | TC | IC | TOC | WSOC | TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | --------------------------------------kg m$^{-2}$ depth$^{-1}$-------------------------------------- | | | | | | | |
| Trailblazer 409 (cont.) | 75-90 | 1.35 | 0.67 | 0.00 | 0.67 | 6.94 | 1.38 | 0.00 | 1.38 | 0.14 | | | | |
| Trailblazer 410 | 0-10 | 1.11 | 3.69 | 0.00 | 3.69 | 15.17 | 4.16 | 0.00 | 4.16 | 0.17 | 23.23 | 0.77 | 22.46 | 1.17 |
| | 10-20 | 1.28 | 3.09 | 0.00 | 3.09 | 13.33 | 4.03 | 0.00 | 4.03 | 0.17 | | | | |
| | 20-30 | 1.27 | 3.04 | 0.00 | 3.04 | 12.64 | 3.91 | 0.00 | 3.91 | 0.16 | | | | |
| | 30-45 | 1.29 | 1.75 | 0.00 | 1.75 | 10.30 | 3.45 | 0.00 | 3.45 | 0.20 | | | | |
| | 45-60 | 1.30 | 1.42 | 0.00 | 1.42 | 9.46 | 2.82 | 0.00 | 2.82 | 0.19 | | | | |
| | 60-75 | 1.33 | 1.07 | 0.00 | 1.07 | 9.57 | 2.15 | 0.00 | 2.15 | 0.19 | | | | |
| | 75-90 | 1.37 | 1.30 | 0.37 | 0.93 | 3.72 | 2.72 | 0.77 | 1.95 | 0.08 | | | | |
| CRP 111 | 0-10 | 1.22 | 2.12 | 0.00 | 2.12 | 12.95 | 2.63 | 0.00 | 2.63 | 0.16 | 17.71 | 5.27 | 12.45 | 0.81 |
| | 10-20 | 1.41 | 1.42 | 0.00 | 1.42 | 10.46 | 2.03 | 0.00 | 2.03 | 0.15 | | | | |
| | 20-30 | 1.43 | 1.13 | 0.00 | 1.13 | 7.05 | 1.65 | 0.00 | 1.65 | 0.10 | | | | |
| | 30-45 | 1.34 | 0.80 | 0.00 | 0.80 | 6.76 | 1.63 | 0.00 | 1.63 | 0.14 | | | | |
| | 45-60 | 1.35 | 0.96 | 0.00 | 0.96 | 6.25 | 1.98 | 0.00 | 1.98 | 0.13 | | | | |
| | 60-75 | 1.28 | 1.21 | 0.50 | 0.71 | 3.32 | 2.37 | 0.98 | 1.39 | 0.06 | | | | |
| | 75-90 | 1.39 | 2.56 | 2.02 | 0.54 | 2.88 | 5.43 | 4.29 | 1.15 | 0.06 | | | | |
| CRP 112 | 0-10 | 1.24 | 2.50 | 0.00 | 2.50 | 17.69 | 3.15 | 0.00 | 3.15 | 0.22 | 16.91 | 0.90 | 16.01 | 1.20 |
| | 10-20 | 1.32 | 2.20 | 0.00 | 2.20 | 14.49 | 2.96 | 0.00 | 2.96 | 0.20 | | | | |
| | 20-30 | 1.28 | 1.63 | 0.00 | 1.63 | 13.48 | 2.12 | 0.00 | 2.12 | 0.18 | | | | |
| | 30-45 | 1.27 | 1.20 | 0.00 | 1.20 | 10.00 | 2.32 | 0.00 | 2.32 | 0.19 | | | | |
| | 45-60 | 1.25 | 1.03 | 0.00 | 1.03 | 8.59 | 1.97 | 0.00 | 1.97 | 0.16 | | | | |
| | 60-75 | 1.23 | 0.92 | 0.00 | 0.92 | 6.73 | 1.72 | 0.00 | 1.72 | 0.13 | | | | |
| | 75-90 | 1.25 | 1.40 | 0.47 | 0.93 | 6.63 | 2.68 | 0.90 | 1.78 | 0.13 | | | | |
| CRP 211 | 0-10 | 1.17 | 2.56 | 0.00 | 2.56 | 13.79 | 3.05 | 0.00 | 3.05 | 0.16 | 18.12 | 3.41 | 14.71 | 0.96 |
| | 10-20 | 1.30 | 2.06 | 0.00 | 2.06 | 10.23 | 2.71 | 0.00 | 2.71 | 0.13 | | | | |
| | 20-30 | 1.23 | 1.50 | 0.00 | 1.50 | 11.03 | 1.87 | 0.00 | 1.87 | 0.14 | | | | |
| | 30-45 | 1.10 | 1.09 | 0.00 | 1.09 | 8.64 | 1.83 | 0.00 | 1.83 | 0.15 | | | | |
| | 45-60 | 1.26 | 0.94 | 0.00 | 0.94 | 6.71 | 1.81 | 0.00 | 1.81 | 0.13 | | | | |

Table C2. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | TOC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g cm⁻³--- | -------Percent------- | | | -mg/L- | ---kg $m^{-2}$ $depth^{-1}$--- | | | | | | | |
| CRP 211 (cont.) | 60-75 | 1.30 | 0.84 | 0.00 | 0.84 | 7.17 | 1.67 | 0.00 | 1.67 | 0.14 | | | | |
| | 75-90 | 1.35 | 2.52 | 1.66 | 0.86 | 4.97 | 5.18 | 3.41 | 1.77 | 0.10 | | | | |
| CRP 212 | 0-10 | 1.16 | 2.80 | 0.00 | 2.80 | 9.32 | 3.30 | 0.00 | 3.30 | 0.11 | 19.11 | 1.36 | 17.75 | 0.97 |
| | 10-20 | 1.36 | 2.34 | 0.00 | 2.34 | 14.73 | 3.22 | 0.00 | 3.22 | 0.20 | | | | |
| | 20-30 | 1.12 | 2.33 | 0.00 | 2.33 | 14.45 | 2.64 | 0.00 | 2.64 | 0.16 | | | | |
| | 30-45 | 1.26 | 1.28 | 0.00 | 1.28 | 7.64 | 2.46 | 0.00 | 2.46 | 0.15 | | | | |
| | 45-60 | 1.26 | 1.10 | 0.00 | 1.10 | 7.19 | 2.11 | 0.00 | 2.11 | 0.14 | | | | |
| | 60-75 | 1.30 | 0.99 | 0.00 | 0.99 | 6.41 | 1.96 | 0.00 | 1.96 | 0.13 | | | | |
| | 75-90 | 1.35 | 1.66 | 0.66 | 1.00 | 4.13 | 3.41 | 1.36 | 2.06 | 0.09 | | | | |
| CRP 319 | 0-10 | 1.14 | 3.39 | 0.00 | 3.39 | 15.17 | 3.92 | 0.00 | 3.92 | 0.18 | 22.28 | 0.00 | 22.28 | 1.35 |
| | 10-20 | 1.31 | 3.02 | 0.00 | 3.02 | 12.75 | 4.02 | 0.00 | 4.02 | 0.17 | | | | |
| | 20-30 | 1.31 | 2.84 | 0.00 | 2.84 | 11.72 | 3.77 | 0.00 | 3.77 | 0.16 | | | | |
| | 30-45 | 1.26 | 2.06 | 0.00 | 2.06 | 12.29 | 3.95 | 0.00 | 3.95 | 0.24 | | | | |
| | 45-60 | 1.30 | 1.35 | 0.00 | 1.35 | 12.83 | 2.67 | 0.00 | 2.67 | 0.25 | | | | |
| | 60-75 | 1.31 | 1.11 | 0.00 | 1.11 | 9.89 | 2.22 | 0.00 | 2.22 | 0.20 | | | | |
| | 75-90 | 1.36 | 0.83 | 0.00 | 0.83 | 7.80 | 1.73 | 0.00 | 1.73 | 0.16 | | | | |
| CRP 320 | 0-10 | 1.06 | 3.71 | 0.00 | 3.71 | 17.43 | 4.01 | 0.00 | 4.01 | 0.19 | 40.74 | 0.00 | 40.74 | 1.41 |
| | 10-20 | 1.29 | 3.11 | 0.00 | 3.11 | 12.78 | 4.08 | 0.00 | 4.08 | 0.17 | | | | |
| | 20-30 | 1.25 | 3.07 | 0.00 | 3.07 | 11.82 | 3.90 | 0.00 | 3.90 | 0.15 | | | | |
| | 30-45 | 1.17 | 3.34 | 0.00 | 3.34 | 10.93 | 5.95 | 0.00 | 5.95 | 0.19 | | | | |
| | 45-60 | 1.09 | 3.99 | 0.00 | 3.99 | 10.38 | 6.64 | 0.00 | 6.64 | 0.17 | | | | |
| | 60-75 | 1.30 | 4.42 | 0.00 | 4.42 | 13.68 | 8.77 | 0.00 | 8.77 | 0.27 | | | | |
| | 75-90 | 1.35 | 3.60 | 0.00 | 3.60 | 12.86 | 7.40 | 0.00 | 7.40 | 0.26 | | | | |
| CRP 417 | 0-10 | 1.14 | 3.71 | 0.00 | 3.71 | 17.47 | 4.28 | 0.00 | 4.28 | 0.20 | 21.42 | 0.00 | 21.42 | 1.57 |
| | 10-20 | 1.17 | 2.79 | 0.00 | 2.79 | 16.49 | 3.32 | 0.00 | 3.32 | 0.20 | | | | |
| | 20-30 | 1.17 | 3.01 | 0.00 | 3.01 | 16.33 | 3.57 | 0.00 | 3.57 | 0.19 | | | | |
| | 30-45 | 1.17 | 1.87 | 0.00 | 1.87 | 15.28 | 3.32 | 0.00 | 3.32 | 0.27 | | | | |

Table C2. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | TOC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | --------kg m$^{-2}$ depth$^{-1}$-------- | | | | | | | |
| CRP 417 (cont.) | 45-60 | 1.23 | 1.51 | 0.00 | 1.51 | 11.71 | 2.82 | 0.00 | 2.82 | 0.22 | | | | |
| | 60-75 | 1.38 | 1.16 | 0.00 | 1.16 | 13.35 | 2.44 | 0.00 | 2.44 | 0.28 | | | | |
| | 75-90 | 1.30 | 0.84 | 0.00 | 0.84 | 10.48 | 1.66 | 0.00 | 1.66 | 0.21 | | | | |
| CRP 418 | 0-10 | 1.17 | 3.35 | 0.00 | 3.35 | 13.01 | 3.97 | 0.00 | 3.97 | 0.15 | 20.59 | 0.00 | 20.59 | 1.14 |
| | 10-20 | 1.27 | 2.94 | 0.00 | 2.94 | 10.47 | 3.80 | 0.00 | 3.80 | 0.14 | | | | |
| | 20-30 | 1.21 | 3.23 | 0.00 | 3.23 | 10.04 | 3.96 | 0.00 | 3.96 | 0.12 | | | | |
| | 30-45 | 1.22 | 2.27 | 0.00 | 2.27 | 9.69 | 4.22 | 0.00 | 4.22 | 0.18 | | | | |
| | 45-60 | 1.34 | 1.47 | 0.00 | 1.47 | 10.23 | 3.01 | 0.00 | 3.01 | 0.21 | | | | |
| | 60-75 | 1.45 | 1.17 | 0.00 | 1.17 | 8.09 | 0.00 | 0.00 | 0.00 | 0.18 | | | | |
| | 75-90 | 1.44 | 0.75 | 0.00 | 0.75 | 7.48 | 1.64 | 0.00 | 1.64 | 0.16 | | | | |
| CREC-CK-1‡ | 0-10 | 1.36 | 1.92 | 0.00 | 1.92 | 5.71 | 2.65 | 0.00 | 2.65 | 0.08 | 15.78 | 2.84 | 12.94 | 0.39 |
| | 10-20 | 1.48 | 1.65 | 0.00 | 1.65 | 5.88 | 2.48 | 0.00 | 2.48 | 0.09 | | | | |
| | 20-30 | 1.46 | 1.12 | 0.00 | 1.12 | 4.21 | 1.66 | 0.00 | 1.66 | 0.06 | | | | |
| | 30-45 | 1.41 | 0.75 | 0.00 | 0.75 | 3.20 | 1.61 | 0.00 | 1.61 | 0.07 | | | | |
| | 45-60 | 1.41 | 0.85 | 0.00 | 0.85 | 2.01 | 1.83 | 0.00 | 1.83 | 0.04 | | | | |
| | 60-75 | 1.38 | 0.84 | 0.00 | 0.84 | 1.51 | 1.76 | 0.00 | 1.76 | 0.03 | | | | |
| | 75-90 | 1.47 | 1.69 | 1.27 | 0.42 | 0.91 | 3.78 | 2.84 | 0.94 | 0.02 | | | | |
| CREC-CK-2 | 0-10 | 1.40 | 2.31 | 0.09 | 2.22 | 3.17 | 3.29 | 0.13 | 3.16 | 0.05 | 21.44 | 6.26 | 15.17 | 0.28 |
| | 10-20 | 1.46 | 1.77 | 0.06 | 1.71 | 3.57 | 2.62 | 0.09 | 2.53 | 0.05 | | | | |
| | 20-30 | 1.39 | 1.47 | 0.00 | 1.47 | 3.06 | 2.08 | 0.00 | 2.08 | 0.04 | | | | |
| | 30-45 | 1.32 | 0.97 | 0.00 | 0.97 | 2.27 | 1.96 | 0.00 | 1.96 | 0.05 | | | | |
| | 45-60 | 1.45 | 0.91 | 0.00 | 0.91 | 1.46 | 2.01 | 0.00 | 2.01 | 0.03 | | | | |
| | 60-75 | 1.48 | 1.83 | 1.09 | 0.74 | 1.28 | 4.13 | 2.46 | 1.67 | 0.03 | | | | |
| | 75-90 | 1.70 | 2.06 | 1.38 | 0.68 | 1.32 | 5.35 | 3.58 | 1.77 | 0.03 | | | | |
| CREC-CK-3 | 0-10 | 1.21 | 2.54 | 0.00 | 2.54 | 6.71 | 3.12 | 0.00 | 3.12 | 0.08 | 26.42 | 11.31 | 15.11 | 0.37 |
| | 10-20 | 1.45 | 2.10 | 0.00 | 2.10 | 3.94 | 3.10 | 0.00 | 3.10 | 0.06 | | | | |
| | 20-30 | 1.28 | 1.94 | 0.00 | 1.94 | 5.48 | 2.52 | 0.00 | 2.52 | 0.07 | | | | |

Table C2.  Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | TOC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | -------kg m$^{-2}$ depth$^{-1}$------- | | | | | | | |
| CREC-CK-3 (cont.) | 30-45 | 1.32 | 1.16 | 0.00 | 1.16 | 3.69 | 2.33 | 0.00 | 2.33 | 0.07 | | | | |
| | 45-60 | 1.29 | 1.36 | 0.13 | 1.23 | 2.13 | 2.68 | 0.26 | 2.42 | 0.04 | | | | |
| | 60-75 | 1.30 | 3.05 | 2.61 | 0.44 | 1.15 | 6.03 | 5.16 | 0.87 | 0.02 | | | | |
| | 75-90 | 1.49 | 2.92 | 2.59 | 0.33 | 0.73 | 6.65 | 5.90 | 0.75 | 0.02 | | | | |
| CREC-CK-4 | 0-10 | 1.18 | 2.24 | 0.00 | 2.24 | 0.50 | 2.70 | 0.00 | 2.70 | 0.01 | 21.53 | 5.84 | 15.69 | 0.35 |
| | 10-20 | 1.50 | 1.77 | 0.00 | 1.77 | 0.50 | 2.69 | 0.00 | 2.69 | 0.01 | | | | |
| | 20-30 | 1.37 | 1.59 | 0.00 | 1.59 | 3.63 | 2.22 | 0.00 | 2.22 | 0.05 | | | | |
| | 30-45 | 1.43 | 0.93 | 0.00 | 0.93 | 3.36 | 2.02 | 0.00 | 2.02 | 0.07 | | | | |
| | 45-60 | 1.40 | 1.40 | 0.27 | 1.13 | 4.20 | 3.00 | 0.58 | 2.42 | 0.09 | | | | |
| | 60-75 | 1.54 | 1.35 | 0.42 | 0.93 | 2.18 | 3.16 | 0.98 | 2.18 | 0.05 | | | | |
| | 75-90 | 1.85 | 2.04 | 1.52 | 0.52 | 2.55 | 5.74 | 4.28 | 1.46 | 0.07 | | | | |

†Alkar 105 represents *Thinopyrum ponticum* var. Alkar, Haymaker: *Agropyron intermedium* var. Haymaker, Sunburst: *Panicum virgatum* var. Sunburst, Trailblazer: *Panicum virgatum* var. Trailblazer, and CRP: Conservation Reserve Program mixture.

‡CREC-CK-1 represents Carrington (CREC) cropland check (CK) repetition 1 of 4.

Table C3. Dickinson total, inorganic, organic, and water soluble organic carbon concentration and mass by soil depth increment.

| Sample | | | Carbon Concentration | | | | Carbon Mass | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number | Depth | B.D. | TC | IC | OC | WSOC | TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | Sum WSOC |
| | ---cm--- | ---g $cm^{-3}$--- | -------Percent------- | | | -mg/L- | --------------------------------------kg $m^{-2}$ $depth^{-1}$-------------------------------------- | | | | | | | |
| CW-PT3R1-1† | 0-10 | 1.42 | 1.92 | 0.00 | 1.92 | 14.76 | 2.76 | 0.00 | 2.76 | 0.21 | 14.12 | 3.65 | 10.47 | 0.74 |
| | 10-20 | 1.45 | 0.99 | 0.00 | 0.99 | 11.01 | 1.46 | 0.00 | 1.46 | 0.16 | | | | |
| | 20-30 | 1.44 | 0.77 | 0.00 | 0.77 | 5.67 | 1.13 | 0.00 | 1.13 | 0.08 | | | | |
| | 30-45 | 1.38 | 0.90 | 0.00 | 0.90 | 4.08 | 1.89 | 0.00 | 1.89 | 0.09 | | | | |
| | 45-60 | 1.31 | 1.28 | 0.43 | 0.85 | 5.09 | 2.56 | 0.86 | 1.70 | 0.10 | | | | |
| | 60-75 | 1.34 | 1.22 | 0.81 | 0.41 | 2.82 | 2.49 | 1.65 | 0.84 | 0.06 | | | | |
| | 75-90 | 1.24 | 0.97 | 0.60 | 0.37 | 1.75 | 1.84 | 1.14 | 0.70 | 0.03 | | | | |
| CW-PT3R1-2 | 0-10 | 1.47 | 2.29 | 0.00 | 2.29 | 10.67 | 3.43 | 0.00 | 3.43 | 0.16 | 15.33 | 3.88 | 11.45 | 0.60 |
| | 10-20 | 1.42 | 1.04 | 0.00 | 1.04 | 4.04 | 1.50 | 0.00 | 1.50 | 0.06 | | | | |
| | 20-30 | 1.48 | 0.85 | 0.00 | 0.85 | 4.51 | 1.28 | 0.00 | 1.28 | 0.07 | | | | |
| | 30-45 | 1.37 | 0.94 | 0.00 | 0.94 | 4.32 | 1.96 | 0.00 | 1.96 | 0.09 | | | | |
| | 45-60 | 1.28 | 1.54 | 0.82 | 0.72 | 4.88 | 3.00 | 1.60 | 1.40 | 0.10 | | | | |
| | 60-75 | 1.28 | 1.42 | 0.85 | 0.57 | 3.51 | 2.77 | 1.66 | 1.11 | 0.07 | | | | |
| | 75-90 | 1.47 | 0.62 | 0.28 | 0.34 | 2.62 | 1.39 | 0.63 | 0.76 | 0.06 | | | | |
| CW-PT4R5-3 | 0-10 | 1.61 | 1.09 | 0.00 | 1.09 | 11.75 | 1.78 | 0.00 | 1.78 | 0.19 | 16.05 | 0.56 | 15.49 | 0.51 |
| | 10-20 | 1.35 | 1.99 | 0.00 | 1.99 | 3.96 | 2.73 | 0.00 | 2.73 | 0.05 | | | | |
| | 20-30 | 1.57 | 0.97 | 0.00 | 0.97 | 5.34 | 1.55 | 0.00 | 1.55 | 0.09 | | | | |
| | 30-45 | 1.49 | 1.41 | 0.00 | 1.41 | 2.60 | 3.20 | 0.00 | 3.20 | 0.06 | | | | |
| | 45-60 | 1.36 | 1.18 | 0.00 | 1.18 | 2.35 | 2.45 | 0.00 | 2.45 | 0.05 | | | | |
| | 60-75 | 1.44 | 1.19 | 0.00 | 1.19 | 1.57 | 2.60 | 0.00 | 2.60 | 0.03 | | | | |
| | 75-90 | 1.59 | 0.72 | 0.23 | 0.49 | 1.69 | 1.74 | 0.56 | 1.19 | 0.04 | | | | |
| CW-PT4R5-4 | 0-10 | 1.20 | 1.80 | 0.00 | 1.80 | 1.20 | 2.20 | 0.00 | 2.20 | 0.16 | 17.78 | 2.00 | 15.78 | 0.69 |
| | 10-20 | 1.45 | 1.36 | 0.00 | 1.36 | 1.45 | 2.00 | 0.00 | 2.00 | 0.14 | | | | |
| | 20-30 | 1.33 | 0.97 | 0.00 | 0.97 | 1.33 | 1.31 | 0.00 | 1.31 | 0.11 | | | | |
| | 30-45 | 1.38 | 0.89 | 0.00 | 0.89 | 1.38 | 1.88 | 0.00 | 1.88 | 0.09 | | | | |
| | 45-60 | 1.33 | 1.46 | 0.00 | 1.46 | 1.33 | 2.96 | 0.00 | 2.96 | 0.08 | | | | |
| | 60-75 | 1.57 | 1.88 | 0.34 | 1.54 | 1.57 | 4.50 | 0.81 | 3.69 | 0.07 | | | | |

Table C3. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | OC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | ---kg m$^{-2}$ depth$^{-1}$--- | | | | | | | |
| CW-PT4R5-4 (cont.) | 75-90 | 1.46 | 1.31 | 0.53 | 0.78 | 1.46 | 2.92 | 1.18 | 1.74 | 0.04 | | | | |
| CW-NT3R1-1 | 0-10 | 1.25 | 2.22 | 0.00 | 2.22 | 14.47 | 2.82 | 0.00 | 2.82 | 0.18 | 15.09 | 3.11 | 11.98 | 0.72 |
| | 10-20 | 1.48 | 1.12 | 0.00 | 1.12 | 11.05 | 1.69 | 0.00 | 1.69 | 0.17 | | | | |
| | 20-30 | 1.42 | 0.82 | 0.00 | 0.82 | 7.84 | 1.18 | 0.00 | 1.18 | 0.11 | | | | |
| | 30-45 | 1.38 | 0.77 | 0.00 | 0.77 | 4.43 | 1.62 | 0.00 | 1.62 | 0.09 | | | | |
| | 45-60 | 1.55 | 0.81 | 0.00 | 0.81 | 3.28 | 1.92 | 0.00 | 1.92 | 0.08 | | | | |
| | 60-75 | 1.43 | 1.13 | 0.37 | 0.76 | 2.16 | 2.47 | 0.81 | 1.66 | 0.05 | | | | |
| | 75-90 | 1.46 | 1.52 | 1.03 | 0.49 | 1.59 | 3.39 | 2.30 | 1.09 | 0.04 | | | | |
| CW-NT3R1-2 | 0-10 | 1.35 | 1.95 | 0.00 | 1.95 | 11.36 | 2.68 | 0.00 | 2.68 | 0.16 | 15.70 | 3.68 | 12.02 | 0.59 |
| | 10-20 | 1.46 | 1.23 | 0.00 | 1.23 | 8.16 | 1.83 | 0.00 | 1.83 | 0.12 | | | | |
| | 20-30 | 1.38 | 1.12 | 0.00 | 1.12 | 7.16 | 1.57 | 0.00 | 1.57 | 0.10 | | | | |
| | 30-45 | 1.25 | 0.87 | 0.00 | 0.87 | 4.04 | 1.65 | 0.00 | 1.65 | 0.08 | | | | |
| | 45-60 | 1.46 | 0.84 | 0.00 | 0.84 | 2.58 | 1.87 | 0.00 | 1.87 | 0.06 | | | | |
| | 60-75 | 1.22 | 1.39 | 0.46 | 0.93 | 2.12 | 2.58 | 0.86 | 1.73 | 0.04 | | | | |
| | 75-90 | 1.56 | 1.48 | 1.19 | 0.29 | 1.72 | 3.52 | 2.83 | 0.69 | 0.04 | | | | |
| CW-NT3R5-3 | 0-10 | 1.11 | 1.82 | 0.00 | 1.82 | 7.49 | 2.05 | 0.00 | 2.05 | 0.08 | 12.84 | 2.22 | 10.62 | 0.49 |
| | 10-20 | 1.34 | 1.35 | 0.00 | 1.35 | 5.36 | 1.84 | 0.00 | 1.84 | 0.07 | | | | |
| | 20-30 | 1.53 | 1.00 | 0.00 | 1.00 | 5.75 | 1.56 | 0.00 | 1.56 | 0.09 | | | | |
| | 30-45 | 1.47 | 0.80 | 0.00 | 0.80 | 3.65 | 1.79 | 0.00 | 1.79 | 0.08 | | | | |
| | 45-60 | 1.42 | 0.71 | 0.00 | 0.71 | 2.60 | 1.53 | 0.00 | 1.53 | 0.06 | | | | |
| | 60-75 | 1.39 | 0.48 | 0.00 | 0.48 | 2.34 | 1.02 | 0.00 | 1.02 | 0.05 | | | | |
| | 75-90 | 1.28 | 1.57 | 1.14 | 0.43 | 2.85 | 3.05 | 2.22 | 0.84 | 0.06 | | | | |
| CW-NT3R5-4 | 0-10 | 1.30 | 1.79 | 0.00 | 1.79 | 9.97 | 2.36 | 0.00 | 2.36 | 0.13 | 11.52 | 0.48 | 11.04 | 0.60 |
| | 10-20 | 1.49 | 1.21 | 0.00 | 1.21 | 6.92 | 1.83 | 0.00 | 1.83 | 0.10 | | | | |
| | 20-30 | 1.39 | 0.91 | 0.00 | 0.91 | 4.20 | 1.28 | 0.00 | 1.28 | 0.06 | | | | |
| | 30-45 | 1.45 | 0.71 | 0.00 | 0.71 | 3.33 | 1.56 | 0.00 | 1.56 | 0.07 | | | | |
| | 45-60 | 1.41 | 0.64 | 0.00 | 0.64 | 4.27 | 1.37 | 0.00 | 1.37 | 0.09 | | | | |

Table C3. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | OC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | --------------------------------------kg m$^{-2}$ depth$^{-1}$-------------------------------------- | | | | | | | |
| CW-NT3R5-4 (cont.) | 60-75 | 1.42 | 0.68 | 0.00 | 0.68 | 3.64 | 1.48 | 0.00 | 1.48 | 0.08 | | | | |
| | 75-90 | 1.16 | 0.92 | 0.27 | 0.65 | 3.18 | 1.63 | 0.48 | 1.15 | 0.06 | | | | |
| CW-OT3R1-1 | 0-10 | 1.28 | 1.83 | 0.00 | 1.83 | 2.38 | 2.38 | 0.00 | 2.38 | 0.14 | 10.60 | 1.69 | 8.91 | 0.67 |
| | 10-20 | 1.50 | 1.07 | 0.00 | 1.07 | 1.64 | 1.63 | 0.00 | 1.63 | 0.13 | | | | |
| | 20-30 | 1.36 | 0.86 | 0.00 | 0.86 | 1.18 | 1.19 | 0.00 | 1.19 | 0.10 | | | | |
| | 30-45 | 1.49 | 0.69 | 0.00 | 0.69 | 1.51 | 1.56 | 0.00 | 1.56 | 0.11 | | | | |
| | 45-60 | 1.43 | 0.92 | 0.31 | 0.61 | 1.55 | 2.00 | 0.67 | 1.33 | 0.10 | | | | |
| | 60-75 | 1.39 | 0.87 | 0.48 | 0.39 | 1.32 | 1.84 | 1.02 | 0.83 | 0.11 | | | | |
| | 75-90 | | | | | | | | | | | | | |
| CW-OT3R1-2 | 0-10 | 1.30 | 2.05 | 0.00 | 2.05 | 12.36 | 2.71 | 0.00 | 2.71 | 0.16 | 11.04 | 1.81 | 9.23 | 0.81 |
| | 10-20 | 1.42 | 1.04 | 0.00 | 1.04 | 8.90 | 1.50 | 0.00 | 1.50 | 0.13 | | | | |
| | 20-30 | 1.37 | 0.85 | 0.00 | 0.85 | 7.88 | 1.18 | 0.00 | 1.18 | 0.11 | | | | |
| | 30-45 | 1.45 | 0.71 | 0.00 | 0.71 | 5.73 | 1.57 | 0.00 | 1.57 | 0.13 | | | | |
| | 45-60 | 1.40 | 0.99 | 0.39 | 0.60 | 5.50 | 2.11 | 0.83 | 1.28 | 0.12 | | | | |
| | 60-75 | 1.57 | 0.82 | 0.41 | 0.41 | 6.82 | 1.97 | 0.98 | 0.98 | 0.16 | | | | |
| | 75-90 | | | | | | | | | | | | | |
| CW-OT4R9-3 | 0-10 | 1.27 | 2.43 | 0.00 | 2.43 | 11.95 | 3.14 | 0.00 | 3.14 | 0.15 | 13.63 | 2.62 | 11.01 | 0.83 |
| | 10-20 | 1.55 | 1.49 | 0.00 | 1.49 | 12.04 | 2.35 | 0.00 | 2.35 | 0.19 | | | | |
| | 20-30 | 1.30 | 1.05 | 0.00 | 1.05 | 7.38 | 1.38 | 0.00 | 1.38 | 0.10 | | | | |
| | 30-45 | 1.40 | 0.87 | 0.00 | 0.87 | 4.75 | 1.85 | 0.00 | 1.85 | 0.10 | | | | |
| | 45-60 | 1.37 | 0.96 | 0.52 | 0.44 | 4.50 | 2.00 | 1.08 | 0.92 | 0.09 | | | | |
| | 60-75 | 1.46 | 1.04 | 0.69 | 0.35 | 5.54 | 2.32 | 1.54 | 0.78 | 0.12 | | | | |
| | 75-90 | 1.42 | 0.27 | 0.00 | 0.27 | 3.20 | 0.58 | 0.00 | 0.58 | 0.07 | | | | |
| CW-OT4R9-4 | 0-10 | 1.33 | 1.50 | 0.00 | 1.50 | 11.66 | 2.03 | 0.00 | 2.03 | 0.16 | 14.45 | 2.54 | 11.92 | 0.78 |
| | 10-20 | 1.40 | 2.29 | 0.00 | 2.29 | 11.63 | 3.25 | 0.00 | 3.25 | 0.17 | | | | |
| | 20-30 | 1.31 | 0.91 | 0.00 | 0.91 | 5.78 | 1.21 | 0.00 | 1.21 | 0.08 | | | | |
| | 30-45 | 1.55 | 1.15 | 0.00 | 1.15 | 4.43 | 2.71 | 0.00 | 2.71 | 0.10 | | | | |

Table C3. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | OC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | --------------------------------------kg m$^{-2}$ depth$^{-1}$-------------------------------------- | | | | | | | |
| CW-OT4R9-4 (cont.) | 45-60 | 1.28 | 1.02 | 0.51 | 0.51 | 4.20 | 1.98 | 0.99 | 0.99 | 0.08 | | | | |
| | 60-75 | 1.53 | 1.09 | 0.66 | 0.43 | 5.32 | 2.55 | 1.54 | 1.01 | 0.12 | | | | |
| | 75-90 | 1.34 | 0.35 | 0.00 | 0.35 | 3.22 | 0.72 | 0.00 | 0.72 | 0.07 | | | | |
| KB-PT3R10-1 | 0-10 | 1.43 | 1.97 | 0.00 | 1.97 | 13.28 | 2.86 | 0.00 | 2.86 | 0.19 | 13.24 | 1.39 | 11.85 | 0.84 |
| | 10-20 | 1.31 | 1.49 | 0.00 | 1.49 | 9.30 | 1.98 | 0.00 | 1.98 | 0.12 | | | | |
| | 20-30 | 1.43 | 1.27 | 0.00 | 1.27 | 9.07 | 1.84 | 0.00 | 1.84 | 0.13 | | | | |
| | 30-45 | 1.47 | 0.88 | 0.00 | 0.88 | 6.60 | 1.97 | 0.00 | 1.97 | 0.15 | | | | |
| | 45-60 | 1.41 | 0.63 | 0.00 | 0.63 | 3.86 | 1.35 | 0.00 | 1.35 | 0.08 | | | | |
| | 60-75 | 1.49 | 0.89 | 0.41 | 0.48 | 3.71 | 2.02 | 0.93 | 1.09 | 0.08 | | | | |
| | 75-90 | 1.58 | 0.50 | 0.19 | 0.31 | 3.36 | 1.21 | 0.46 | 0.75 | 0.08 | | | | |
| KB-PT3R10-2 | 0-10 | 1.45 | 2.11 | 0.00 | 2.11 | 9.08 | 3.11 | 0.00 | 3.11 | 0.13 | 14.31 | 2.95 | 11.36 | 0.72 |
| | 10-20 | 1.28 | 1.46 | 0.00 | 1.46 | 11.80 | 1.89 | 0.00 | 1.89 | 0.15 | | | | |
| | 20-30 | 1.48 | 1.04 | 0.00 | 1.04 | 7.21 | 1.57 | 0.00 | 1.57 | 0.11 | | | | |
| | 30-45 | 1.48 | 0.79 | 0.00 | 0.79 | 4.56 | 1.78 | 0.00 | 1.78 | 0.10 | | | | |
| | 45-60 | 1.53 | 0.98 | 0.30 | 0.68 | 3.62 | 2.28 | 0.70 | 1.58 | 0.08 | | | | |
| | 60-75 | 1.38 | 1.31 | 0.87 | 0.44 | 3.68 | 2.75 | 1.83 | 0.92 | 0.08 | | | | |
| | 75-90 | 1.27 | 0.48 | 0.22 | 0.26 | 3.32 | 0.93 | 0.42 | 0.50 | 0.06 | | | | |
| KB-PT3R2-3 | 0-10 | 1.19 | 2.64 | 0.00 | 2.64 | 19.30 | 3.20 | 0.00 | 3.20 | 0.23 | 14.43 | 0.00 | 14.43 | 1.02 |
| | 10-20 | 1.49 | 1.88 | 0.00 | 1.88 | 16.56 | 2.85 | 0.00 | 2.85 | 0.25 | | | | |
| | 20-30 | 1.27 | 1.46 | 0.00 | 1.46 | 9.41 | 1.88 | 0.00 | 1.88 | 0.12 | | | | |
| | 30-45 | 1.45 | 0.94 | 0.00 | 0.94 | 5.43 | 2.07 | 0.00 | 2.07 | 0.12 | | | | |
| | 45-60 | 1.57 | 0.71 | 0.00 | 0.71 | 5.09 | 1.69 | 0.00 | 1.69 | 0.12 | | | | |
| | 60-75 | 1.47 | 0.56 | 0.00 | 0.56 | 4.36 | 1.25 | 0.00 | 1.25 | 0.10 | | | | |
| | 75-90 | 1.62 | 0.60 | 0.00 | 0.60 | 3.17 | 1.48 | 0.00 | 1.48 | 0.08 | | | | |
| KB-PT3R2-4 | 0-10 | 1.28 | 2.63 | 0.00 | 2.63 | 12.94 | 3.42 | 0.00 | 3.42 | 12.94 | 14.73 | 0.00 | 14.73 | 48.21 |
| | 10-20 | 1.25 | 1.80 | 0.00 | 1.80 | 9.80 | 2.28 | 0.00 | 2.28 | 9.80 | | | | |
| | 20-30 | 1.39 | 1.49 | 0.00 | 1.49 | 8.29 | 2.11 | 0.00 | 2.11 | 8.29 | | | | |

Table C3. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | OC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | --------------------------------------kg m$^{-2}$ depth$^{-1}$-------------------------------------- | | | | | | | |
| KB-PT3R2-4 (cont.) | 30-45 | 1.35 | 1.05 | 0.00 | 1.05 | 6.33 | 2.16 | 0.00 | 2.16 | 6.33 | | | | |
| | 45-60 | 1.45 | 0.75 | 0.00 | 0.75 | 4.72 | 1.66 | 0.00 | 1.66 | 4.72 | | | | |
| | 60-75 | 1.51 | 0.61 | 0.00 | 0.61 | 3.41 | 1.40 | 0.00 | 1.40 | 3.41 | | | | |
| | 75-90 | 1.64 | 0.68 | 0.00 | 0.68 | 2.71 | 1.70 | 0.00 | 1.70 | 2.71 | | | | |
| KB-OT2R7-1 | 0-10 | 12.94 | 1.91 | 0.00 | 1.91 | 10.95 | 2.75 | 0.00 | 2.75 | 10.95 | 16.37 | 2.32 | 14.05 | 47.31 |
| | 10-20 | 9.80 | 1.35 | 0.00 | 1.35 | 9.88 | 1.86 | 0.00 | 1.86 | 9.88 | | | | |
| | 20-30 | 8.29 | 1.09 | 0.00 | 1.09 | 7.72 | 1.49 | 0.00 | 1.49 | 7.72 | | | | |
| | 30-45 | 6.33 | 1.01 | 0.00 | 1.01 | 5.89 | 2.22 | 0.00 | 2.22 | 5.89 | | | | |
| | 45-60 | 4.72 | 1.36 | 0.46 | 0.90 | 4.78 | 3.43 | 1.16 | 2.27 | 4.78 | | | | |
| | 60-75 | 3.41 | 1.34 | 0.35 | 0.99 | 4.32 | 2.81 | 0.73 | 2.07 | 4.32 | | | | |
| | 75-90 | 2.71 | 0.89 | 0.21 | 0.68 | 3.77 | 1.81 | 0.43 | 1.38 | 3.77 | | | | |
| KB-OT2R7-2 | 0-10 | 1.22 | 1.83 | 0.00 | 1.83 | 10.95 | 2.28 | 0.00 | 2.28 | 0.11 | 15.88 | 1.83 | 14.05 | 0.68 |
| | 10-20 | 1.49 | 1.32 | 0.00 | 1.32 | 9.88 | 2.00 | 0.00 | 2.00 | 0.06 | | | | |
| | 20-30 | 1.43 | 1.04 | 0.00 | 1.04 | 7.72 | 1.52 | 0.00 | 1.52 | 0.08 | | | | |
| | 30-45 | 1.51 | 1.03 | 0.00 | 1.03 | 5.89 | 2.36 | 0.00 | 2.36 | 0.13 | | | | |
| | 45-60 | 1.50 | 1.21 | 0.16 | 1.05 | 4.78 | 2.76 | 0.37 | 2.40 | 0.09 | | | | |
| | 60-75 | 1.34 | 1.48 | 0.57 | 0.91 | 4.32 | 3.03 | 1.17 | 1.86 | 0.10 | | | | |
| | 75-90 | 1.49 | 0.85 | 0.13 | 0.72 | 3.77 | 1.93 | 0.29 | 1.63 | 0.10 | | | | |
| KB-OT4R8-3 | 0-10 | 1.43 | 1.90 | 0.00 | 1.90 | 9.66 | 2.76 | 0.00 | 1.90 | 0.14 | 17.18 | 2.35 | 8.20 | 0.83 |
| | 10-20 | 1.47 | 1.26 | 0.00 | 1.26 | 7.11 | 1.88 | 0.00 | 1.26 | 0.11 | | | | |
| | 20-30 | 1.45 | 1.01 | 0.00 | 1.01 | 8.74 | 1.49 | 0.00 | 1.01 | 0.13 | | | | |
| | 30-45 | 1.49 | 0.99 | 0.00 | 0.99 | 6.69 | 2.26 | 0.00 | 0.99 | 0.15 | | | | |
| | 45-60 | 1.30 | 1.69 | 0.00 | 1.69 | 6.48 | 3.34 | 0.00 | 1.69 | 0.13 | | | | |
| | 60-75 | 1.40 | 1.11 | 0.21 | 0.90 | 3.15 | 2.37 | 0.45 | 0.90 | 0.07 | | | | |
| | 75-90 | 1.73 | 1.17 | 0.72 | 0.45 | 4.10 | 3.08 | 1.90 | 0.45 | 0.11 | | | | |
| KB-OT4R8-4 | 0-10 | 1.34 | 1.89 | 0.00 | 1.89 | 6.79 | 2.57 | 0.00 | 2.57 | 0.09 | 16.52 | 1.73 | 14.79 | 0.73 |

Table C3. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | OC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | ---kg m$^{-2}$ depth$^{-1}$--- | | | | | | | |
| KB-OT4R8-4 (Cont.) | 10-20 | 1.48 | 1.18 | 0.00 | 1.18 | 8.34 | 1.78 | 0.00 | 1.78 | 0.13 | | | | |
| | 20-30 | 1.47 | 0.98 | 0.00 | 0.98 | 7.44 | 1.46 | 0.00 | 1.46 | 0.11 | | | | |
| | 30-45 | 1.56 | 0.82 | 0.00 | 0.82 | 6.81 | 1.95 | 0.00 | 1.95 | 0.16 | | | | |
| | 45-60 | 1.33 | 1.59 | 0.00 | 1.59 | 4.51 | 3.22 | 0.00 | 3.22 | 0.09 | | | | |
| | 60-75 | 1.42 | 1.22 | 0.00 | 1.22 | 3.98 | 2.64 | 0.00 | 2.64 | 0.09 | | | | |
| | 75-90 | 1.62 | 1.17 | 0.70 | 0.47 | 2.44 | 2.90 | 1.73 | 1.16 | 0.06 | | | | |
| KB-NT1R7-1 | 0-10 | 1.37 | 1.95 | 0.00 | 1.95 | 14.04 | 2.72 | 0.00 | 2.72 | 0.20 | 15.33 | 4.12 | 11.21 | 0.54 |
| | 10-20 | 1.31 | 0.87 | 0.00 | 0.87 | 7.37 | 1.16 | 0.00 | 1.16 | 0.10 | | | | |
| | 20-30 | 1.18 | 0.74 | 0.00 | 0.74 | 4.88 | 0.89 | 0.00 | 0.89 | 0.06 | | | | |
| | 30-45 | 1.40 | 0.65 | 0.00 | 0.65 | 3.71 | 1.39 | 0.00 | 1.39 | 0.08 | | | | |
| | 45-60 | 1.30 | 0.80 | 0.00 | 0.80 | 2.40 | 1.58 | 0.00 | 1.58 | 0.05 | | | | |
| | 60-75 | 1.37 | 1.84 | 0.89 | 0.95 | 1.71 | 3.83 | 1.85 | 1.98 | 0.04 | | | | |
| | 75-90 | 1.18 | 2.09 | 1.26 | 0.83 | 1.53 | 3.76 | 2.27 | 1.49 | 0.03 | | | | |
| KB-NT1R7-2 | 0-10 | 1.60 | 2.14 | 0.00 | 2.14 | 13.48 | 3.47 | 0.00 | 3.47 | 0.22 | 17.41 | 4.47 | 12.94 | 0.57 |
| | 10-20 | 1.49 | 0.92 | 0.00 | 0.92 | 7.21 | 1.40 | 0.00 | 1.40 | 0.11 | | | | |
| | 20-30 | 1.34 | 0.82 | 0.00 | 0.82 | 5.58 | 1.11 | 0.00 | 1.11 | 0.08 | | | | |
| | 30-45 | 1.39 | 0.76 | 0.00 | 0.76 | 2.49 | 1.61 | 0.00 | 1.61 | 0.05 | | | | |
| | 45-60 | 1.31 | 1.09 | 0.24 | 0.85 | 2.21 | 2.17 | 0.48 | 1.69 | 0.04 | | | | |
| | 60-75 | 1.27 | 1.74 | 0.86 | 0.88 | 1.79 | 3.36 | 1.66 | 1.70 | 0.03 | | | | |
| | 75-90 | 1.30 | 2.17 | 1.18 | 0.99 | 1.51 | 4.29 | 2.33 | 1.96 | 0.03 | | | | |
| KB-NT2R6-3 | 0-10 | 1.25 | 1.99 | 0.00 | 1.99 | 7.87 | 2.52 | 0.00 | 2.52 | 0.10 | 11.22 | 1.90 | 9.32 | 0.59 |
| | 10-20 | 1.35 | 1.28 | 0.00 | 1.28 | 9.63 | 1.76 | 0.00 | 1.76 | 0.13 | | | | |
| | 20-30 | 1.41 | 0.97 | 0.00 | 0.97 | 4.96 | 1.39 | 0.00 | 1.39 | 0.07 | | | | |
| | 30-45 | 1.50 | 0.72 | 0.00 | 0.72 | 3.97 | 1.65 | 0.00 | 1.65 | 0.09 | | | | |
| | 45-60 | 1.40 | 1.08 | 0.75 | 0.33 | 2.93 | 2.31 | 1.61 | 0.71 | 0.06 | | | | |
| | 60-75 | 1.47 | 0.51 | 0.13 | 0.38 | 3.00 | 1.14 | 0.29 | 0.85 | 0.07 | | | | |
| | 75-90 | 1.54 | 0.19 | 0.00 | 0.19 | 2.83 | 0.44 | 0.00 | 0.44 | 0.07 | | | | |

Table C3. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | OC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | ---kg m$^{-2}$ depth$^{-1}$--- | | | | | | | |
| KB-NT2R6-4 | 0-10 | 1.16 | 2.01 | 0.00 | 2.01 | 7.64 | 2.36 | 0.00 | 2.36 | 0.09 | 11.67 | 2.50 | 9.17 | 0.46 |
| | 10-20 | 1.36 | 1.25 | 0.00 | 1.25 | 5.89 | 1.73 | 0.00 | 1.73 | 0.08 | | | | |
| | 20-30 | 1.39 | 0.94 | 0.00 | 0.94 | 3.62 | 1.33 | 0.00 | 1.33 | 0.05 | | | | |
| | 30-45 | 1.50 | 0.74 | 0.00 | 0.74 | 3.19 | 1.69 | 0.00 | 1.69 | 0.07 | | | | |
| | 45-60 | 1.45 | 1.31 | 0.93 | 0.38 | 2.64 | 2.89 | 2.06 | 0.84 | 0.06 | | | | |
| | 60-75 | 1.33 | 0.53 | 0.22 | 0.31 | 2.42 | 1.08 | 0.45 | 0.63 | 0.05 | | | | |
| | 75-90 | 1.47 | 0.26 | 0.00 | 0.26 | 2.74 | 0.58 | 0.00 | 0.58 | 0.06 | | | | |
| SB-NT7R10-1 | 0-10 | 1.30 | 2.18 | 0.00 | 2.18 | 13.47 | 2.89 | 0.00 | 2.89 | 0.18 | 15.68 | 2.14 | 13.53 | 0.85 |
| | 10-20 | 1.41 | 1.39 | 0.00 | 1.39 | 9.75 | 1.99 | 0.00 | 1.99 | 0.14 | | | | |
| | 20-30 | 1.57 | 1.31 | 0.00 | 1.31 | 8.23 | 2.09 | 0.00 | 2.09 | 0.13 | | | | |
| | 30-45 | 1.45 | 1.05 | 0.00 | 1.05 | 5.77 | 2.32 | 0.00 | 2.32 | 0.13 | | | | |
| | 45-60 | 1.56 | 0.75 | 0.00 | 0.75 | 5.49 | 1.78 | 0.00 | 1.78 | 0.13 | | | | |
| | 60-75 | 1.34 | 1.25 | 0.44 | 0.81 | 4.25 | 2.56 | 0.90 | 1.66 | 0.09 | | | | |
| | 75-90 | 1.36 | 0.99 | 0.60 | 0.39 | 2.86 | 2.05 | 1.24 | 0.81 | 0.06 | | | | |
| SB-NT7R10-2 | 0-10 | 1.47 | 0.22 | 0.00 | 0.22 | 12.15 | 0.33 | 0.00 | 0.33 | 0.18 | 11.99 | 2.15 | 9.84 | 0.96 |
| | 10-20 | 1.36 | 1.44 | 0.00 | 1.44 | 10.83 | 1.99 | 0.00 | 1.99 | 0.15 | | | | |
| | 20-30 | 1.35 | 1.41 | 0.00 | 1.41 | 10.28 | 1.94 | 0.00 | 1.94 | 0.14 | | | | |
| | 30-45 | 1.35 | 1.01 | 0.00 | 1.01 | 8.89 | 2.07 | 0.00 | 2.07 | 0.18 | | | | |
| | 45-60 | 1.38 | 0.76 | 0.00 | 0.76 | 6.42 | 1.60 | 0.00 | 1.60 | 0.14 | | | | |
| | 60-75 | 1.52 | 0.89 | 0.41 | 0.48 | 4.19 | 2.06 | 0.95 | 1.11 | 0.10 | | | | |
| | 75-90 | 1.35 | 0.97 | 0.58 | 0.39 | 3.34 | 2.00 | 1.20 | 0.80 | 0.07 | | | | |
| SB-NT5R3-3 | 0-10 | 1.23 | 2.37 | 0.00 | 2.37 | 19.20 | 2.97 | 0.00 | 2.97 | 0.24 | 10.89 | 0.00 | 10.89 | 1.04 |
| | 10-20 | 1.55 | 1.31 | 0.00 | 1.31 | 10.42 | 2.06 | 0.00 | 2.06 | 0.16 | | | | |
| | 20-30 | 1.51 | 0.97 | 0.00 | 0.97 | 10.25 | 1.49 | 0.00 | 1.49 | 0.16 | | | | |
| | 30-45 | 1.49 | 0.82 | 0.00 | 0.82 | 7.96 | 1.86 | 0.00 | 1.86 | 0.18 | | | | |
| | 45-60 | 1.51 | 0.58 | 0.00 | 0.58 | 6.28 | 1.33 | 0.00 | 1.33 | 0.14 | | | | |
| | 60-75 | 1.51 | 0.51 | 0.00 | 0.51 | 6.45 | 1.18 | 0.00 | 1.18 | 0.15 | | | | |

Table C3. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | OC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | ---kg m$^{-2}$ depth$^{-1}$--- | | | | | | | |
| SB-NT5R3-3 (Cont.) | 75-90 | | | | | | | | | | | | | |
| SB-NT5R3-4 | 0-10 | 1.32 | 1.96 | 0.00 | 1.96 | 11.21 | 2.63 | 0.00 | 2.63 | 0.15 | 9.25 | 0.00 | 9.25 | 0.75 |
| | 10-20 | 1.29 | 1.37 | 0.00 | 1.37 | 11.49 | 1.80 | 0.00 | 1.80 | 0.15 | | | | |
| | 20-30 | 1.52 | 0.61 | 0.00 | 0.61 | 8.75 | 0.94 | 0.00 | 0.94 | 0.14 | | | | |
| | 30-45 | 1.50 | 0.77 | 0.00 | 0.77 | 6.81 | 1.76 | 0.00 | 1.76 | 0.16 | | | | |
| | 45-60 | 1.46 | 0.95 | 0.00 | 0.95 | 7.11 | 2.11 | 0.00 | 2.11 | 0.16 | | | | |
| | 60-75 | | | | | | | | | | | | | |
| | 75-90 | | | | | | | | | | | | | |
| SB-OT5R9-1 | 0-10 | 1.44 | 2.20 | 0.00 | 2.20 | 13.88 | 3.22 | 0.00 | 3.22 | 0.20 | 15.55 | 2.49 | 13.06 | 0.91 |
| | 10-20 | 1.39 | 1.54 | 0.00 | 1.54 | 15.34 | 2.18 | 0.00 | 2.18 | 0.22 | | | | |
| | 20-30 | 1.55 | 0.99 | 0.00 | 0.99 | 9.86 | 1.56 | 0.00 | 1.56 | 0.16 | | | | |
| | 30-45 | 1.36 | 0.93 | 0.00 | 0.93 | 5.09 | 1.93 | 0.00 | 1.93 | 0.11 | | | | |
| | 45-60 | 1.51 | 1.03 | 0.00 | 1.03 | 4.12 | 2.36 | 0.00 | 2.36 | 0.09 | | | | |
| | 60-75 | 1.48 | 0.71 | 0.34 | 0.37 | 3.60 | 1.60 | 0.77 | 0.83 | 0.08 | | | | |
| | 75-90 | 1.45 | 1.22 | 0.78 | 0.44 | 2.31 | 2.70 | 1.72 | 0.97 | 0.05 | | | | |
| SB-OT7R9-2 | 0-10 | 1.37 | 2.04 | 0.00 | 2.04 | 15.64 | 2.84 | 0.00 | 2.84 | 0.22 | 12.05 | 0.87 | 11.18 | 0.94 |
| | 10-20 | 1.27 | 1.39 | 0.00 | 1.39 | 14.55 | 1.80 | 0.00 | 1.80 | 0.19 | | | | |
| | 20-30 | 1.34 | 0.94 | 0.00 | 0.94 | 10.27 | 1.28 | 0.00 | 1.28 | 0.14 | | | | |
| | 30-45 | 1.46 | 0.86 | 0.00 | 0.86 | 6.08 | 1.91 | 0.00 | 1.91 | 0.14 | | | | |
| | 45-60 | 1.44 | 0.79 | 0.00 | 0.79 | 5.72 | 1.74 | 0.00 | 1.74 | 0.13 | | | | |
| | 60-75 | 1.41 | 0.40 | 0.00 | 0.40 | 3.95 | 0.86 | 0.00 | 0.86 | 0.08 | | | | |
| | 75-90 | 1.50 | 0.71 | 0.38 | 0.33 | 2.18 | 1.63 | 0.87 | 0.76 | 0.05 | | | | |
| SB-OT7R5-3 | 0-10 | 0.99 | 2.13 | 0.00 | 2.13 | 13.08 | 2.14 | 0.00 | 2.14 | 0.13 | 12.77 | 1.78 | 11.00 | 0.74 |
| | 10-20 | 1.13 | 1.35 | 0.00 | 1.35 | 11.40 | 1.55 | 0.00 | 1.55 | 0.13 | | | | |
| | 20-30 | 1.12 | 1.01 | 0.00 | 1.01 | 8.98 | 1.15 | 0.00 | 1.15 | 0.10 | | | | |
| | 30-45 | 1.20 | 0.93 | 0.00 | 0.93 | 7.11 | 1.70 | 0.00 | 1.70 | 0.13 | | | | |
| | 45-60 | 1.24 | 1.08 | 0.00 | 1.08 | 7.18 | 2.04 | 0.00 | 2.04 | 0.14 | | | | |

Table C3. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | OC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | --------------------------------------kg m$^{-2}$ depth$^{-1}$-------------------------------------- | | | | | | | |
| SB-OT7R5-3 (Cont.) | 60-75 | 1.17 | 1.16 | 0.29 | 0.87 | 4.35 | 2.08 | 0.52 | 1.56 | 0.08 | | | | |
| | 75-90 | 1.09 | 1.28 | 0.76 | 0.52 | 2.17 | 2.12 | 1.26 | 0.86 | 0.04 | | | | |
| SB-OT7R5-4 | 0-10 | 1.09 | 3.50 | 0.00 | 3.50 | 13.04 | 3.88 | 0.00 | 3.88 | 0.14 | 15.49 | 1.51 | 13.98 | 0.78 |
| | 10-20 | 1.44 | 1.42 | 0.00 | 1.42 | 10.78 | 2.08 | 0.00 | 2.08 | 0.16 | | | | |
| | 20-30 | 1.52 | 0.97 | 0.00 | 0.97 | 7.64 | 1.50 | 0.00 | 1.50 | 0.12 | | | | |
| | 30-45 | 1.34 | 0.90 | 0.00 | 0.90 | 6.15 | 1.84 | 0.00 | 1.84 | 0.13 | | | | |
| | 45-60 | 1.37 | 1.06 | 0.00 | 1.06 | 5.33 | 2.21 | 0.00 | 2.21 | 0.11 | | | | |
| | 60-75 | 1.28 | 1.07 | 0.26 | 0.81 | 3.75 | 2.09 | 0.51 | 1.58 | 0.07 | | | | |
| | 75-90 | 1.40 | 0.89 | 0.47 | 0.42 | 2.24 | 1.89 | 1.00 | 0.89 | 0.05 | | | | |
| SB-PT5R3-1 | 0-10 | 1.01 | 2.03 | 0.00 | 2.03 | 13.08 | 2.09 | 0.00 | 2.09 | 0.13 | 10.87 | 0.63 | 10.24 | 0.64 |
| | 10-20 | 1.21 | 1.15 | 0.00 | 1.15 | 8.72 | 1.42 | 0.00 | 1.42 | 0.11 | | | | |
| | 20-30 | 1.07 | 0.96 | 0.00 | 0.96 | 7.30 | 1.05 | 0.00 | 1.05 | 0.08 | | | | |
| | 30-45 | 1.22 | 0.85 | 0.00 | 0.85 | 5.79 | 1.58 | 0.00 | 1.58 | 0.11 | | | | |
| | 45-60 | 1.32 | 1.00 | 0.00 | 1.00 | 5.38 | 2.01 | 0.00 | 2.01 | 0.11 | | | | |
| | 60-75 | 1.19 | 0.75 | 0.00 | 0.75 | 2.81 | 1.36 | 0.00 | 1.36 | 0.05 | | | | |
| | 75-90 | 1.25 | 0.71 | 0.33 | 0.38 | 2.62 | 1.35 | 0.63 | 0.72 | 0.05 | | | | |
| SB-PT5R3-2 | 0-10 | 1.43 | 1.83 | 0.00 | 1.83 | 14.66 | 2.65 | 0.00 | 2.65 | 0.21 | 14.10 | 2.17 | 11.93 | 0.96 |
| | 10-20 | 1.56 | 1.01 | 0.00 | 1.01 | 11.11 | 1.60 | 0.00 | 1.60 | 0.18 | | | | |
| | 20-30 | 1.47 | 0.87 | 0.00 | 0.87 | 6.67 | 1.30 | 0.00 | 1.30 | 0.10 | | | | |
| | 30-45 | 1.47 | 0.80 | 0.00 | 0.80 | 6.88 | 1.79 | 0.00 | 1.79 | 0.15 | | | | |
| | 45-60 | 1.51 | 0.98 | 0.00 | 0.98 | 6.47 | 2.25 | 0.00 | 2.25 | 0.15 | | | | |
| | 60-75 | 1.49 | 1.04 | 0.43 | 0.61 | 4.96 | 2.36 | 0.98 | 1.39 | 0.11 | | | | |
| | 75-90 | 1.38 | 1.02 | 0.57 | 0.45 | 2.54 | 2.14 | 1.20 | 0.94 | 0.05 | | | | |
| SB-PT1R7-3 | 0-10 | 1.18 | 2.86 | 0.00 | 2.86 | 14.74 | 3.44 | 0.00 | 3.44 | 0.18 | 15.33 | 3.35 | 11.98 | 0.91 |
| | 10-20 | 1.47 | 1.08 | 0.00 | 1.08 | 15.12 | 1.61 | 0.00 | 1.61 | 0.23 | | | | |
| | 20-30 | 1.37 | 0.75 | 0.00 | 0.75 | 11.40 | 1.05 | 0.00 | 1.05 | 0.16 | | | | |
| | 30-45 | 1.35 | 0.91 | 0.00 | 0.91 | 7.26 | 1.88 | 0.00 | 1.88 | 0.15 | | | | |

Table C3. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | OC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | --------------------------------------kg m$^{-2}$ depth$^{-1}$-------------------------------------- | | | | | | | |
| SB-PT1R7-3 (Cont.) | 45-60 | 1.37 | 0.82 | 0.00 | 0.82 | 4.49 | 1.71 | 0.00 | 1.71 | 0.09 | | | | |
| | 60-75 | 1.29 | 1.37 | 0.64 | 0.73 | 3.26 | 2.70 | 1.26 | 1.44 | 0.06 | | | | |
| | 75-90 | 1.35 | 1.43 | 1.01 | 0.42 | 1.77 | 2.95 | 2.09 | 0.87 | 0.04 | | | | |
| SB-PT1R7-4 | 0-10 | 1.22 | 3.34 | 0.00 | 3.34 | 19.34 | 4.12 | 0.00 | 4.12 | 0.24 | 15.08 | 1.60 | 13.48 | 0.98 |
| | 10-20 | 1.53 | 0.98 | 0.00 | 0.98 | 13.19 | 1.52 | 0.00 | 1.52 | 0.20 | | | | |
| | 20-30 | 1.29 | 0.72 | 0.00 | 0.72 | 11.73 | 0.94 | 0.00 | 0.94 | 0.15 | | | | |
| | 30-45 | 1.36 | 0.76 | 0.00 | 0.76 | 7.63 | 1.58 | 0.00 | 1.58 | 0.16 | | | | |
| | 45-60 | 1.32 | 0.84 | 0.00 | 0.84 | 4.89 | 1.69 | 0.00 | 1.69 | 0.10 | | | | |
| | 60-75 | 1.34 | 1.08 | 0.11 | 0.97 | 3.99 | 2.20 | 0.22 | 1.98 | 0.08 | | | | |
| | 75-90 | 1.27 | 1.56 | 0.71 | 0.85 | 2.19 | 3.02 | 1.37 | 1.65 | 0.04 | | | | |
| MX-PT2R6‡ | 0-10 | 1.32 | 1.56 | 0.00 | 1.56 | 10.66 | 2.09 | 0.00 | 2.09 | 0.14 | 16.84 | 3.36 | 13.48 | 0.67 |
| | 10-20 | 1.52 | 1.19 | 0.00 | 1.19 | 8.79 | 1.84 | 0.00 | 1.84 | 0.14 | | | | |
| | 20-30 | 1.36 | 0.96 | 0.00 | 0.96 | 5.62 | 1.32 | 0.00 | 1.32 | 0.08 | | | | |
| | 30-45 | 1.38 | 0.95 | 0.00 | 0.95 | 5.36 | 2.00 | 0.00 | 2.00 | 0.11 | | | | |
| | 45-60 | 1.34 | 2.01 | 1.08 | 0.93 | 3.93 | 4.10 | 2.20 | 1.90 | 0.08 | | | | |
| | 60-75 | 1.29 | 1.68 | 0.59 | 1.09 | 3.13 | 3.30 | 1.16 | 2.14 | 0.06 | | | | |
| | 75-90 | 1.27 | 1.13 | 0.00 | 1.13 | 2.85 | 2.19 | 0.00 | 2.19 | 0.06 | | | | |
| MX-PT4R10 | 0-10 | 1.18 | 2.35 | 0.00 | 2.35 | 5.70 | 2.81 | 0.00 | 2.81 | 0.07 | 11.79 | 0.00 | 11.79 | 0.43 |
| | 10-20 | 1.37 | 1.30 | 0.00 | 1.30 | 4.79 | 1.81 | 0.00 | 1.81 | 0.07 | | | | |
| | 20-30 | 1.30 | 1.02 | 0.00 | 1.02 | 4.68 | 1.34 | 0.00 | 1.34 | 0.06 | | | | |
| | 30-45 | 1.45 | 0.83 | 0.00 | 0.83 | 3.82 | 1.84 | 0.00 | 1.84 | 0.08 | | | | |
| | 45-60 | 1.55 | 0.65 | 0.00 | 0.65 | 2.69 | 1.53 | 0.00 | 1.53 | 0.06 | | | | |
| | 60-75 | 1.56 | 0.58 | 0.00 | 0.58 | 2.14 | 1.38 | 0.00 | 1.38 | 0.05 | | | | |
| | 75-90 | 1.47 | 0.48 | 0.00 | 0.48 | 1.56 | 1.07 | 0.00 | 1.07 | 0.03 | | | | |
| MX-PT7R4 | 0-10 | 1.42 | 1.56 | 0.00 | 1.56 | 9.90 | 2.25 | 0.00 | 2.25 | 0.14 | 15.37 | 4.88 | 10.50 | 0.70 |
| | 10-20 | 1.51 | 1.04 | 0.00 | 1.04 | 7.08 | 1.59 | 0.00 | 1.59 | 0.11 | | | | |
| | 20-30 | 1.47 | 0.88 | 0.00 | 0.88 | 4.23 | 1.31 | 0.00 | 1.31 | 0.06 | | | | |

Table C3. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | OC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | ---------kg m$^{-2}$ depth$^{-1}$--------- | | | | | | | |
| MX-PT7R4 (Cont.) | 30-45 | 1.47 | 0.86 | 0.00 | 0.86 | 6.08 | 1.92 | 0.00 | 1.92 | 0.14 | | | | |
| | 45-60 | 1.56 | 0.91 | 0.22 | 0.69 | 4.27 | 2.16 | 0.52 | 1.64 | 0.10 | | | | |
| | 60-75 | 1.45 | 1.46 | 1.05 | 0.41 | 3.26 | 3.22 | 2.31 | 0.90 | 0.07 | | | | |
| | 75-90 | 1.37 | 1.40 | 0.98 | 0.42 | 3.45 | 2.91 | 2.04 | 0.87 | 0.07 | | | | |
| MX-PT6R2 | 0-10 | 1.09 | 2.29 | 0.00 | 2.29 | 13.12 | 2.54 | 0.00 | 2.54 | 0.15 | 14.58 | 3.85 | 10.73 | 0.78 |
| | 10-20 | 1.45 | 1.40 | 0.00 | 1.40 | 14.44 | 2.06 | 0.00 | 2.06 | 0.21 | | | | |
| | 20-30 | 1.39 | 0.95 | 0.00 | 0.95 | 7.79 | 1.34 | 0.00 | 1.34 | 0.11 | | | | |
| | 30-45 | 1.38 | 0.89 | 0.00 | 0.89 | 4.64 | 1.88 | 0.00 | 1.88 | 0.10 | | | | |
| | 45-60 | 1.43 | 0.60 | 0.00 | 0.60 | 3.91 | 1.30 | 0.00 | 1.30 | 0.09 | | | | |
| | 60-75 | 1.31 | 1.33 | 0.82 | 0.51 | 3.27 | 2.65 | 1.63 | 1.01 | 0.07 | | | | |
| | 75-90 | 1.50 | 1.23 | 0.97 | 0.26 | 2.79 | 2.81 | 2.22 | 0.59 | 0.06 | | | | |
| MX-PT2R7 | 0-10 | 1.17 | 2.87 | 0.00 | 2.87 | 13.10 | 3.40 | 0.00 | 3.40 | 0.16 | 16.10 | 0.00 | 16.10 | 1.12 |
| | 10-20 | 1.31 | 2.45 | 0.00 | 2.45 | 11.97 | 3.26 | 0.00 | 3.26 | 0.16 | | | | |
| | 20-30 | 1.22 | 2.01 | 0.00 | 2.01 | 13.10 | 2.48 | 0.00 | 2.48 | 0.16 | | | | |
| | 30-45 | 1.25 | 1.19 | 0.00 | 1.19 | 12.19 | 2.26 | 0.00 | 2.26 | 0.23 | | | | |
| | 45-60 | 1.40 | 0.85 | 0.00 | 0.85 | 8.61 | 1.81 | 0.00 | 1.81 | 0.18 | | | | |
| | 60-75 | 1.56 | 0.66 | 0.00 | 0.66 | 5.86 | 1.57 | 0.00 | 1.57 | 0.14 | | | | |
| | 75-90 | 1.54 | 0.56 | 0.00 | 0.56 | 3.90 | 1.31 | 0.00 | 1.31 | 0.09 | | | | |
| MX-PT1R6 | 0-10 | 1.02 | 2.95 | 0.00 | 2.95 | 12.75 | 3.06 | 0.00 | 3.06 | 0.13 | 16.98 | 0.00 | 16.98 | 1.00 |
| | 10-20 | 1.30 | 2.05 | 0.00 | 2.05 | 12.23 | 2.72 | 0.00 | 2.72 | 0.16 | | | | |
| | 20-30 | 1.25 | 2.04 | 0.00 | 2.04 | 10.11 | 2.59 | 0.00 | 2.59 | 0.13 | | | | |
| | 30-45 | 1.32 | 1.42 | 0.00 | 1.42 | 9.72 | 2.86 | 0.00 | 2.86 | 0.20 | | | | |
| | 45-60 | 1.43 | 0.97 | 0.00 | 0.97 | 7.37 | 2.12 | 0.00 | 2.12 | 0.16 | | | | |
| | 60-75 | 1.49 | 0.79 | 0.00 | 0.79 | 5.47 | 1.80 | 0.00 | 1.80 | 0.12 | | | | |
| | 75-90 | 1.51 | 0.80 | 0.00 | 0.80 | 4.27 | 1.84 | 0.00 | 1.84 | 0.10 | | | | |
| MX-PT3R2 | 0-10 | 1.11 | 2.69 | 0.00 | 2.69 | 10.71 | 3.02 | 0.00 | 3.02 | 0.12 | 14.57 | 0.00 | 14.57 | 0.83 |
| | 10-20 | 1.36 | 1.91 | 0.00 | 1.91 | 12.94 | 2.64 | 0.00 | 2.64 | 0.18 | | | | |

Table C3. Continued.

| Sample | | | Carbon Concentration | | | | Carbon Mass | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number | Depth | B.D. | TC | IC | OC | WSOC | TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | |
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | --------------------------------------kg m$^{-2}$ depth$^{-1}$-------------------------------------- | | | | | | | |
| MX-PT3R2 (Cont.) | 20-30 | 1.40 | 1.61 | 0.00 | 1.61 | 11.15 | 2.29 | 0.00 | 2.29 | 0.16 | | | | |
| | 30-45 | 1.32 | 0.99 | 0.00 | 0.99 | 5.50 | 2.00 | 0.00 | 2.00 | 0.11 | | | | |
| | 45-60 | 1.47 | 0.71 | 0.00 | 0.71 | 4.43 | 1.59 | 0.00 | 1.59 | 0.10 | | | | |
| | 60-75 | 1.48 | 0.60 | 0.00 | 0.60 | 3.68 | 1.35 | 0.00 | 1.35 | 0.08 | | | | |
| | 75-90 | 1.70 | 0.65 | 0.00 | 0.65 | 3.16 | 1.69 | 0.00 | 1.69 | 0.08 | | | | |
| MX-PT1R4 | 0-10 | 1.15 | 2.14 | 0.00 | 2.14 | 10.31 | 2.50 | 0.00 | 2.50 | 0.12 | 11.44 | 0.00 | 11.44 | 0.66 |
| | 10-20 | 1.45 | 1.21 | 0.00 | 1.21 | 9.56 | 1.78 | 0.00 | 1.78 | 0.14 | | | | |
| | 20-30 | 1.34 | 0.87 | 0.00 | 0.87 | 6.11 | 1.18 | 0.00 | 1.18 | 0.08 | | | | |
| | 30-45 | 1.43 | 0.86 | 0.00 | 0.86 | 4.95 | 1.88 | 0.00 | 1.88 | 0.11 | | | | |
| | 45-60 | 1.43 | 0.72 | 0.00 | 0.72 | 3.77 | 1.56 | 0.00 | 1.56 | 0.08 | | | | |
| | 60-75 | 1.44 | 0.70 | 0.00 | 0.70 | 3.89 | 1.54 | 0.00 | 1.54 | 0.09 | | | | |
| | 75-90 | 1.41 | 0.46 | 0.00 | 0.46 | 2.06 | 0.99 | 0.00 | 0.99 | 0.04 | | | | |
| MX-PT3R8 | 0-10 | 1.28 | 2.13 | 0.00 | 2.13 | 11.70 | 2.77 | 0.00 | 2.77 | 0.15 | 14.58 | 0.00 | 14.58 | 0.81 |
| | 10-20 | 1.34 | 1.55 | 0.00 | 1.55 | 9.49 | 2.10 | 0.00 | 2.10 | 0.13 | | | | |
| | 20-30 | 1.41 | 1.26 | 0.00 | 1.26 | 7.31 | 1.80 | 0.00 | 1.80 | 0.10 | | | | |
| | 30-45 | 1.42 | 0.93 | 0.00 | 0.93 | 8.04 | 2.01 | 0.00 | 2.01 | 0.17 | | | | |
| | 45-60 | 1.56 | 0.77 | 0.00 | 0.77 | 4.26 | 1.83 | 0.00 | 1.83 | 0.10 | | | | |
| | 60-75 | 1.49 | 0.65 | 0.00 | 0.65 | 3.40 | 1.48 | 0.00 | 1.48 | 0.08 | | | | |
| | 75-90 | 2.17 | 0.78 | 0.00 | 0.78 | 2.08 | 2.58 | 0.00 | 2.58 | 0.07 | | | | |
| MX-PT1R2 | 0-10 | 1.20 | 2.06 | 0.00 | 2.06 | 8.23 | 2.52 | 0.00 | 2.52 | 0.10 | 12.90 | 0.00 | 12.90 | 0.60 |
| | 10-20 | 1.38 | 1.48 | 0.00 | 1.48 | 7.66 | 2.08 | 0.00 | 2.08 | 0.11 | | | | |
| | 20-30 | 1.35 | 1.16 | 0.00 | 1.16 | 6.57 | 1.60 | 0.00 | 1.60 | 0.09 | | | | |
| | 30-45 | 1.43 | 0.89 | 0.00 | 0.89 | 4.55 | 1.95 | 0.00 | 1.95 | 0.10 | | | | |
| | 45-60 | 1.47 | 0.92 | 0.00 | 0.92 | 3.08 | 2.05 | 0.00 | 2.05 | 0.07 | | | | |
| | 60-75 | 1.40 | 0.70 | 0.00 | 0.70 | 3.29 | 1.49 | 0.00 | 1.49 | 0.07 | | | | |
| | 75-90 | 1.51 | 0.53 | 0.00 | 0.53 | 2.88 | 1.22 | 0.00 | 1.22 | 0.07 | | | | |
| MX-PT6R7 | 0-10 | 1.32 | 1.83 | 0.00 | 1.83 | 10.47 | 2.45 | 0.00 | 2.45 | 0.14 | 11.88 | 2.24 | 9.65 | 0.56 |

Table C3. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | OC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | --------------------------------------kg m$^{-2}$ depth$^{-1}$-------------------------------------- | | | | | | | |
| MX-PT6R7 (cont.) | 10-20 | 1.53 | 1.10 | 0.00 | 1.10 | 7.96 | 1.71 | 0.00 | 1.71 | 0.12 | | | | |
| | 20-30 | 1.36 | 0.88 | 0.00 | 0.88 | 4.03 | 1.21 | 0.00 | 1.21 | 0.06 | | | | |
| | 30-45 | 1.40 | 0.80 | 0.00 | 0.80 | 3.91 | 1.70 | 0.00 | 1.70 | 0.08 | | | | |
| | 45-60 | 1.38 | 0.64 | 0.17 | 0.47 | 3.30 | 1.35 | 0.36 | 0.99 | 0.07 | | | | |
| | 60-75 | 1.39 | 0.71 | 0.35 | 0.36 | 2.32 | 1.50 | 0.74 | 0.76 | 0.05 | | | | |
| | 75-90 | 1.41 | 0.91 | 0.53 | 0.38 | 1.73 | 1.96 | 1.14 | 0.82 | 0.04 | | | | |
| MX-PT6R3 | 0-10 | 1.25 | 2.17 | 0.00 | 2.17 | 7.30 | 2.76 | 0.00 | 2.76 | 0.09 | 18.31 | 0.00 | 18.31 | 0.70 |
| | 10-20 | 1.45 | 1.78 | 0.00 | 1.78 | 5.42 | 2.62 | 0.00 | 2.62 | 0.08 | | | | |
| | 20-30 | 1.36 | 1.80 | 0.00 | 1.80 | 7.83 | 2.48 | 0.00 | 2.48 | 0.11 | | | | |
| | 30-45 | 1.29 | 2.01 | 0.00 | 2.01 | 7.16 | 3.96 | 0.00 | 3.96 | 0.14 | | | | |
| | 45-60 | 1.32 | 1.34 | 0.00 | 1.34 | 6.04 | 2.70 | 0.00 | 2.70 | 0.12 | | | | |
| | 60-75 | 1.42 | 0.91 | 0.00 | 0.91 | 3.62 | 1.96 | 0.00 | 1.96 | 0.08 | | | | |
| | 75-90 | 1.57 | 0.76 | 0.00 | 0.76 | 3.35 | 1.81 | 0.00 | 1.81 | 0.08 | | | | |
| MX-PT7R2 | 0-10 | 1.31 | 1.77 | 0.00 | 1.77 | 8.78 | 2.36 | 0.00 | 2.36 | 0.12 | 10.84 | 0.00 | 10.84 | 0.60 |
| | 10-20 | 1.38 | 1.31 | 0.00 | 1.31 | 9.56 | 1.84 | 0.00 | 1.84 | 0.13 | | | | |
| | 20-30 | 1.36 | 0.98 | 0.00 | 0.98 | 7.02 | 1.35 | 0.00 | 1.35 | 0.10 | | | | |
| | 30-45 | 1.41 | 0.80 | 0.00 | 0.80 | 2.98 | 1.72 | 0.00 | 1.72 | 0.06 | | | | |
| | 45-60 | 1.50 | 0.70 | 0.00 | 0.70 | 2.63 | 1.60 | 0.00 | 1.60 | 0.06 | | | | |
| | 60-75 | 1.50 | 0.49 | 0.00 | 0.49 | 3.03 | 1.12 | 0.00 | 1.12 | 0.07 | | | | |
| | 75-90 | 1.44 | 0.39 | 0.00 | 0.39 | 2.47 | 0.86 | 0.00 | 0.86 | 0.05 | | | | |
| MX-NT3R5 | 0-10 | 1.22 | 1.92 | 0.00 | 1.92 | 7.51 | 2.37 | 0.00 | 2.37 | 0.09 | 11.35 | 1.70 | 9.66 | 0.45 |
| | 10-20 | 1.29 | 1.22 | 0.00 | 1.22 | 4.87 | 1.60 | 0.00 | 1.60 | 0.06 | | | | |
| | 20-30 | 1.37 | 0.85 | 0.00 | 0.85 | 3.95 | 1.18 | 0.00 | 1.18 | 0.06 | | | | |
| | 30-45 | 1.47 | 0.72 | 0.00 | 0.72 | 2.98 | 1.61 | 0.00 | 1.61 | 0.07 | | | | |
| | 45-60 | 1.39 | 0.56 | 0.00 | 0.56 | 3.27 | 1.18 | 0.00 | 1.18 | 0.07 | | | | |
| | 60-75 | 1.33 | 0.45 | 0.00 | 0.45 | 2.51 | 0.91 | 0.00 | 0.91 | 0.05 | | | | |
| | 75-90 | 1.37 | 1.19 | 0.81 | 0.38 | 2.50 | 2.49 | 1.70 | 0.80 | 0.05 | | | | |

Table C3. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | OC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | --kg m$^{-2}$ depth$^{-1}$-- | | | | | | | |
| MX-NT1R5 | 0-10 | 1.22 | 1.89 | 0.00 | 1.89 | 10.86 | 2.35 | 0.00 | 2.35 | 0.13 | 16.48 | 2.04 | 14.44 | 0.84 |
| | 10-20 | 1.40 | 1.15 | 0.00 | 1.15 | 6.36 | 1.64 | 0.00 | 1.64 | 0.09 | | | | |
| | 20-30 | 1.49 | 0.90 | 0.00 | 0.90 | 3.30 | 1.36 | 0.00 | 1.36 | 0.05 | | | | |
| | 30-45 | 1.43 | 1.09 | 0.00 | 1.09 | 4.51 | 2.38 | 0.00 | 2.38 | 0.10 | | | | |
| | 45-60 | 1.52 | 1.45 | 0.28 | 1.17 | 4.74 | 3.36 | 0.65 | 2.71 | 0.11 | | | | |
| | 60-75 | 1.26 | 1.55 | 0.72 | 0.83 | 6.51 | 2.98 | 1.39 | 1.60 | 0.13 | | | | |
| | 75-90 | 1.22 | 1.30 | 0.00 | 1.30 | 12.38 | 2.41 | 0.00 | 2.41 | 0.23 | | | | |
| MX-NT2R9 | 0-10 | 1.05 | 2.79 | 0.00 | 2.79 | 9.00 | 2.98 | 0.00 | 2.98 | 0.10 | 15.60 | 3.21 | 12.39 | 0.60 |
| | 10-20 | 1.42 | 1.49 | 0.00 | 1.49 | 6.26 | 2.15 | 0.00 | 2.15 | 0.09 | | | | |
| | 20-30 | 2.14 | 1.19 | 0.00 | 1.19 | 7.01 | 2.58 | 0.00 | 2.58 | 0.15 | | | | |
| | 30-45 | 1.43 | 0.96 | 0.00 | 0.96 | 3.90 | 2.09 | 0.00 | 2.09 | 0.08 | | | | |
| | 45-60 | 1.44 | 0.89 | 0.32 | 0.57 | 2.77 | 1.95 | 0.70 | 1.25 | 0.06 | | | | |
| | 60-75 | 1.39 | 0.98 | 0.65 | 0.33 | 2.56 | 2.07 | 1.37 | 0.70 | 0.05 | | | | |
| | 75-90 | 1.51 | 0.77 | 0.49 | 0.28 | 2.50 | 1.78 | 1.13 | 0.65 | 0.06 | | | | |
| MX-NT2R7 | 0-10 | 1.14 | 2.64 | 0.00 | 2.64 | 7.27 | 3.04 | 0.00 | 3.04 | 0.08 | 15.26 | 0.81 | 14.44 | 0.52 |
| | 10-20 | 1.44 | 1.27 | 0.00 | 1.27 | 6.25 | 1.86 | 0.00 | 1.86 | 0.09 | | | | |
| | 20-30 | 1.35 | 0.99 | 0.00 | 0.99 | 3.60 | 1.36 | 0.00 | 1.36 | 0.05 | | | | |
| | 30-45 | 1.50 | 1.24 | 0.00 | 1.24 | 5.01 | 2.84 | 0.00 | 2.84 | 0.11 | | | | |
| | 45-60 | 1.41 | 1.10 | 0.00 | 1.10 | 3.92 | 2.37 | 0.00 | 2.37 | 0.08 | | | | |
| | 60-75 | 1.34 | 0.83 | 0.00 | 0.83 | 2.97 | 1.69 | 0.00 | 1.69 | 0.06 | | | | |
| | 75-90 | 1.44 | 0.95 | 0.37 | 0.58 | 1.67 | 2.09 | 0.81 | 1.28 | 0.04 | | | | |
| MX-NT6R1 | 0-10 | 1.07 | 3.26 | 0.00 | 3.26 | 11.76 | 3.54 | 0.00 | 3.54 | 0.13 | 18.88 | 0.00 | 18.88 | 0.76 |
| | 10-20 | 1.28 | 2.12 | 0.00 | 2.12 | 9.70 | 2.76 | 0.00 | 2.76 | 0.13 | | | | |
| | 20-30 | 1.30 | 2.06 | 0.00 | 2.06 | 7.20 | 2.72 | 0.00 | 2.72 | 0.10 | | | | |
| | 30-45 | 1.35 | 1.59 | 0.00 | 1.59 | 5.64 | 3.26 | 0.00 | 3.26 | 0.12 | | | | |
| | 45-60 | 1.33 | 1.15 | 0.00 | 1.15 | 3.96 | 2.33 | 0.00 | 2.33 | 0.08 | | | | |
| | 60-75 | 1.50 | 0.82 | 0.00 | 0.82 | 5.22 | 1.87 | 0.00 | 1.87 | 0.12 | | | | |

Table C3. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | OC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | --------kg m$^{-2}$ depth$^{-1}$-------- | | | | | | | |
| MX-NT6R1 (cont.) | 75-90 | 1.71 | 0.92 | 0.00 | 0.92 | 3.66 | 2.40 | 0.00 | 2.40 | 0.10 | | | | |
| MX-NT7R1 | 0-10 | 1.22 | 2.30 | 0.00 | 2.30 | 8.30 | 2.84 | 0.00 | 2.84 | 0.10 | 13.02 | 1.96 | 11.06 | 0.54 |
| | 10-20 | 1.32 | 1.29 | 0.00 | 1.29 | 6.86 | 1.73 | 0.00 | 1.73 | 0.09 | | | | |
| | 20-30 | 1.37 | 0.97 | 0.00 | 0.97 | 5.96 | 1.35 | 0.00 | 1.35 | 0.08 | | | | |
| | 30-45 | 1.34 | 0.82 | 0.00 | 0.82 | 3.83 | 1.68 | 0.00 | 1.68 | 0.08 | | | | |
| | 45-60 | 1.48 | 0.66 | 0.00 | 0.66 | 3.40 | 1.49 | 0.00 | 1.49 | 0.08 | | | | |
| | 60-75 | 1.37 | 0.68 | 0.23 | 0.45 | 2.89 | 1.42 | 0.48 | 0.94 | 0.06 | | | | |
| | 75-90 | 1.47 | 1.12 | 0.66 | 0.46 | 2.03 | 2.51 | 1.48 | 1.03 | 0.05 | | | | |
| MX-NT1R6 | 0-10 | 1.14 | 2.36 | 0.00 | 2.36 | 6.80 | 2.73 | 0.00 | 2.73 | 0.08 | 14.46 | 0.00 | 14.46 | 0.58 |
| | 10-20 | 1.37 | 1.44 | 0.00 | 1.44 | 6.20 | 2.00 | 0.00 | 2.00 | 0.09 | | | | |
| | 20-30 | 1.40 | 1.37 | 0.00 | 1.37 | 7.11 | 1.95 | 0.00 | 1.95 | 0.10 | | | | |
| | 30-45 | 1.33 | 1.07 | 0.00 | 1.07 | 5.83 | 2.17 | 0.00 | 2.17 | 0.12 | | | | |
| | 45-60 | 1.45 | 0.89 | 0.00 | 0.89 | 3.66 | 1.96 | 0.00 | 1.96 | 0.08 | | | | |
| | 60-75 | 1.57 | 0.76 | 0.00 | 0.76 | 3.04 | 1.82 | 0.00 | 1.82 | 0.07 | | | | |
| | 75-90 | 1.59 | 0.75 | 0.00 | 0.75 | 1.66 | 1.82 | 0.00 | 1.82 | 0.04 | | | | |
| MX-OT3R1 | 0-10 | 1.37 | 1.58 | 0.00 | 1.58 | 8.02 | 2.20 | 0.00 | 2.20 | 0.11 | 11.10 | 2.78 | 8.32 | 0.56 |
| | 10-20 | 1.51 | 1.06 | 0.00 | 1.06 | 6.71 | 1.63 | 0.00 | 1.63 | 0.10 | | | | |
| | 20-30 | 1.43 | 0.88 | 0.00 | 0.88 | 3.72 | 1.28 | 0.00 | 1.28 | 0.05 | | | | |
| | 30-45 | 1.42 | 0.65 | 0.00 | 0.65 | 3.36 | 1.41 | 0.00 | 1.41 | 0.07 | | | | |
| | 45-60 | 1.48 | 0.81 | 0.49 | 0.32 | 3.86 | 1.83 | 1.11 | 0.72 | 0.09 | | | | |
| | 60-75 | 1.39 | 1.12 | 0.79 | 0.33 | 4.04 | 2.37 | 1.67 | 0.70 | 0.09 | | | | |
| | 75-90 | 1.47 | 0.17 | 0.00 | 0.17 | 1.91 | 0.38 | 0.00 | 0.38 | 0.04 | | | | |
| MX-OT1R6 | 0-10 | 1.40 | 1.51 | 0.00 | 1.51 | 8.41 | 2.14 | 0.00 | 2.14 | 0.12 | 15.98 | 3.27 | 12.71 | 0.48 |
| | 10-20 | 1.41 | 1.16 | 0.00 | 1.16 | 7.09 | 1.66 | 0.00 | 1.66 | 0.10 | | | | |
| | 20-30 | 1.33 | 0.91 | 0.00 | 0.91 | 4.65 | 1.23 | 0.00 | 1.23 | 0.06 | | | | |
| | 30-45 | 1.36 | 1.01 | 0.00 | 1.01 | 3.41 | 2.09 | 0.00 | 2.09 | 0.07 | | | | |
| | 45-60 | 1.37 | 1.13 | 0.00 | 1.13 | 2.80 | 2.36 | 0.00 | 2.36 | 0.06 | | | | |

Table C3. Continued.

| Sample | | | Carbon Concentration | | | | Carbon Mass | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number | Depth | B.D. | TC | IC | OC | WSOC | TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | |
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | ----kg m$^{-2}$ depth$^{-1}$---- | | | | | | | |
| MX-OT1R6 (Cont.) | 60-75 | 1.31 | 1.38 | 0.77 | 0.61 | 1.84 | 2.76 | 1.54 | 1.22 | 0.04 | | | | |
| | 75-90 | 1.25 | 1.96 | 0.91 | 1.05 | 1.67 | 3.74 | 1.73 | 2.00 | 0.03 | | | | |
| MX-OT1R2 | 0-10 | 1.22 | 2.22 | 0.00 | 2.22 | 9.37 | 2.76 | 0.00 | 2.76 | 0.12 | 13.42 | 3.37 | 10.05 | 0.53 |
| | 10-20 | 1.33 | 1.37 | 0.00 | 1.37 | 7.17 | 1.86 | 0.00 | 1.86 | 0.10 | | | | |
| | 20-30 | 1.28 | 1.03 | 0.00 | 1.03 | 5.23 | 1.34 | 0.00 | 1.34 | 0.07 | | | | |
| | 30-45 | 1.49 | 0.82 | 0.00 | 0.82 | 3.82 | 1.86 | 0.00 | 1.86 | 0.09 | | | | |
| | 45-60 | 1.41 | 0.97 | 0.55 | 0.42 | 3.00 | 2.08 | 1.18 | 0.90 | 0.06 | | | | |
| | 60-75 | 1.32 | 1.07 | 0.70 | 0.37 | 2.50 | 2.16 | 1.41 | 0.75 | 0.05 | | | | |
| | 75-90 | 1.46 | 0.61 | 0.35 | 0.26 | 2.03 | 1.36 | 0.78 | 0.58 | 0.05 | | | | |
| MX-OT4R3 | 0-10 | 1.22 | 2.35 | 0.00 | 2.35 | 7.75 | 2.91 | 0.00 | 2.91 | 0.10 | 10.71 | 0.27 | 10.44 | 0.44 |
| | 10-20 | 1.38 | 1.31 | 0.00 | 1.31 | 8.21 | 1.84 | 0.00 | 1.84 | 0.12 | | | | |
| | 20-30 | 1.34 | 0.94 | 0.00 | 0.94 | 5.39 | 1.28 | 0.00 | 1.28 | 0.07 | | | | |
| | 30-45 | 1.48 | 0.77 | 0.00 | 0.77 | 3.29 | 1.74 | 0.00 | 1.74 | 0.07 | | | | |
| | 45-60 | 1.37 | 0.56 | 0.00 | 0.56 | 1.95 | 1.17 | 0.00 | 1.17 | 0.04 | | | | |
| | 60-75 | 1.34 | 0.37 | 0.00 | 0.37 | 1.14 | 0.75 | 0.00 | 0.75 | 0.02 | | | | |
| | 75-90 | 1.47 | 0.45 | 0.12 | 0.33 | 0.89 | 1.01 | 0.27 | 0.74 | 0.02 | | | | |
| MX-OT4R1 | 0-10 | 1.43 | 1.60 | 0.00 | 1.60 | 9.26 | 2.33 | 0.00 | 2.33 | 0.13 | 12.23 | 1.44 | 10.80 | 0.52 |
| | 10-20 | 1.48 | 1.20 | 0.00 | 1.20 | 7.79 | 1.80 | 0.00 | 1.80 | 0.12 | | | | |
| | 20-30 | 1.40 | 0.88 | 0.00 | 0.88 | 4.90 | 1.25 | 0.00 | 1.25 | 0.07 | | | | |
| | 30-45 | 1.49 | 0.77 | 0.00 | 0.77 | 2.78 | 1.75 | 0.00 | 1.75 | 0.06 | | | | |
| | 45-60 | 1.50 | 0.69 | 0.00 | 0.69 | 2.49 | 1.58 | 0.00 | 1.58 | 0.06 | | | | |
| | 60-75 | 1.51 | 0.65 | 0.00 | 0.65 | 1.75 | 1.49 | 0.00 | 1.49 | 0.04 | | | | |
| | 75-90 | 1.39 | 0.96 | 0.68 | 0.28 | 1.64 | 2.03 | 1.44 | 0.59 | 0.03 | | | | |
| MX-OT3R7 | 0-10 | 1.18 | 2.12 | 0.00 | 2.12 | 5.67 | 2.53 | 0.00 | 2.53 | 0.07 | 11.75 | 1.49 | 10.26 | 0.45 |
| | 10-20 | 1.38 | 1.29 | 0.00 | 1.29 | 6.79 | 1.81 | 0.00 | 1.81 | 0.10 | | | | |
| | 20-30 | 1.41 | 0.96 | 0.00 | 0.96 | 4.95 | 1.37 | 0.00 | 1.37 | 0.07 | | | | |
| | 30-45 | 1.41 | 0.80 | 0.00 | 0.80 | 2.44 | 1.72 | 0.00 | 1.72 | 0.05 | | | | |

Table C3. Continued.

| Sample Number | Depth | B.D. | Carbon Concentration TC | IC | OC | WSOC | Carbon Mass TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | ---kg m$^{-2}$ depth$^{-1}$--- | | | | | | | |
| MX-OT3R7 (Cont.) | 45-60 | 1.39 | 0.55 | 0.00 | 0.55 | 3.09 | 1.16 | 0.00 | 1.16 | 0.07 | | | | |
| | 60-75 | 1.35 | 0.63 | 0.21 | 0.42 | 2.26 | 1.29 | 0.43 | 0.86 | 0.05 | | | | |
| | 75-90 | 1.48 | 0.83 | 0.47 | 0.36 | 2.41 | 1.87 | 1.06 | 0.81 | 0.05 | | | | |
| MX-OT5R8 | 0-10 | 1.18 | 2.24 | 0.00 | 2.24 | 8.99 | 2.68 | 0.00 | 2.68 | 0.11 | 13.64 | 2.55 | 11.08 | 0.83 |
| | 10-20 | 1.44 | 1.34 | 0.00 | 1.34 | 9.43 | 1.96 | 0.00 | 1.96 | 0.14 | | | | |
| | 20-30 | 1.41 | 1.09 | 0.00 | 1.09 | 4.82 | 1.56 | 0.00 | 1.56 | 0.07 | | | | |
| | 30-45 | 1.52 | 0.95 | 0.00 | 0.95 | 3.40 | 2.20 | 0.00 | 2.20 | 0.08 | | | | |
| | 45-60 | 1.53 | 1.38 | 0.92 | 0.46 | 3.74 | 3.21 | 2.14 | 1.07 | 0.09 | | | | |
| | 60-75 | 1.43 | 0.57 | 0.19 | 0.38 | 2.72 | 1.24 | 0.41 | 0.83 | 0.06 | | | | |
| | 75-90 | 1.38 | 0.37 | 0.00 | 0.37 | 13.99 | 0.78 | 0.00 | 0.78 | 0.29 | | | | |
| MX-OT3R10 | 0-10 | 1.23 | 1.65 | 0.00 | 1.65 | 6.60 | 2.06 | 0.00 | 2.06 | 0.08 | 15.46 | 4.08 | 11.38 | 0.40 |
| | 10-20 | 1.25 | 1.18 | 0.00 | 1.18 | 6.85 | 1.50 | 0.00 | 1.50 | 0.09 | | | | |
| | 20-30 | 1.36 | 0.94 | 0.00 | 0.94 | 5.79 | 1.30 | 0.00 | 1.30 | 0.08 | | | | |
| | 30-45 | 1.26 | 0.95 | 0.00 | 0.95 | 3.30 | 1.82 | 0.00 | 1.82 | 0.06 | | | | |
| | 45-60 | 1.25 | 0.93 | 0.00 | 0.93 | 1.98 | 1.77 | 0.00 | 1.77 | 0.04 | | | | |
| | 60-75 | 1.19 | 1.95 | 0.96 | 0.99 | 1.55 | 3.53 | 1.74 | 1.79 | 0.03 | | | | |
| | 75-90 | 1.22 | 1.87 | 1.26 | 0.61 | 1.27 | 3.47 | 2.34 | 1.13 | 0.02 | | | | |
| MX-OT6R2 | 0-10 | 1.24 | 1.82 | 0.00 | 1.82 | 9.38 | 2.29 | 0.00 | 3.37 | 0.12 | 17.67 | 5.06 | 15.47 | 0.50 |
| | 10-20 | 1.50 | 1.07 | 0.00 | 1.07 | 8.11 | 1.63 | 0.00 | 1.16 | 0.12 | | | | |
| | 20-30 | 1.28 | 0.92 | 0.00 | 0.92 | 5.29 | 1.20 | 0.00 | 0.86 | 0.07 | | | | |
| | 30-45 | 1.35 | 0.82 | 0.00 | 0.82 | 3.44 | 1.68 | 0.00 | 1.02 | 0.07 | | | | |
| | 45-60 | 1.31 | 1.00 | 0.00 | 1.00 | 1.99 | 1.99 | 0.00 | 1.52 | 0.04 | | | | |
| | 60-75 | 1.23 | 2.38 | 1.33 | 1.05 | 2.21 | 4.45 | 2.49 | 3.81 | 0.04 | | | | |
| | 75-90 | 1.20 | 2.42 | 1.41 | 1.01 | 2.00 | 4.42 | 2.58 | 3.72 | 0.04 | | | | |
| DK-CK-1§ | 0-10 | 1.47 | 1.94 | 0.00 | 1.94 | 4.52 | 2.90 | 0.00 | 2.90 | 0.07 | 17.38 | 3.37 | 14.01 | 0.47 |
| | 10-20 | 1.39 | 1.53 | 0.00 | 1.53 | 7.72 | 2.16 | 0.00 | 2.16 | 0.11 | | | | |
| | 20-30 | 1.43 | 0.99 | 0.00 | 0.99 | 4.35 | 1.44 | 0.00 | 1.44 | 0.06 | | | | |

Table C3. Continued.

| Sample | | | Carbon Concentration | | | | Carbon Mass | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number | Depth | B.D. | TC | IC | OC | WSOC | TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC | |
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | ---kg m$^{-2}$ depth$^{-1}$--- | | | | | | | |
| DK-CK-1 (Cont.) | 30-45 | 1.59 | 0.89 | 0.00 | 0.89 | 2.99 | 2.16 | 0.00 | 2.16 | 0.07 | | | | |
| | 45-60 | 1.46 | 0.86 | 0.00 | 0.86 | 2.78 | 1.92 | 0.00 | 1.92 | 0.06 | | | | |
| | 60-75 | 1.48 | 1.51 | 0.63 | 0.88 | 2.13 | 3.41 | 1.42 | 1.99 | 0.05 | | | | |
| | 75-90 | 1.37 | 1.62 | 0.93 | 0.69 | 2.22 | 3.39 | 1.95 | 1.45 | 0.05 | | | | |
| DK-CK-2 | 0-10 | 1.50 | 1.33 | 0.00 | 1.33 | 6.03 | 2.03 | 0.00 | 2.03 | 0.09 | 10.78 | 0.21 | 10.56 | 0.44 |
| | 10-20 | 1.44 | 1.31 | 0.00 | 1.31 | 8.56 | 1.92 | 0.00 | 1.92 | 0.13 | | | | |
| | 20-30 | 1.43 | 1.03 | 0.00 | 1.03 | 5.65 | 1.50 | 0.00 | 1.50 | 0.08 | | | | |
| | 30-45 | 1.53 | 0.77 | 0.00 | 0.77 | 2.00 | 1.79 | 0.00 | 1.79 | 0.05 | | | | |
| | 45-60 | 1.44 | 0.63 | 0.00 | 0.63 | 2.47 | 1.38 | 0.00 | 1.38 | 0.05 | | | | |
| | 60-75 | 1.48 | 0.43 | 0.00 | 0.43 | 0.96 | 0.97 | 0.00 | 0.97 | 0.02 | | | | |
| | 75-90 | 1.54 | 0.51 | 0.09 | 0.42 | 0.88 | 1.19 | 0.21 | 0.98 | 0.02 | | | | |
| DK-CK-3 | 0-10 | 1.58 | 1.33 | 0.00 | 1.33 | 6.15 | 2.13 | 0.00 | 2.13 | 0.10 | 11.04 | 0.21 | 10.83 | 0.55 |
| | 10-20 | 1.53 | 1.31 | 0.00 | 1.31 | 8.01 | 2.03 | 0.00 | 2.03 | 0.12 | | | | |
| | 20-30 | 1.44 | 1.03 | 0.00 | 1.03 | 6.03 | 1.51 | 0.00 | 1.51 | 0.09 | | | | |
| | 30-45 | 1.46 | 0.77 | 0.00 | 0.77 | 3.14 | 1.71 | 0.00 | 1.71 | 0.07 | | | | |
| | 45-60 | 1.50 | 0.63 | 0.00 | 0.63 | 2.47 | 1.44 | 0.00 | 1.44 | 0.06 | | | | |
| | 60-75 | 1.55 | 0.43 | 0.00 | 0.43 | 3.40 | 1.01 | 0.00 | 1.01 | 0.08 | | | | |
| | 75-90 | 1.56 | 0.51 | 0.09 | 0.42 | 1.37 | 1.21 | 0.21 | 1.00 | 0.03 | | | | |
| DK-CK-4 | 0-10 | 1.30 | 4.29 | 0.00 | 4.29 | 9.07 | 5.68 | 0.00 | 5.68 | 0.12 | 16.16 | 0.00 | 16.16 | 1.09 |
| | 10-20 | 1.53 | 1.34 | 0.00 | 1.34 | 9.44 | 2.09 | 0.00 | 2.09 | 0.15 | | | | |
| | 20-30 | 1.44 | 1.12 | 0.00 | 1.12 | 10.10 | 1.64 | 0.00 | 1.64 | 0.15 | | | | |
| | 30-45 | 1.78 | 0.88 | 0.00 | 0.88 | 7.94 | 2.38 | 0.00 | 2.38 | 0.22 | | | | |
| | 45-60 | 1.61 | 0.77 | 0.00 | 0.77 | 6.74 | 1.89 | 0.00 | 1.89 | 0.17 | | | | |
| | 60-75 | 1.87 | 0.52 | 0.00 | 0.52 | 5.00 | 1.49 | 0.00 | 1.49 | 0.14 | | | | |
| | 75-90 | 1.58 | 0.41 | 0.00 | 0.41 | 6.08 | 0.99 | 0.00 | 0.99 | 0.15 | | | | |

Table C3. Continued.

| Sample | | | Carbon Concentration | | | | Carbon Mass | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number | Depth | B.D. | TC | IC | OC | WSOC | TC | IC | OC | WSOC | Sum TC | Sum IC | Sum OC |
| | ---cm--- | ---g cm$^{-3}$--- | -------Percent------- | | | -mg/L- | ---------------------------------------kg m$^{-2}$ depth$^{-1}$--------------------------------------- | | | | | | |

†CW-PT3R1-1 represents *Agropyron cristatum* (CW) under the phosphorus treatment (PT), plot design repetition 1 of 10, and soil sample repetition 1 of 4. KB: *Poa pratensis*, *and* SB: *Bromus inermis.* NT: nitrogen fertilizer application treatment, and OT: no fertilizer applied treatment.

‡MX-PT2R6 represents species richness (MX) at a level of 2 species within the phosphorus fertilizer treatment (PT2), repetition 6 (R6). Treatments (T1-T7) indicate level of species richness: T1=1 species, T2=2 species, T3=5 species, T4=5 species, T5=10 species, T6=10 species and T7=20 species per plot.

§DK-CK-1 represents Dickinson (DK) cropland check (CK) repetition 1 of 4.