ABSTRACT

Title of Document: NUTRIENT LEVELS AND ORGANIC MATTER DECOMPOSITION IN RESPONSE TO PRESCRIBED BURNS IN MID-ATLANTIC COASTAL MARSHES

George W. Geatz IV, M.S. Wetland Science, 2012

Directed By: Associate Professor Brian A. Needelman, Department of Environmental Science and Technology

Prescribed winter burning is a commonly used management practice in coastal marshes along the Atlantic Coast. I conducted a manipulative field study to explore the mechanisms by which fire increases plant productivity. I found that prescribed fire does not provide a fertilization effect for vegetation through ash deposition due to the low amounts of nutrients in ash. Modeling biomass nutrient stocks in other marshes with similar vegetation types shows that this lack of a fertilization effect likely exists across all coastal marsh types. Through the mechanism of canopy removal, organic matter decomposition rates in marsh areas tended to decrease later in the growing season, corresponding with a decrease in porewater ammonium and phosphate, which were taken up in much higher quantities in the biomass. These effects were stronger and more consistent in areas dominated by the sedge species, as these areas showed more of a biomass response to canopy removal.

NUTRIENT LEVELS AND ORGANIC MATTER DECOMPOSITION IN RESPONSE TO PRESCRIBED BURNS IN MID-ATLANTIC COASTAL MARSHES

by

George W. Geatz IV

Thesis submitted to the Faculty of the Graduate School of the
University of Maryland, College Park in partial fulfillment
of the requirements for the degree of
Master of Science
2012

Advisory Committee:
Associate Professor Brian A. Needelman, Chair
Professor Raymond R. Weil
Professor Martin C. Rabenhorst

ACKNOWLEDGEMENTS

First and foremost I would like to thank my main advisor Brian Needelman for his guidance and support throughout not only this project, but for the last 5 years of my professional career. I am extremely thankful for the opportunity he gave me in 2007 to begin work as an undergraduate in his Soil and Water Geospatial Analysis Laboratory (SAWGAL). At the time I had no field experience and little education in environmental science, I just knew I loved the outdoors. Since that time I have developed into a confident, well-educated scientist who has found the joy of research and gotten to know a thing or two about the world around him. I look forward to many years of learning ahead in the field of environmental science and realize that it is due in no small part to my years spent working for you at SAWGAL.

I would also like to thank all of the wonderful people I have had the opportunity to meet and work with in the SAWGAL lab throughout my years at the University of Maryland. At the top of this list would be my coworker and friend Wesley Bickford. Fieldwork was a large part of this study and the majority of it was carried out by Wes and I, often in less than ideal conditions (this was a winter burn study in a tidal marsh, after all). I believe we developed a good chemistry and working relationship which would have made this study all but impossible to carry out if it had not been present. Additionally, I would like to thank Amanda Garzio-Hadzick who managed SAWGAL and kept everything in order from the summer of 2009 through the summer of 2010. Miriam Myers and Emily Hutchins were great help in the field and the lab for this study, and have been great to work with over the past 4 years as well. Finally, I would like to thank Becca Mead, Michele Miller, Asia Vinnikova, and Joey Scholosnagle who all provided undergraduate field and lab help for this project.

A thanks goes out to my committee members Dr. Martin Rabenhorst and Dr. Ray Weil, not only for their help with this project, but for help developing into an environmental scientist over my years at UMD. I would most likely not have my current position if it were not for being on the 2007-2008 UMD Soil Judging Team and taking Wetland Soils, both instructed by Dr. Rabenhorst, as they form the basis of my day-to-day activities at the Illinois Natural History Survey. Dr. Weil sparked my interest in soils as wonderful and unique aspect of environmental science which is often overlooked yet plays such a vital role in the everyday livelihood of society and health of the environment. He has also been vital to my understanding of nutrient use within plants and movement in soils, which has been of great help throughout this project.

The Environmental Science and Technology Department as whole, especially my fellow graduate students, deserve a big thanks. The professors have provided wonderful courses, presentations, and general insights which have given me an advanced understanding of several aspects of environmental science over my years in the department. The graduate students were a great group to learn with and to interact with on a daily basis, especially the crew housed in H.J. Patterson Hall. Specifically, the friendships I have developed with Daniel Fenstermacher, Michelle Hetu, and Annie Rossi have made life in College Park excellent both on and off work.

I would like to thank the Maryland Sea Grant for project funding for this study. The logistical support necessary for completion of this study would not have been possible without the help of Fish and Wildlife Service staff members located at the Blackwater National Wildlife

Refuge, specifically Matt Whitbeck, Bill Giese, Leticia Melendez, Nate Carle, and Suzanne Baird. The FWS staff was always helpful when we needed a boat, field hands, or overnight lodging. Patrick J. Megonigal and his staff at the Smithsonian Environmental Research Center provided field and lab help with porewater sampling and analysis, and also with the initial experimental design of this project, and I thank him for this. A special thanks goes out to Dennis Skultety at the Illinois Natural History Survey for help in making the GIS maps for this paper. I would also like to thank Donald Cahoon and Jim Lynch of the USGS Patuxent Wildlife Research Center for collaborating and sharing data and methods used for the planning and implementation of this study.

Finally, I would like to thank my close friends and family for their loving support over the past few years. Without the care and companionship of people like my Mother and Father, Sister and Brother, Sean Schnably, Shawn Pillai, Eric Boyd, Matthew Finger, John Hughes, Josh Pratt, Derrick Swandol, and Clinton Gill the workload and stress from this project would have certainly gotten the best of me. They will never know how important their contribution to this end product was.

I have truly been blessed to have each of these people and organizations present in my life. Each of them has contributed more to my professional development and development as a person more than can be written in a couple of pages. The end product of this thesis is just as much theirs as it is mine. My sincerest thanks go out to each and every one of them.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1: Literature Review

1. Introduction

This literature review will cover the current state of research on nutrient availability and organic matter decomposition rates in response to prescribed burns in coastal marshes. The focus will generally be on the Mid-Atlantic region of the USA, with a special focus on the study site at Blackwater National Wildlife Refuge.

Blackwater NWR, located in Dorchester County on the lower Eastern Shore of Maryland (38°27'N, 76°07'W) is over 27,000 acres in size and consists mostly of microtidal brackish marshes characterized by fluctuating water levels and salinities. The refuge is part of and managed by the U. S. Fish and Wildlife Service's Chesapeake Marshlands National Wildlife Refuge Complex which manages four wildlife refuges on the Chesapeake Bay, with Blackwater NWR representing the largest area.

Fire has been a disturbance which has been present throughout the development of Mid-Atlantic marshes such as those at Blackwater NWR. Both wild and prescribed fires play important roles in nutrient cycling within ecosystems (Wan et al., 2001). Nutrients contained in surface vegetation are redistributed through particulate (ash) and non-particulate (volatilization) pathways following fire (Raison et al., 1985). Particulate material can be redistributed from a burn site to adjacent areas through wind, rainfall, erosion, runoff, and leaching, or can remain onsite and may have a significant impact on the soil nutrient status and water quality (Badia and Marti, 2003; Hauer and Spencer, 1998; Thomas et al., 1999; Townsend and Douglas, 2004). Increased post-fire nutrient concentrations in soil and water have been observed in numerous studies (Ilstedt et al., 2003; Murphy et al., 2006; Ubeda et al., 2005). Nutrients with relatively low volatilization temperatures, such as carbon, nitrogen, and sulfur, may be removed from the burn site through volatilization and result in atmospheric pollution (Cachier et al., 1995; Liu et al., 2000; McNaughton et al., 1998; Wan et al., 2001).

In the face of climate change, numerous ecological processes within the marsh ecosystem may be affected. Soil organic matter decomposition rates, which control the mobilization of nutrients required for plant growth, and control organic matter turnover rates which affect the ability of marshes to vertically accrete with sea level rise, may have the largest implications relating to marsh sustainability due to environmental change (Mendelssohn et al., 1999). Numerous studies involving litterbag decomposition and chemical analysis have demonstrated that organic matter decomposition and turnover rates exert controlling factors on the chemistry and fertility of salt marsh soils (Sherr and Payne, 1978; Howes et al., 1981; White and Howes, 1994). Decomposition rates in wetland environments are variable and influenced by a number of abiotic factors including nutrients, oxygen, hydroperiod, temperature, salinity, and pH (Mendelssohn et al., 1999). Increased organic matter decomposition may lead to elevation loss from these ecosystems, hindering their ability to keep pace with sea level rise. However, organic matter decomposition may also release plant nutrients, thereby stimulating increased biomass production and leading to a net organic matter increase and associated elevation gains (Cahoon et al., 2004). Although the decomposition of organic matter in wetlands has been extensively examined, few studies have specifically addressed the effects of fire on organic matter decomposition rates in marshes. A more thorough understanding of the mechanisms affecting organic matter decomposition rates in marshes following prescribed burning is needed to inform land managers of the most sustainable land management practices in these threatened areas.

2. Background

2.1 Coastal Marsh Loss in the Mid-Atlantic Region

The Mid-Atlantic Region as a whole is at risk for extensive coastal marsh loss due to numerous reasons. Extensive areas of coastal marshes have been lost at alarming rates in Delaware (Phillips, 1986), Maryland (Stevenson, 1985), and in Virginia (Kearney and Stevenson, 1991). As a result, the ability of these areas to provide the necessary functions to nesting water birds such as the great blue heron and snowy egret as well as numerous mammals and amphibians that inhabit these marshes may be in danger. Reasons for marsh loss in this reason include urban and suburban development, draining for agriculture, and eutrophication (STAC, 2003). However, it is widely believed that the largest future threat to coastal marshes in this area is increased rates of sea level rise in conjunction with land subsidence.

The marshes at Blackwater NWR have been lost at alarming rates in the past century due to numerous interacting factors. It is estimated that since the 1930’s, over 3,200 ha of tidal marshes have been converted to open water due to increased sea level rise rates, herbivory, land subsidence, erosion, and saltwater intrusion (U.S. Department of Interior, 2008). Sea level rise rates in the Blackwater NWR area have outpaced the ability of these marshes to accrete vertically, therefore leading to the loss of marsh areas to open water (Stevenson et al., 1985). Blackwater NWR represents an especially bad scenario for marshes in the Mid-Atlantic region when it comes to sea level rise vulnerability, as this area is facing greater land subsidence rates than other areas due to groundwater withdrawal for agriculture (DOI, 2006) and glacial rebound. Exacerbating these factors is the finding that many eastern shore marshes appear to have naturally lower rates of accretion (Kearney et al., 1998). Additionally, these eastern shore marshes have a lower potential for sediment input than western shore marshes due to the lower elevation surrounding landscape and associated lower energy gradient for sediment transport, which is one of the main generalizations of why western shore marshes are more able to keep abreast with sea-level rise (Stevenson and Kearney, 2009).

Marsh loss typically occurs in several distinct stages (Kearney et al. 1998). Stable coastal marshes show intact interior sections where large interior ponds are absent, and the abundance of tidal creeks is relatively low. As marsh loss begins to take place, tidal creeeks increase in number and widen, and small interior ponds form. These interior ponds enlarge and eventually coalesce as the marsh loss process proceeds, which extensive areas of coalescing interior ponds marking an advanced stage of marsh loss. Finally, concurrent lateral erosion of the shoreline area of the marsh merge with interior ponds and the area is lost.

The U. S. Climate Change Science focused on the mid-Atlantic region in a 2009 report and has Blackwater NWR and the lower Dorchester County, MD region identified as the area most vulnerable to sea level rise (CCSP, 2009). This is the only area in the mid-Atlantic that is predicted with extremely high certainty to be lost under current sea-level rise rates within the next century. This does not even take into account the fact that due to climate change, the rate of sea level rise is expected to increase even beyond the current 3 – 4 mm/year observed in the region (CCSP, 2009).

Sea Level Affecting Marshes Modeling (SLAMM) done by the National Wildlife Federation has reinforced these observations (NWF, 2008). SLAMM simulates changes in tidal marsh area and habitat type by simulating the dominant processes involved in wetland conversions and shoreline modification during long-term sea level rise. Three scenarios of eustatic SLR were used for modeling based off of scenarios given by the Intergovernmental Panel on Climate Change. Under the scenarios, a 39 cm rise in sea level by 2100 would result in a 66 percent loss in brackish marshes, while a 69 cm rise in sea level would result in a drastic 94 percent loss in these marsh types. Current relative SLR rates on the nearby Choptank River of 3.52 mm/year (NOAA tide gauge 8571892, www.tidesandcurrents.noaa.gov), would produce about a 32 cm rise in sea level, however this ignores the fact that these rates will be increasing in the future (CCPS, 2009). Rahmstorf 2007 suggested that, taking into account dynamic melting of the Greenland ice sheet and possible error, a range in SLR we may see by 2100 would be 50 to 140 cm.

This habitat destruction has been costly for over 50,000 migrating geese, ducks, and tundra swans as the as the refuge is an important stop on the Atlantic flyway. Furthermore, the refuge is host to the largest breeding population of American Bald Eagles north of Florida, and marsh habitat destruction poses a significant risk to the future of these great birds. Therefore, future management operations at the refuge are concerned with marsh sustainability as one of, if not the main objective.

2.2 Fire History at Blackwater National Wildlife Refuge

Fire history at Blackwater NWR began by Native Americans as they used prescribed fire as a tool to clear land and facilitate fur trapping (U.S. Department of the Interior, 2001). Before European settlement, fires in this region were likely relatively frequent but temporally sporadic in nature, primarily due to anthropogenic causes (Pyne, 1995). After European settlement, the fire regime in this area changed to a practically annual winter burn regime to improve wildlife food production in the form of *Schenoplectus americanus*, and to facilitate the harvest of fur-bearing animals such as the muskrat and nutria (Pendleton and Stevenson, 1983). Prescribed fire has been used by land managers at Blackwater NWR since 1978 (Dept. of Interior, 2006) as a land management technique in this area during the winter months (Nyman and Chabreck, 1995). During this time, approximately 3000-4000 acres were burned on an annual basis (Dept. of Interior, 2001). In 1995, an evaluation of the prescribed fire program at Blackwater NWR and adjacent Fishing Bay Wildlife Management Area was implemented, which evaluated no burn, annual burn, 3-5 year burns, and 7-10 year buns on numerous marsh ecosystem attributes. This is important to recognize as it represents a release from almost 30 years of continuous prescribed burning for the no burn sites evaluated in this study.

Prescribed fire has been viewed as an effective technique to promote the growth of favorable wetland vegetation on the East and Gulf coast (Lynch, 1941; Mitchell et al., 2006); however, the effect of this short term goal on long term marsh sustainability has not been investigated at length (Cahoon et al., 2004). Marsh fires can be classified into three groups as peat burns, root burns, and cover burns, differentiated by water level and soil conditions present at the time of burning (Lynch 1941; Smith 1942, Uhler 1944; O'Neil 1949; Nyman and Chabreck 1995). Peat burns are not used as a management tool as they burn into and remove peat soils, releasing carbon and lowering marsh surface elevation (Uhler 1944). Marshes may produce plant roots that grow upwards into surficial detritus accumulation, especially areas which have not been burned for several years. If fire occurs in these marshes and the litter layer burns, then the plant roots also burn resulting in a root burn (Lynch 1941). The most valuable, widely used burn type by land managers is the cover burn. The cover burn results from when several centimeters of water is above the marsh surface, and removes existing plant aboveground biomass by combustion and volatilization (Arthur 1931; Griffith 1949; Lynch 1941; Uhler 1944). Cover burns are the main type of prescribed fire used by marsh managers in the Mid-Atlantic region (Griffith 1949, Dept. of Interior, 2006).

2.3 Coastal Marsh Elevation Dynamics

For a coastal marsh to survive, it must maintain its surface elevation close to that of the local sea level. Marshes accomplish this by the process of accretion, or vertical growth as sea levels rise. The main mechanisms behind accretion are surficial deposition of mineral sediment and organic debris, along with root deposition (Cahoon et al. 2004, 2006). While mineral sediment inputs may play a large role in marsh accretion in other physiographic settings, the drowned river valley marshes and low landscape elevation gradients typical of those on the eastern shore of the Chesapeake Bay are mineral sediment “starved” and rely primarily on organic matter inputs for their vertical development (Stevenson et al., 2002; Stevenson and Kearney, 2009). Due to low soil decomposition rates caused by anaerobic conditions in the absence of oxygen, belowground inputs to the marsh ecosystem, such as those by upward and lateral extension of rhizome and root networks, are generally regarded as having a greater contribution to marsh vertical accretion (Stevenson et al. 1985). Greater oxygen availability near the soil surface allows for faster decomposition of aboveground plant materials. Thus, any management practice which will increase the production of belowground biomass and therefore volume of soil will increase accretion rates.

Globally, sea levels are rising, and there is significant evidence that the rate is not only accelerating, but also that anthropogenic contributions to atmospheric greenhouse gas levels and their associated glacier melt, as well as thermal ocean expansion are very likely the main cause (CCSP, 2009). Each year, global sea level rises approximately 1.8 mm due to an increase in water volume (Douglas, 1997). The increased surficial flooding resulting from SLR will eventually drown out marsh areas that cannot keep pace, as the increased flooding stress will ultimately kill marsh vegetation (DOI, 2006). These affected areas will be converted to open water and lose substantial habitat value for wildlife. Another potential effect of inundation and breakup is the greater intrusion of saltwater into the upper reaches of the marsh, where the sulfate ion will be preferentially used by soil microbes for more efficient organic matter decomposition and may produce additional sulfide stress on the plants (DOI, 2006).

When putting into context the ability of coastal marshes vulnerability to sea level rise, the actual measurement which should be used is relative sea-level rise, which takes into account land subsidence as well as eustatic sea level rise. This figure is often substantially greater than the global SLR rate of 1.8 mm/year, as can be seen by varying readings at tide gauges located in geographically similar locations (Emery and Aubrey, 1991). Throughout the Mid-Atlantic region, the RSLR rates are higher than global rates, due to the gradual sinking of the Earth's crust in response to the melting of the Laurentide ice sheet which did not come this far south and the compaction of aquifer sediments due to groundwater withdrawal (Kearney and Stevenson, 1991). Currently, the relative rate of SLR in the nearby Choptank River is 3.52 mm/year (NOAA tide gauge 8571892, www.tidesandcurrents.noaa.gov), which puts Blackwater NWR at one of the top locations in the Mid-Atlantic region with respect to SLR vulnerability.

2.4 Fire Ecological Mechanisms Affecting Coastal Marshes

Fire represents a drastic disturbance at the ecosystem level to coastal marshes, at the physical, biological, and chemical levels. Currently, observational evidence exists that burning tends to make marshes "healthier," meaning that burned areas show less breakup and more evenly distributed grass species than non-burned areas. The two main mechanisms by which prescribed burns are suspected to affect coastal marsh ecosystems are through ash deposition in the form of combusted aboveground plant materials and by the removal of both alive and dead canopy vegetation. Due to the fact that prescribed burns in the Chesapeake Bay region are conducted during the winter times when most marsh grass species have sensed, the canopy which is ignited consists mainly of, if not completely of dead vegetation.

Ash deposition from combusted aboveground plant tissues may be one mechanism responsible for marsh plant response to prescribed fire. Ash additions to the marsh soil represent a soluble, inorganic, plant-available source of nutrient additions, and may produce a "fertilizer" effect on marsh grasses. Typically, nitrogen is the primary nutrient lost to volatilization by fire (Rice and Owensby, 2000), although significant amounts of sulfur and carbon are also lost and may contribute to atmospheric pollution (Cachier et al., 1995; McNaughton et al., 1998). The quantity of nutrient loss resulting from fires is dependent on the temperature of the first, with the hottest fires creating white ash and resulting in nitrogen volatilization of near 100 percent (White et al. 1973). Also, ash additions to upland soils have shown to increase short-term pH levels in a Maryland coastal plain grassland (Sherman et al., 2005).

Canopy removal is the other main mechanism which is suspected to effect herbaceous marsh vegetation following prescribed burning through increased light availability and increased soil temperatures. Previous research conducted in tall grass prairies has associated these mechanisms with vegetative growth stimulation following fires (Knapp and Seastedt, 1986). The combustion of the senesced canopy from the previous year's growing season removes a physical barrier to emergence and growth of new vegetation. Increased light availability to emerging plant shoots lessens the completion factor for plants and increases the photosynthetic efficiency of the marsh, proving to be an important factor determining overall biomass production (Turitzan and Dranke, 1981). Removal of canopy and detritus could also provide increased solar radiation contacting the dark soil surface, increasing soil temperatures. This may extend the growing season by stimulating earlier spring growth, and may also increase nutrient availability for plants by stimulating soil organic matter mineralization, as has been observed in rangelands (Sharrow and Wright, 1977).

3. Nutrient Dynamics and Plant Productivity in Marshes

3.1 Wetland Nutrient Biogeochemistry

Biogeochemical cycling in wetlands involves the transport and transformation of chemicals and involves numerous interrelated physical, chemical and biological processes

(Mitsch and Gooselink, 2007). The processes that exert control over the biogeochemical forms of nutrients, mainly redox status which is controlled by hydrology, are particularly important because they affect the spatial distribution of these nutrients within the wetland through such processes as plant uptake and sediment-water exchange. In turn, these nutrient flows are important determinants of wetland plant productivity and organic matter decomposition. Nutrient cycling is generally thought to occur most rapidly in wetland ecosystems that have pulsing hydrologic regimes, "open" hydrologic connections, and high rates of plant productivity. Brackish tidal marshes meet these three requirements, and thus a sound knowledge of the processes that determine nutrient availability is necessary to determine the overall effects of disturbance on these ecosystems. Specifically, the focus of this literature review will be on nitrogen and phosphorous because they are most often the limiting nutrients in wetland ecosystems and are both plant macronutrients. The Chesapeake Bay and its associated tidal marshes are subject to high rates of nitrogen and phosphorous loading, primarily from the anthropogenic sources of agriculture and urban development in the watershed (Kemp et al., 2005). Any alteration of the nutrient biogeochemical cycling within tidal marshes will have implications to the sustainability of these areas in response to fire and thus the health of the Bay as a whole.

3.2 Nitrogen Biogeochemistry in Wetlands

Nitrogen is one of the most important elements in wetland ecosystems, as it is used in the production of numerous organic molecules, such as amino acids, proteins, and nucleic acids. Nitrogen appears in a number of dynamic chemical species and oxidation states; the transformation between these states is often microbially mediated. Nitrogen is commonly the limiting nutrient for plant primary production in wetlands. This is especially true for coastal wetlands and associated waters, where nitrogen abundance is relatively low to other nutrients, adding to the importance of understanding nitrogen dynamics in these ecosystems. This concept of nitrogen as the limiting factor stems from the anoxic conditions present in wetlands which allow for microbial denitrification of nitrates to gaseous nitrogen forms which are subsequently lost to the atmosphere. However, too much nitrogen loading into wetlands may lead to eutrophication and associated hypoxia (where dissolved oxygen concentrations fall below 2 mg/L), which causes damage to aquatic life and has become a major problem in coastal waters worldwide (NRC, 2000). Much of this problem stems from the fact that humans have approximately doubled the amount of nitrogen which enters the lithosphere through the Haber-Bosch process of fertilizer manufacturing, increasing usage of nitrogen-fixing legume crops, and fossil fuel burning (Vitousek et al. 1997; Galloway et al., 2003). Finally, nitrogen in the form of nitrate provides one of the first electron acceptors in wetland soils after the loss of oxygen due to saturated conditions, making nitrogen availability important in the process of organic matter decomposition in wetlands.

The nitrogen cycle begins as a process called nitrogen mineralization converts organically bound nitrogen, found in the organic matter of plant tissues and soil, to ammonium nitrogen (NH_4-N) under both aerobic and anerobic conditions. This is known as ammonification and stems from numerous biological processes. The ammonium ion (NH_4^+), with nitrogen in a reduced oxidation state of -3, is the most common form of nitrogen in wetlands. Once ammonium is formed, several pathways exist for this ion to travel. The ion can be taken up directly by plant root systems and incorporated into vegetative tissues, or by anaerobic bacteria, both which concert NH_4^+ back into organic matter. The ammonium ion can be immobilized by negative charged soil particles as well, although this is most likely a minor process in organically derived soils such as those on the coastal marshes of the Chesapeake Bay. Furthermore, under basic conditions where the pH of water may be greater than 8, such as in calcareous or coastal environments (Waldbusser et al., 2011 found an average spring pH of 7.98 and summer pH of 7.9 in waters of the Choptank River between 2003 and 2008), ammonium may be volatilized and lost from the wetland. Finally, oxidation of ammonium may occur, typically in the rhizosphere of plants or the upper zone of soil which may be intermittently exposed to oxygen when water tables fall, through a process called nitrification. Nitrification is carried out by two separate types of bacteria, first *Nitrosomonas* sp. which convert ammonium to nitrate, followed by *Nitrobacter* sp., which convert nitrite to nitrate.

Nitrate (NO_3^-) is the next main nitrogen species of concern in wetlands, and it is more mobile than ammonium due to its negative charge which is likely to interact with soil particles. This mobility of nitrogen through the wetland system creates problems as nitrate is easily lost to groundwater or surface waters, where it commonly leads to eutrophication and hypoxia. Denitrification is the most common way nitrate is lost from a wetland, and involves the decomposition of organic substances by facultative anaerobic bacteria, which convert nitrate to molecular nitrogen and less substantially nitrous oxide. While release of molecular dinitrogen poses no environmental hazard, the production of nitrous oxide is of concern as it is a potent greenhouse gas. Conditions such as pulse-flooding rather than continuous saturation, along with location near aerobic/anaerobic wetland edges favor increased N_2O production during denitrification (Hernandez and Mitsch, 2006; 2007). Overall, denitrification is typically limited by the nitrification rate, which is controlled by the diffusion of ammonium upwards into more aerobic soil layers, as it moves at a rate of about seven times faster than nitrate will diffuse back to the anaerobic layer (Reddy and Patrick, 1984). Denitrification is a significant pathway from which nitrogen is lost in all wetlands, including the brackish tidal marshes of the Chesapeake Bay.

Nitrogen fixation represents the introduction of nitrogen from the atmosphere into the wetland ecosystem through organic matter assimilation. The atmosphere, composed of 80% nitrogen, represents an essentially limitless pool of this element, and certain aerobic and anaerobic bacteria, along with blue-green algae, are able to harness this source of nitrogen in the presence of the enzyme nitrogenase. Bacterial nitrogen fixation by nonsymbiotic bacteria or by symbiotic bacteria of the genus *Rhizobium* provide the most significant pathway for nitrogen fixation in brackish marsh soils.

Other processes in the nitrogen cycle, which are relatively new discoveries, include dissimilatory nitrate reduction to ammonia (DNRA) and anaerobic ammonium oxidation (anammox). DNRA involves the conversion of nitrate to ammonium, and may be significant in instances of high organic carbon availability and/or low nitrate concentration, where this process is favored over denitrification (Megonigal et al., 2004). Numerous bacteria have been shown to carry out this process, and can be anaerobic, facultative, or aerobic. Anammox involves the oxidation of nitrate by ammonium to produce dinitrogen gas, and may be a substantial process in wetland environments limited by lack of a labile organic carbon source (Megonigal et al., 2004). However, it is unlikely that either of these processes dominate the nitrogen dynamics in Chesapeake Bay tidal marshes, where nutrient loadings and organic matter contents are high.

3.3 Phosphorus Biogeochemistry in Wetlands

Phosphorus is one of the most important limiting chemicals in ecosystems, as it forms the basis of the molecule ATP, upon which the energy for cellular respiration is stored. It has been shown that in most cases, freshwater wetlands and aquatic ecosystems are phosphorus, rather than nitrogen limited. However, while it is still important in saltwater marshes and coastal waters, it is not considered as a limiting factor due to its relative abundance and biogeochemical stability. The transformations involving phosphorus are markedly different from those involving nitrogen, whereas the nitrogen cycle is a microbially mediated system and the phosphorus cycle is dominated by physical, sedimentary processes.

In wetland ecosystems, phosphorus occurs as soluble and insoluble complexes in both organic and inorganic forms. Organic forms of phosphorous may be soluble or insoluble, however both are unavailable for biological use and must go through the process of mineralization to the inorganic form for assimilation into plants and microrganisms. Inorganic forms are often lumped together and talked about as the orthophosphates (PO_4^{3-}, HPO_4^{2-}, and $H_2PO_4^-$), with the dominant speciation dependent on pH. The orthophosphates represent the form of phosphorus which are both soluble and biologically available. Phosphorus forms are not directly affected by redox status, however their association with other compounds which control the availability of phosphorus to higher organisms are affected. Specifically, iron plays a large role in phosphorous availability in wetlands as it may bind with it to create insoluble iron phosphates. Upon introduction of anaerobic conditions, the ferric iron is reduced to ferrous iron and thus releases the bound phosphate for biological use.

Also, the sorption of phosphorous onto the surfaces of clay particles is important in wetlands. This holds especially true for coastal salt marshes, where much of the phosphorus entering these ecosystems is brought by flooding rivers and tides depositing mineral clay-phosphorous complexes on the marsh surface. Since macrophytic vegetation obtains nutrients for growth from the soil, this mechanism is important in allowing phosphorous to climb the trophic level allowing for higher wetland functions to thrive.

3.4 Estuarine Wetland Specific Biogeochemistry

It is important to note the uniqueness of the estuarine system, and connected tidal marshes, and they represent the focus and scope of this study. Whereas upland ecosystems are often relatively closed, connecting with adjacent hydrologic entities such as slow moving groundwater and smaller surface waters, estuaries represent places where rivers meet the sea and there is a significant dilution of freshwater with saltwater. Salt marshes are continuously exchanging physical and chemical materials with tidal waters, which in turn are influenced by local, regional, and seasonal conditions.

The chemistry of the waters which affect salt marshes is significantly different than that of those affecting freshwater marshes. Nutrients enter coastal water bodies from numerous sources, including agriculture (Jordan et al. 1997), sewage (Howarth et al. 2002), and atmospheric deposition (Morris 1991). Sea water is much higher in concentrations of sodium, magnesium, calcium, potassium, chloride, sulfate, and carbonates (all of which come mainly from oceanic sources) than freshwater under normal conditions, which in turn affects the ecological niches of these wetlands and the biogeochemical paths therein. Also, due to the large reservoir of salt water in the ocean compared to the small amount of freshwater, sea water maintains a chemical composition which is relatively constant across regions whereas freshwater is much more likely to be impacted by temporally sporadic events or local geophysical conditions. Finally, elements such as iron, silicon, and our focus nutrients of nitrogen and phosphorus are supplied to estuarine waters from freshwater sources, mainly rivers.

Phosphate is usually abundant in salt marsh sediments and is rarely found to be the limiting nutrient for ecosystem productivity, especially in saltier regions (Stribling and Cornwell, 2001). The availability of this nutrient is closely related to iron and sulfide chemistry, as these form iron sulfides but released iron may bond with phosphate, restricting its mobility. A common pattern in estuarine systems is for a late summer phosphate maximum in the water column, as has been detected in Chesapeake Bay brackish marsh systems (Stevenson et al., 1977).

Nitrogen is primarily utilized by vegetation as ammonium in salt marshes (Mendelssohn, 1978). However, nitrate is also a significant source of nitrogen supplied to estuaries, especially in the mid-Atlantic region, primarily through ground water losses from agriculture (Staver and Brinsfield, 1990). Often, most of this nitrate is lost in winter when fields are in fallow, and generates strong pulses in stream waters near the upper reaches of the estuary. Event-scale pulses are also important for the delivery of nitrate into the estuary, and have been shown to deliver a disproportionally high amount of nitrate into the Chesapeake Bay during heavy storm flows (Prestegaard and O'Connell, 1995). Overall, the uptake and transformation processes of nitrate are strongly biochemically-driven in marsh soils and sediments (Scudlark and Church, 1989). Anaerobic wetland soils with redox potentials similar to salt marsh soils have been documented to lose 30 to 90 mg N/L per day as a result of denitrification (Patrick et al. 1972). Tidal flushing is also likely to leach away nitrogen in both ammonium and nitrate forms (Mendelssohn, 1979).

In the lower Chesapeake Bay near Carter's Creek, VA, Wolaver et al. 1983 conducted a 22-month study to determine the exchange of nitrogen and phosphorus between a mesohaline marsh and the surrounding estuarine waters. The researchers found that there was a net annual removal of ammonium, nitrate, and phosphate from the tidal water as enters the marsh nutrient cycle. Only nitrite showed trends of net release from the marsh to the estuary waters.

3.5 Nutrient Additions and Plant Productivity

Understanding the interaction between plant productivity and nutrient levels is essential to this study for numerous reasons. Increased plant productivity has been observed in marshes following prescribed burns (Hackney and de la Cruz, 1983; Gabrey and Afton, 2001; Schmitz, 2000), and bottom-up forces in the form of nutrient additions (ash deposition), are one possible cause which is often assumed but has not been investigated at length. Salt marshes are nitrogen limited (Valiela and Teal, 1974) yet highly productive environments (Bertness, 1992), and thus are potentially sensitive to changes in nutrient availability. Also, since marshes in the Chesapeake Bay region are dependent on organic matter inputs from plant production for accretion, nutrient fluxes due to prescribed burns may have significant ecological impacts in the organic matter cycling and, in turn, overall elevation of salt marshes (Nyman and Chabreck, 1995). Several studies have been conducted using controlled fertilization experiments to address this issue.

Crain 2007 conducted a 3-year in-situ fertilization addition experiment of 163 g N/m^2/yr and 110 g P/m^2/yr and found that two *Spartina patens* salt and brackish marshes in southern Maine were N limited, with possible secondary P limitation. The nutrients were added in three increments during the growing season, during May, June, and July, meaning that each addition gave the plants 54.3 g N/m^2 and 36.7 g P/m^2. A significant increase ($F=9.88$, $p<0.0001$) in aboveground biomass relative to the control treatment was observed of 50% and 75% in N and N+P plots, respectively, over the first year of the study. In the third year, significant biomass increases were 100% (N plots) and 300% (N+P plots) greater than the control plots ($F=62.47$, $p<0.0001$).

In a greenhouse study, DeLaune et al. 2005 found that *Spartina patens* showed a doubling in biomass production ($F=26.80$, $P<0.0001$) with the addition of 10 g N/m^2 and 8.7 g P/m^2 when compared to non-fertilized mesocosms taken from southern Louisiana, both 8 and 12 weeks after fertilization. However, the fertilizer treatment combined application of nitrogen and phosphorous so any individual effects of the nutrients were impossible to determine.

Gusewell et al. 2003 conducted a greenhouse experiment and observed a significant ($p<0.0001$) increase in the aboveground biomass of all 15 Swiss wetland plant species examined when given weekly 0.95 g N/m^2 relative to the control treatment of 0.32 g N/m^2. In the second year of the study, plant response to a phosphorus addition of 0.06 g P/m^2 increased shoot growth relative to the control treatment of 0.02 g P/m^2, indicating that once nitrogen requirements were met by the plant, then advantages of P resources could be utilized.

Alberti et al. 2009 conducted an in-situ study of the interaction between fertilization effects and crab herbivory on *Spartina densiflora* in the Mar Chiquita coastal lagoon in Argentina. When compared to control treatments without fertilizer, monthly additions (from January 2006 through June 2007) of 8.7 g N/m^2 and 1.5 g P/m^2 increased plant biomass 4.5 times on the marsh-mudflat edge and 6.5 in the low marsh area ($p<0.05$).

In a study conducted by Daleo et al. 2008 at the Argentinian marshlands of the Bahia Samborombon, bi-weekly (from December 2005 through April 2007) of *Spartina alterniflora* by the addition of 4.35 g N/m^2 and 0.75 g P/m^2 showed numerous results. Aboveground biomass increases of 5.3 times ($F=255.71$, $p<0.0001$) were observed compared to non-fertilized plots, and a doubling of stem density was observed ($F=48.32$, $p<0.0001$). Also, stem heights increased by a factor of 1.65 ($F=108.25$, $p<0.0001$).

Levine et al. 1998 conducted a fertilization experiment at the Rumstick Cove salt marsh in Rhode Island. From April to September in 1993 and 1994, additions of 4.35 g N/m^2 and 0.45 g P/m^2 were applied to marsh plots of 4 common East Coast salt marsh plant species. It was found that fertilization doubled the monoculture biomass of *Spartina alterniflora* ($p<0.05$), *Spartina patens* ($p<0.05$), and *Distichlis spicata* ($p<0.05$).

A multiyear study was conducted by Gratton and Denno 2003 in a *Spartina alterniflora* dominated salt marsh near Tuckerton, New Jersey. The study was designed to represent a nutrient pulse event to the marshes, and essentially contained two separate experiments. In the meadow experiment, 60 g N/m^2 was applied biweekly for 4 weeks in mid-May 1998. A significant ($p<0.05$) 3-fold increase in fertilized *Spartina* biomass over control plots was observed in the first year after fertilization, with significant ($p<0.05$) increases in nitrogen plant tissue content as well (1.4%). The second experiment involved adding 120 g N/m^2 to *Spartina* plots biweekly for 8 weeks starting in mid-May 1999. This produced a significant ($p<0.05$) 2.5 fold increase in the aboveground fertilized *Spartina* biomass over control plots, and resulted in a significant ($p<0.05$) 1.5 – 1.8% increase in the nitrogen content of the plant tissue.

Emery et al. 2001 conducted a fertilization experiment at the Nag Cove marshes at the Narragansett Bay National Estuarine Research Reserve on Prudence Island, Rhode Island. A fertilizer was applied to plots at the rate of 4.35 g N/m^2 and 0.45 g P/m^2 starting in mid-May 1997 and continuing through the end of August. The next year, the same fertilizer treatment was applied and analyses were performed at the end of August. General findings of the study were that monoculture plots of *Spartina alterniflora*, *Spartina patens*, and *Distichlis spicata* showed a doubling in biomass compared with nonfertilzed plots. However, no statistics were performed on these findings as the paper was mainly focused on competitive interactions in mixed species plots.

van Wijen and Bakker 1999 performed a fertilization experiment that was perhaps the most applicable to real world nutrient availability rates in marshes. They applied nitrogen at low (5 g/m^2/yr) and high (25 g/m^2/yr) rates and phosphorus at low (2 g/m^2/yr) and high (10 g/m^2/yr) rates to different areas of a salt marsh on the island of Schiermonnikoog in the Netherlands. Results from the experiment showed that phosphorus addition alone had little effect on plant biomass unless paired with nitrogen, indicating that nitrogen was limiting plant growth. Nitrogen addition significantly ($p < 0.001$) explained increases in biomass compared to control plots in the experiment. The low N application rate proved to show drastic vegetation changes when applied to the younger marsh areas, which were found to have N mineralization rates of 2.5 g N/m^2/yr, while it took the high N application rate to overcome the N mineralization rate of 12.7 g N/m^2/yr in the older marsh areas.

Mendelssohn 1979 conducted a fertilization study on *Spartina alterniflora* in a North Carolina salt marsh. Nitrogen additions of 56.0 g/m^2 added in two split increments, once on June 10th and again on July 22, 1976, doubled the aboveground production of smooth cordgrass. Plant responses in the form of increased biomass were shown at all N application levels of 28.0, 56.0, and 112 g N/m^2. The range of N applications showed a 49% to 172% increase in biomass yield.

Buresh et al. 1980 examined *Spartina alterniflora* response to additions of both nitrogen and phosphorus. Ammonium-N and phosphate-P were added to plots in May 1976 at a rate of 20 g/m^2. Nitrogen additions significantly increased total aboveground plant biomass and plant height by 28% and 25%, respectively, 4 months after fertilization. Phosphorous additions did not significantly affect plant height and biomass.

It is also worth noteing that although most of the work on fertilization studies in marshes has focused on aboveground plant response, the majority of annual biomass production occurs belowground, and this production is expected to contribute more significantly to marsh vigor (Turner, 2011; Anisfeld and Hill, 2012). The hypothesis that increased nutrient availability may develop lower root:shoot ratios for *Spartina alterniflora*, as observed in grasslands when soil fertility and aboveground biomass increase (Tilman and Wedin, 1991) has been explored by a several researchers with mixed results.

Darby and Turner, 2008 (a,b) found that nutrient enrichment, especially with phosphorus, reduces belowground productivity of *Spartina alterniflora*. The authors theorized that this is due to plants putting more resources towards developing aboveground tissue for photosynthesis rather than belowground tissues for nutrient scavenging in high fertility conditions. In addition to less carbon produced belowground, soil metabolism may also increase as denitrification uses carbon as an electron donor, leading to diminished pools of soil carbon (Morris and Bradley, 1999). The end result is less carbon being produced and more carbon being metabolized and lost.

Conversely, Anisfeld and Hill, 2012 found that fertilization with either nitrogen or phosphorus did not decrease belowground production or soil carbon over a 5-year study in a central Long Island Sound salt marsh dominated by *Spartina alterniflora*. The authors concluded that observed increases in CO_2 fluxes from the soil were compensated for by other processes. Thus, the effects of nutrient additions on belowground production in salt marshes remains understudied and unclear, relative to aboveground biomass studies.

In summary, nitrogen appears to have dramatic effects on emergent salt marsh vegetation aboveground biomass and density when added at rates of at or above 5 $g/m^2/yr$. Nitrogen needs to be about double the rate of natural mineralization for an effect in vegetation to be seen (van Wijen and Bakker, 1999). The effects of phosphorus appear to be much less dramatic and only effect vegetation after initial nitrogen limitations have been overcome, if at all. A summary table of the results detailed in this section can be found in Table 1-1.

Study	Nitrogen Added (g/m^2)	Phosphorus Added (g/m^2)	Increments	Yearly Nitrogen Addition ($g/m^2/yr$)	Yearly Phosphorus Addition ($g/m^2/yr$)	Findings
Crain, 2007	54.3	36.7	Monthly, May - July 2001	162.9	110.1	*S. patens* 50% biomass increase (N only), 75% biomass increase (N+P)
DeLaune et al., 2005	10	8.7	Single, 3 month greenhouse experiment	10	8.7	*S. patens* doubling in biomass production
Gusewell et al., 2003	0.95	0.06	Weekly, 15 weeks in 1998	14.25	0.9	Increase in aboveground biomass of all 15 plant species examined, albeit a small increase
Alberti et al., 2009	8.7	1.5	Monthly, Jan. 2006 - June 2007	52.2	9.0	*S. densiflora* biomass 4.5 times increase (marsh edge), 6.5 times increase (low marsh)
Daleo et al., 2008	4.35	0.75	Biweekly, Dec. – April 1993, 1994	34.8	6.0	*S. alterniflora* aboveground biomass increase of 5.3 times, doubling of stem density, stem height increase of 1.65 times
Levine et al., 1998	4.35	0.45	Biweekly, April – Sept. 1993, 1994	43.5	4.50	Doubling of *S. alterniflora*, *S. patens*, and *D. spicata* biomass
Emery et al., 2001	4.35	0.45	Biweekly, mid-May – end Aug. 1997, 1998	30.45	3.15	Doubling of *S. alterniflora*, *S. patens*, and *D. spicata* biomass
Gratton and	60	N/A	Biweekly, 4 weeks, mid-	240	N/A	3-fold increase in *S. alterniflora* biomass,

Denno, 2003			May start			1.5 – 1.8% increase in plant tissue N content
Gratton and Denno, 2003	120	N/A	Biweekly, 8 weeks, mid-May start	960	N/A	2.5-fold increase in *S. alterniflora* biomass, 1.4% increase in plant tissue N content
Van Wijen and Bakker, 1999	5 (low) and 25 (high)	2 (low) and 10 (high)	Early May 1994, 1995, 1996	5 (low) and 25 (high)	2 (low) and 10 (high)	N application affected plant growth while P application did not.
Mendelssohn, 1979	56	N/A	Twice, June and July 1976	112	N/A	Doubling of plant biomass
Buresh et al. 1980	20	20	Single, May 1976	20	20	N additions significantly increased total aboveground plant biomass and plant height. No effect of P additions.

Table 1-1. Summary chart detailing nutrient additions and resulting plant responses in coastal marshes.

3.6 Nutrients and Soil Organic Matter Decomposition in Wetlands

Ecosystem nutrients and soil organic matter decomposition are closely related to one another. Through the process of decomposition, soil organic matter can contribute to the availability of nutrients for plant growth through mineralization. Conversely, the availability of nutrients is suspected to be a major factor controlling organic matter decomposition, although relatively few studies have attempted to differentiate between which environmental factors exert control over organic matter decomposition in the field (Mendelsshon et al. 1999, Latter and Harrison, 1988). Some of the studies that have attempted to measure the relationship of nutrients and soil organic matter decomposition in wetlands are summarized in this section.

Mendelsshon et al. 1999 attempted to elucidate the relationship of soil environmental conditions and soil organic matter decomposition rates, as determined by the cotton strip method, along a salinity gradient in a *Phragmites* dominated coastal marsh in Jutland, Denmark. CTSL rates ranged from a high of 5.5% per day to a low of 1.8% per day, with a general trend of CTSL rates decreasing with depth. Soil porewater interstitial nitrogen (NH_4 + NO_3) was highest at the lowest salinity site and significantly lower at the remaining marsh sites. Phosphorous varied similarly to N, K, Mg, Na, S, Mo, Fe, and Mn, with the lowest concentration at the freshwater sites and greater concentrations at the saltier sites. For decomposition data analysis, the 20 environmental variables which were collected at the 7 sampling locations with the 7 marsh sites were simplified into three major principal components describing the variation in the environmental data. The largest percentage of the variation (45%) was explained by the first principal component, which had high loadings for conductivity, K, Na, and Mg and was interpreted as a salinity-related factor. An additional 25% of the variation was explained by principal component 2 and had high loadings for NH_4, P, and sulfide, and was interpreted as a nutrient-soil reduction related factor. Principal component 3 further explained 10% of the variation and had high loadings for B, S, and Ca, and was also likely to be salinity related to seawater. Together, these three principal components explained 79% of the variation in the environmental data, with salinity and soil nutrient reduction status explaining the greatest amount of variation. These three principal components were then used as independent variables in a multiple regression where the dependent variable was CTSL. Two of the three principal components were significant in the multiple regressions.

An investigation between soil organic matter decomposition in a Maryland marsh affected by an oil spill was examined by Mendelsshon and Slocum 2004. The investigators found that, contrary to their hypothesis, oil did not have a significant effect on soil organic matter decomposition rates. Rather, abiotic factors played the largest role in determining organic matter decomposition rates. Principal component analysis revealed four principal components explaining 78% of the variation in the data set, two of which were found to have a significant effect on decomposition (stepwise linear regression: df=2, 33, $F = 12.6$, $p < 0.0001$). The first principal component consisted of salt and pH factors, and had a negative effect on decomposition and explained a substantial proportion of the variation in soil data ($r^2 = 0.38$). This suggests that higher salinity and lower pH decreased decomposition rates, a theory supported by simple correlation between decomposition rate with these various measures of soil chemistry. The second principle component, Eh, had a marginally significant effect on decomposition ($F = 3.1$, $p = 0.09$), yet explained a very small amount of the data set's variation ($r^2 = 0.05$). The third and fourth principal components identified, representing nitrogen and phosphorus respectively, were not significant to decomposition rates.

Haraguchi et al. 2002 examined the relationship between decomposition indices and physiochemical soil properties in a minerotrophic mire ecosystem. Also, the relationship between decomposition indices and plant community types was examined. They found that cellulose decomposition rate showed differences corresponding to plant community types, but could not determine any correlation between cellulose decomposition and water table level data. Cellulose decomposition rates also showed a significant positive correlation with the pH of pore water.

Rybczyk et al. 1996 reviewed 24 publications that examined nutrient amendments on wetland soil litter decomposition rates. Out of the 24 studies, eight showed enhanced rates of decomposition, seven showed variable effects dependent on environmental conditions, and nine found no hosphorus effect. It was noted however, that nitrogen rather than phosphorus limits decomposition, although phosphorus can stimulate decomposition after primary nitrogen limitations have been alleviated.

Rubio and Childers examined the effects of nutrient availability on litter decomposition in oligotrophic phosphorus-limited Florida Everglades estuaries. Litter bags filled with *Cladium jamaicense*, *Eleocharis* spp., and *Juncus roemerianus* were transplanted into two estuaries, one which received appreciable amounts of marine P and one which did not. Over the 18 month deployment period, beginning in December 2001, the researchers found that increasing nutrient availability led to higher decomposition rates, although the rates were species specific. The effects of increasing N and P were likewise species specific.

If any generalization about nutrients relative to wetland soil organic matter rates can be made, it is that none can be made. Typically, decomposition rates, like nutrient availability, are highly variable over vary small distances and change with environmental conditions. Therefore, studies on these relationships are ecosystem dependent and must be taken with caution in extrapolation to wider environments.

4. Fire and Nutrient Availability

4.1 Fire and Ash Characteristics

Probably the most obvious direct ecosystem consequence, next to removal of vegetation and production of volatilized compounds (a.k.a. smoke), is the production of ash.

Ash represents a mineralization of the organically bound nutrients within plants, at least those of which are not lost to volatilization and removed from the ecosystem. The ash, once deposited onto the soil, is often rich in basic cations such as K, Mg, and Ca, which have high volatilization temperatures not produced during prescribed burns. These cations are present as soluble salts which, upon contact with water, undergo hydrolysis and produce alkalinity (Daubenmire, 1968). The cations themselves are also readily available for plant uptake and serve as a fertilizer source which may or may not be significant, dependent on ash nutrient content, amount of ash deposited, and time of deposition.

Ash nutrient content has been studied in numerous studies. Faulkner and de la Cruz, 1982 found that volatilization losses of N and K from *Juncus romerianus* and *Spartina cynosuroides* were 90% and 50%, respectively. Ash nutrient content in post-fire residues broke down to approximately 0.3 g N/m^2, 0.3 g P/m^2, 1.9 g K/m^2, 1.7 g Ca/m^2, 1.8 g Mg/m^2, 0.2 g Mn/m^2, and 0.25 g Fe/m^2. Sherman et al. 2005 found that the primary cations in burned grassland vegetation were Ca (1.12%), Mg (0.17%), and K (0.24%), while Na, Fe, Mn, Zn, and Cu concentrations were all below 0.1% of the ash.

Qian et al. 2009 used laboratory simulation methods to evaluate temperature effects on the nutrient composition of sawgrass and cattail ash. Almost all (99%) of total nitrogen and total carbon were lost via volatilization at 450 and 550 °C. This finding corresponded to earlier findings by Marion et al., 1991 and Certini, 2005 who both found nearly complete organic matter combustion at temperatures of 400 to 500 °C. Approximately 30 to 70% of the total nitrogen was lost from 150 to 350 °C. The authors successfully modeled the loss of nitrogen as a function of burn temperature with good accuracy, according to the equation $y=0.01(x^{1.46})$,

r^2=0.83, where y=total nitrogen loss (%) and x=burn temperature (°C). Modeling the response of phosphorus to fire was more difficult, although a decent relationship between laboratory ash total hosphorus:plant leaf total phosphorus and burn temperature. The equation=$5.96+3.25e^{(0.004x)}$, r^2=0.73, where y=lab ashTP:leafTP and x=burn Temperature (°C). It is worth noteing that the authors realized that while nitrogen is lost primarily through the volatilization pathway, phosphorus may be lost through volatilization and, more predominantly, through fine particulate losses (Raison et al., 1985). This makes field determination of P losses through a fire more difficult and problematic to determine than N losses. Findings of this study show that fires which maintain intensities fewer than 350 °C may contain approximately half of the fuel sources' original nitrogen content and thus may constitute a more effective fertilizer source than more intense fires. Fires with intensities greater than 450 °C will likely provide no nitrogen fertilization to vegetation.

Liu et al. 2010 examined the incubation release of phosphorus from cattail and sawgrass ash taken from the Florida Everglades. Laboratory ash samples were made by combusting the plant tissues at 400 °C based on the Qian et al. 2009 study above, which was supposed to simulate natural burning conditions. Based on the Qian et al. 2009 study, it was assumed that nitrogen addition to the ecosystem by ash was minimal, and so phosphorus was the nutrient of focus. The study performed incubation extractions on the ash at small increments for the first day (0, 2, 8, 12 and 24 hours) followed by longer term measurements on the order of days and weeks up through 65 days. Approximately 17.4% of the cattail biomass became ash and 19.8% of the sawgrass tissue became ash. Key findings of this study include the fact that the first 24 hours after burning are critical in P release from the ash. Approximately 60 to 80 percent of the

P that would be released over the entire incubation period was released in the first 24 hours, leading the authors to note that water stagnation following a fire would be a key factor in allowing plant uptake rather than generating a P pulse downstream. The P salts left in ash following a burn can release large amounts of P into surface waters, on the order of $3.5 * 10^3$ micrograms P/L for tricalcium phosphate, and most likely even more for magnesium phosphate due to its higher solubility (Liu et al., 2007).

In summary, the ash characteristics of a fire are dependent on plant species, habitat nutrient availability, live/dead status of aboveground biomass and perhaps most importantly fire intensity. Basic cations (e.g. K, Mg, Ca) tend to accumulate in ash and may potentially increase surficial soil pH, although in tidal systems this effect is likely to be minimal. Burn temperatures over 400 °C likely volatilize most, if not all, of the organic compounds present and provide minimal fertilization value especially with respect to nitrogen and phosphorus. Thus, fire intensity is a primary factor in predicting how ecosystems will respond to fire.

4.2 Fire and Soil Nutrients in Upland Ecosystems

Numerous studies have been conducted in upland ecosystems concerning nutrient dynamics following fire. Some key studies will be examined in this section to supplement the following section, as the literature on nutrient dynamics pertaining to marsh fires is limited compared to studies in upland environments.

Sherman et al. 2005 studied the effects of prescribed burning management on grassland ecosystem restoration in the Mid-Atlantic, with a special focus on soil chemical properties. The study found that the general effects of a mid-April burn on properties of the ultisol were short lived and dissipated within one years' time. Soil pH had increased significantly ($p<0.05$) in both surface and subsurface horizons 11 days following burning. Surface soil horizon pH rose from 5.72 to 5.94, which is similar to the average pH rise of 0.23 found in all horizons from 0 to 20 cm. However, this effect was short lived and was no longer present after 1 year. Small increases in extractable Ca and Mg were found after 11 days, but no increase was found for other nutrients examined (K, Na, Fe, Mn, Zn, Cu, S, and P). Overall, the authors concluded that the effects of fire with respect to the soil environment were short lived and minimal.

Picone et al. 2003 found shifting in the soil nutrient pools and microbial activity following winter-spring burning in the Flooding Pampa region of Buenos Aires. Following burning, microbial biomass C and N were higher in the burned (433 mg C/kg and 37 mg N/kg) than in the unburned treatment (386 mg C/kg and 26 mg N/kg). The authors attributed this to higher temperatures attained in the surface soil layers during burning (Garcia, 1992), which increased decomposition rates and in turn mineralization rates of organic matter (Risser and Parton, 1982).

Stephens et al. 2004 examined the effect of moderate-intensity wildfires on soil and stream characteristics at Sugar Pine State Park in Lake Tahoe, California. The prescribed fire was done in October 1996 to selected forested areas, and soils were sampled 3 months before and after the burns for comparison. Large increases in ammonium were found in the post burn soils, from 1.56 mg NH_4/kg pre burn to 38.43 mg NH_4/kg post burn, which was attributed to the conversion of organic N to reduced inorganic N forms. Nitrate did not show any significant increases post burn, and the authors noted that this matched up well with numerous other studies who found little to no NO_3^- increases post burn (Laubhan 1995). Surface soil depths showed an increase in phosphorus from 0.03 to 0.04% P by mass which was attributed to ash deposition but not considered significant.

Rhoades et al. 2002 studied the effects of a spring fire on Kentucky barrens restoration, which represent small grassland patches nestled among forest habitat. The soils of this area were classified as Typic Hapludalfs. Using resin capsules installed for 30 days immediately post burn, ammonium and nitrate levels were found not to differ between control and burned plots. Likewise, extractable soil P did not show any response to burning, and while extractable cations such as K, Ca, and Mg did show slight increases, these were not substantial or suspected to provide any noticeable change in ecosystem function.

In summary, the effects of fire on the nutrient status of soils in upland ecosystems following fire tend to be short lived, if any effects are seen at all. Fire appears to be used mostly to reduce fuel loads for public safety. Land managers also use burning to manipulate plant community composition in favor of native vegetation, especially in grasslands, by eliminating woody invaders and non-native vegetation (Packard and Mutel 1997). Nutrient fluxes are often ignored as a negligible side effect of attaining these primary goals.

4.3 Fire and Soil Nutrients in Marshes

Fire relating to nutrient dynamics in marshes is remarkably different from the effects that may be shown in upland ecosystems. This is mainly suspected to be a function of fluctuating water levels, at or near the surface where ash would be deposited. The following studies have examined the effects of fire as it pertains to plant nutrients.

Smith et al. 2001 examined the effects of aboveground (surface) fires similar to those in Mid-Atlantic marshes on soil fertility characteristics following fire in a northern Florida Everglades marsh. Sites in the Rotenberger Wildlife Management Area were sampled pre-burn in February 1998, ignited by a lightning strike in May 1999, and sampled post-burn in June 1999. The authors found that surface burning resulted in decreases of 0.6 kg N/ha and 11.9 kg C/ha attributed to the volatilization of these nutrients due to the intensity of the fire. Organic P also decreased in the 0- to 2-cm soil layer due to surface fire; however there was no significant corresponding enrichment of any inorganic P fraction present, indicating P was also lost to volatilization or physical erosion. The study stressed the importance of differentiating between surface and peat fires, as peat fires alter soil nutrient status drastically while surface fires are relatively mild in their effects.

Faulkner and de la Cruz, 1982 looked at the effects of prescribed winter burning on nutrient pools in a St. Louis Bay, Missouri marsh. They noted that enhancement of the soil nutrient pool by ash deposition was limited to the top 2 cm of the soil. Surficial pH levels increased but were short-lived in a *Juncus* marsh (less than 29 days); however the increase in pH remained after 68 days in a *Spartina* marsh. Phosphorus levels increased dramatically following burning (from 23 to 83 mg/kg) and remained elevated 68 days post-burn (88 mg/kg). The P increase could not be solely attributed to ash deposition and was hypothesized to be partially from mild sediment heating. Potassium levels increased by 47% (from 409 to 600 mg/kg) at the *Juncus* marsh and by 10% (from 446 to 490 mg/kg) at the *Spartina* marsh. These levels remained elevated 68 days post burn. Calcium levels increased over 30% at both sites and remained elevated at the *Spartina* site 68 days post burn. Nitrogen levels remained unchanged in the *Juncus* site and slightly lowered at the *Spartina* site. Water levels during burning, which were at low tide, were most likely responsible for higher than average soil temperatures which resulted in the nutrient status changes, rather than ash deposition.

Laubhan 1995 measured the effects of fire on wetland soil macronutrients in southwest Missouri. Following both winter and spring burning, no detectable differences in soil nutrients could be determined for any nutrient investigated (NO_3-N, P, K, Ca, Mg) by the end of the growing season. The lack of change was related to the low fuel biomass present; the authors noted that this finding was similar to the findings of Faulkner and de la Cruz, 1982 and Weiss, 1980.

Schmalzer and Hinkle 1992 found that November burning increased calcium, magnesium, potassium, and phosphate 1 month after burning of a *Juncus roemerianus* and *Spartina bakeri* marsh in Florida. These increased levels of nutrients were found to persist from 6 to 12 months postburn. However, nitrate-N and ammonium-N did not differ between burned and unburned marsh sites.

Wilbur and Christensen 1983 looked at soil nutrient levels as they responded to fire in a North Carolina pocosin. A spring burn in March of 1979 was implemented and the soil characteristics were monitored for just over one year. Phosphate levels increased dramatically in burned areas, although the variance was high indicating that the dispersal of phosphate was not uniform. Nitrate concentrations were higher consistently and significantly higher in the burned areas during the first and second growing seasons, although much notably less in the second season. Soil ammonium was higher in burned areas as well, although much less consistently. Magnesium levels were higher in the burned areas than the control areas throughout the course of the monitoring. Calcium concentrations were either the same as or lower in burned areas compared to control areas. Potassium levels showed an increase in the growing season immediately following burning, but showed lower levels compared with control plots the following year. The authors concluded that prescribed fire increased the availability of plant nutrients in this ecosystem, leading to increased post-fire biomass production, and that it also created patchiness within the ecosystem with areas of low and high nutrients. One detail to note is that this burn appeared to be extreme in nature, burning into the peat often enough to be called a peat fire.

The literature tends to converge on the importance that water level during the time of burning plays on marsh soil chemistry. Water level effects whether or not the burn will directly affect the marsh soil through combustion, whether the burn will indirectly effect the marsh soil through warming, or whether the effects of burning on the marsh soil will be minimal through ash deposition. Ash deposition is thought to supply a readily available source of soluble plant nutrients, however the hydrology of wetlands with fluctuating water tables near the surface appear to "wash out" most nutrients before they are used for plant uptake.

5. Fire and Organic Matter Dynamics

5.1 Fire and Soil Organic Matter Decomposition in Upland Ecosystems

The ecosystem disturbance of fire may directly affect the status of organic matter in a coastal marsh, both above and belowground. The most direct effect of prescribed winter fire is the combustion of senesced aboveground herbaceous plant tissue as it provides fuel. This may have wide ranging implications to marsh sustainability, especially in marshes which rely mainly on organic matter inputs for accretion such as those in the Chesapeake Bay region, as it removes vegetation which could be incorporated into the marsh surface. The relationship between prescribed burning in marshes and accretionary processes which are largely determined by soil organic matter additions are not well understood (Nyman and Chabreck, 1995; Gabrey and Afton, 2001). No study to date has tried to directly determine the effects of burning on organic matter decomposition rates in coastal wetlands, so this section will attempt to summarize the few studies that have made an attempt at understanding the relationship between processes related to organic matter decomposition in upland ecosystems.

Most of the previous research on the relationship between fire and organic matter has been conducted in rangeland ecosystems, where burning is used to promote earlier grass germination in the spring, eliminate weeds and brush, obtain greater animal gains, and to promote uniform grazing distribution (Anderson et al. 1970). This makes sense as rangelands (i.e. grasslands, shrublands, savannas, deserts) represent about 50% of the earth's land area (Allen-Diaz, 1996) when compared to the 4-6% wetland areas comprise (Matthews and Fung, 1987; Aselman and Crutzen, 1989). The bulk of these studies have found that the net effect is approximately neutral, as increased belowground biomass production has equaled carbon volatilization losses.

Owensby and Wyrill, 1973 studied the effects of prescribed burning on soil physiochemical properties in annually burned pachic argiustolls in the Flint Hills of Kansas. Soil organic matter levels were found to increase approximately 0.20% in winter and spring-burned plots when compared to mid-spring, late-spring, and non-burned plots. The authors attributed this increase in soil organic matter due to increased root production rather than surface accumulation of aboveground vegetation. Rice, 2000 found that annual burning on a grazed tallgrass prarie resulted in an increase in soil carbon storage of 0.22 Mg/ha/yr. Sherman et al, 2005 found that soil organic matter levels increased shortly after prescribed burning but were not statistically significant and did not differ from pre-burn levels after one year.

Aboveground biomass combustion can also produce a carbon form extremely resistant to decomposition known as charcoal, which has been shown to account for up to 30% of the soil carbon in Australian rangeland soils (Skjemstad et al., 1996). However, methods to measure this highly refracterant form of C remain unrefined and usually involve photo-oxidation of the soil, followed by scanning electron microscopy examination for wood-like morphology in the remaining particles, followed by solid state C-13 nuclear magnetic resonance spectroscopy (Skjemstad et al., 1996; Manning and Lopez-Capel, 2009).

5.2 Fire and Plant Productivity in Marshes

As discussed above, no study to date has directly measured organic matter decomposition dynamics in coastal marshes. It has been noted however, that organic matter inputs and soil elevation are directly related to plant productivity, especially in eastern shore marshes which are sediment starved. The focus of this section will be on plant responses to fire that are primary controls on vertical accretion in these marshes. Any positive or negative response of marsh vegetation to prescribed fire would have implications relating to marsh sustainability.

Penfound and Hathaway 1938 first suggested that burning could lead to decreased vertical accretion and sedimentation in marsh ecosystems. This study focused on the concern that repeated removal of aboveground biomass could negatively impact the ability of the marsh surface to capture sediment inputs, and to incorporate the senesced vegetation into the soil surface.

Gabrey and Afton 2001 studied plant biomass response to winter burning in Gulf Coast marshes, and found results similar to Bickford et al., in review. They found that burning significantly ($p<0.05$) affected above-ground live biomass, with burned plots having higher biomass than unburned plots. However, no below-ground biomass response was observed in the study. The apparent non-effect that winter burning had on belowground biomass suggests that burning may not enhance soil elevation; however enhanced aboveground growth may increase sedimentation the following growing season.

De la Cruz and Hackney 1980 examine the effects of winter fire on productivity on *Juncus roemerianus* and *Spartina cynosuroides* marshes in Mississippi. Winter burning of the *Juncus* marsh increased the primary aboveground biomass productivity by 21 to 48% the following growing season, and primary productivity in the *Spartina* marsh increased by 12 to 24% over the control plots. However, species specific effects were noted, especially concerning the Juncus marsh in which the increase in aboveground biomass production was associated with a general decrease in plant vigor. This was attributed to the fact that the species was not completely senesced at the time of burning, and thus harm may have been inflicted to the plants by burning. The *Spartina* marshes responded better to the fire treatment; the authors concluded that these communities may benefit from annual burning. Conversely, the *Juncus* communities would not benefit from burning, and may have natural fire protection mechanisms evolved to exclude fire such as lack of accumulated dry biomass and debris.

Flores et al. 2011 examined the response of two fire rotations (annual and 3 year) on marsh vegetation response at the Blackwater NWR in Cambridge, MD. The authors found that *Distichlis spicata* biomass was greater in annual burn treatments than in 3 year burn treatments. For *Schoenoplectus americanus*, *Spartina alterniflora*, and *Spartina patens* no biomass differences were observed between burn treatments. The authors concluded that burning may increase the abundance of vegetation thought to be less desirable as wildlife habitat; it should be noted that these trends oppose those in the bulk of the literature.

In the only study to directly measure soil accretion and elevation after a burn event, Cahoon et al. 1998 used Surface Elevation Tables to monitor a *Spartina patens* coastal marsh in Texas. An accidental wildfire occurred at this marsh during the middle of the growing season, and results suggested that were no effects on soil vertical accretion, but at least a two year positive effect was observed on soil elevation. The authors hypothesized that the rapid mineralization of organic matter during the growing season resulted in an increase in overall soil organic matter production, possibly belowground.

Leonard et al. 2010 examined the effects of four burn regimes (annual, 3-5 year, 5-7 year, 7-10 year) on above- and belowground plant response over 2 years at Blackwater NWR. The study found no effects on burn regime and plant production in 2004; however in 2005 the annual burn treatment produced greater aboveground biomass than other burn treatments. The belowground biomass did not show any difference between burn regimes in either year.

Belowground vegetation biomass plays a large role in regulating ecosystem process, specifically soil organic matter production in tidal wetlands and therefore in the ability of these ecosystems to keep pace with sea-level rise (Saunders et al., 2006; Turner et al., 2004).

Therefore, belowground biomass production may be a better index for monitoring marsh ecosystem health than above-ground plant biomass (Turner et al., 2004). Turner et al. 2004 showed a direct relationship between vertical marsh accretion rate and the accumulation of soil organic matter, mostly contributed by the below-ground biomass of marsh vegetation. Unfortunately, little information is currently available on belowground biomass and the associated responses to change in environmental conditions in coastal wetlands (Leonard et al., 2010).

Overall, the literature suggests that there is much to be learned about plant productivity effecting organic matter dynamics in marshes following fire events. The biggest concern for organic matter dynamics in mid-Atlantic marshes is that it may contribute to or reduce marsh elevation, as these soils are highly organic in nature with little mineral input. Therefore, the directionality of the decomposition/formation process of organic matter, especially in the root zone, is of major concern. Even if soil organic matter decomposition is increased following prescribed burning, if the resulting vegetative growth is enhanced then the total amount of organic matter present may be increased and thus the marsh would be more adept to keep pace with sea level rise.

6. Summary

Coastal ecosystems worldwide and in the U.S. are pressured by population growth, leaving them vulnerable to pollution, overfishing, invasive species, habitat degradation and loss, and increased coastal hazards such as sea-level rise (UNEP/GPA, 2006; WRI, 2000; Hinrichsen, 1998; National Safety Council, 1998). It was estimated that in 2003, approximately 153 million people (53 percent of the nation's population) lived in the 673 U.S. coastal counties, an increase of 33 million people since 1980 (NOAA, 2004). With such a large percentage of the population living in coastal areas, it makes sense that 10 of the 15 most populous cities in the United States are located in coastal counties (U.S. Census Bureau, 2001). The Chesapeake Bay watershed ranked at the top of the growth rate chart for U.S. coastal watersheds in the years of 1980 through 2000, growing by over two million people to a total population of over 10 million (NOAA, 2004). As the largest, most productive, and most diverse estuary in North America (NOAA, 1990; Prasad et al., 2011), protection of this resource is of the upmost importance for the land managers, citizens, and lawmakers of this region.

Fire affects marshes through the mechanisms of canopy removal and ash deposition. Coastal marshes are nitrogen limited environments, however any management practice related to the dynamics of either nitrogen or phosphorus are likely to affect primary production. As coastal marshes face increasing rates of sea level rise, those which have low mineral inputs, such as Eastern Shore marshes, rely almost entirely on plant production for vertical accretion. Nitrogen inputs of around 5 $g/m^2/yr$ are needed to observe a significant increase in marsh vegetation production, with phosphorus inputs being much less important. It is likely that the amount of nitrogen deposited from combustion of the standing senesced vegetation stock during prescribed winter burns does not provide this necessary amount of nitrogen to the marsh vegetation. Further evidence that ash deposition does not play a role in vegetative response to burning is that winter burns often take place months before burning, allowing ample time for flushing of these tidal systems.

Overall, burning is suspected to be a good management technique for coastal marsh health, however questions remain. For example, the export of detrital particles by tidal flushing is known to be vital to secondary estuarine production (de la Cruz, 1973), however potential impacts of litter removal and associated nutrient export to the estuary as a whole is not well-known. Currently, it is likely that burning will continue to some degree on various sections of tidal marsh throughout the Chesapeake Bay and at Blackwater National Wildlife Refuge. It is recommended that continued long-term monitoring strategies investigate these sites, focusing on plant-soil-estuary interactions which will have implications for sustainability strategies.

7. References

Alberti, J., A. Mendez-Casariego, P. Daleo, E. Fanjul, B. Silliman, M. Bertness, and O. Iribarne. 2010. Aboitc stress mediates top-down and bottom-up control in a Southwestern Atlantic salt marsh. Oecologia 163:181-191.

Arthur, S. C. 1931. The fur animals of Louisiana Bulletin No. 18 (revised). State of Louisiana Department of Conservation. New Orleans.

Aselmann, I., and P. J. Crutzen. 1989. Global distribution of natural freshwater wetlands and rice paddies, their net primary productivity, seasonality, and possible methand emissions. Journal of Atmospheric Chemistry 8:307-358.

Badia, D., and C. Marti. 2003. Plant ash and heat intensity effects on chemical and physical properties of two contrasting soils. Arid Land Resource Management 17:23-41.

Bertness, M. D. 1992. The ecology of a New England salt marsh. American Scientist 80:260-268.

Bickford, W. A., B. A. Needelman, R. R. Weil, and A. H. Baldwin. 2012. Vegetation response to prescribed fire in Mid-Atlantic brackish marshes. (In review)

Buresh, R. J., R. D. DeLaune, and W. H. Patrick Jr. 1980. Nitrogen and phosphorus distribution and utilization by *Spartina alterniflora* in a Louisiana gulf coast marsh. Estuaries 3(2):111-121.

Cahoon, D. R., J. W. Day Jr., D. J. Reed, and R. S. Young. 1998. Global climate change and sea-level rise: estimating the potential for submergence of coastal wetlands. In: Vulnerability of Coastal Wetlands in the Southeastern United States: Climate Change Research Results, 1992 – 1997. G. R. Guntenspergen and B. A. Vairin (Eds.), 19 – 32, U.S. Geological Survey, Biological Resources Division Biological Sciences Report USGS/BRD/BSR – 1998 – 0002.

Cahoon, D. R., M. A. Ford, and P. F. Hensel. 2004. Ecogeomorphology of *Spartina patens*-dominated tidal marshes: Soil organic matter accumulation, marsh elevation dynamics, and disturbance. Coastal and Estuarine Studies 59:247-266.

Cahoon, D.R., P. F. Hensel, T. Spence, D. J. Reed, K. L. McKee, and N. Saintilan. 2006. Coastal wetland vulnerability to relative sea-level rise: Wetland elevation trends and process controls. Pp. 271-292. In Verhoeven, J.T.A., Beltman, B., Bobboink, R., and Whigham, D., ed. Wetlands and Natural Resource Management. Ecological Studies, Volume 190, Spring-Verlag, Berlin, Heidelberg.

Cachier, H., C. Liousse, and P. Buat-Menard. 1995. Particulate content of savanna fire emissions. Journal of Atmospheric Chemistry 22:123-148.

Climate Change Science Program (CCSP). 2009. Coastal Sensitivity to Sea-Level Rise: A Focus on the Mid-Atlantic Region. A report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. U.S. Environmental Protection Agency, Washington D.C., USA, 320 pp. Clough, J.S. 2008. Application of the sea-level affecting marshes model (SLAMM 5.0) to the Chesapeake Bay region. National Wildlife Federation, Seattle, WA. 107 p.

Crain, C. M. 2007. Shifting nutrient limitation and eutrophication effects in marsh vegetation across estuarine salinity gradients. Estuaries and Coasts 30:26-34.

Daleo, P., J. Alberti, A. Canepuccia, M. Escapa, E. Fanjul, B. R. Silliman, M. D. Bertness, and O. Iribane. 2008. Mycorrhizal fungi determine salt-marsh plant zonation depending on nutrient supply. Journal of Ecology 96:431-437.

Daubenmire, R. 1968. The ecology of fire in grasslands. Advances in Ecological Research 5:209-266.

DeLaune, R. D., S. R. Pezeshki, and A. Jugsujinda. 2005. Impact of Mississippi river freshwater reintroduction on *Spartina patens* marshes: responses to nutrient input and lowering of salinity. Wetlands 25:155-161.

De la Cruz, A. A. 1973. The role of tidal marshes in the productivity of coastal waters. ASB Bulletin 20 :147-156.

De la Cruz, A. A., and C. T. Hackney. 1980. The effects of winter fire and harvest on the vegetational structure and primary productivity of two tidal marsh communities in Mississippi. Publication No. M-ASGP-80-013. Mississippi-Alabama Sea Grant Consortium, Ocean Springs, MS.

Douglas, B. C. 1997. Global sea rise; a redetermination. Surveys in Geophysics 18:279-292.

Emery, N. C., P. J. Ewanchuk, and M. D. Bertness. 2001. Competition and salt-marsh plant zonation: stress tolerators may be dominant competitors. Ecology 82(9):2471-2485.

Emery, K. O., and D. G. Aubrey. 1991. Sea levels, land levels, and tide gauges. Springer-Verlag, New York, 237 p.

Faulkner, S. P., and A. A. de la Cruz. 1982. Nutrient mobilization following winter fires in an irregularly flooded marsh. Journal of Environmental Quality 11:129-133.

Flores, C., D. L. Bounds, and D. E. Ruby. 2011. Does prescribed fire benefit wetland vegetation? Wetlands 31:35-44.

Gabrey, S.W., and A. D. Afton. 2001. Plant community composition and biomass in Gulf Coast Chenier Plain marshes: responses to winter burning and structural marsh management. Environmental Management 27:281-293.

Galloway, J. N., J. D. Aber, J. W. Erisman, S. P. Seitzinger, R. W. Howarth, E. B. Cowling, and B. J. Cosby. 2003. The nitrogen cascade. BioScience 53:341-356.

Garcia, F. O. 1992. Carbon and nitrogen dynamics and microbial ecology in tallgrass prairie. Ph. D. Thesis, Kansas State University, Manhattan, KS, USA.

Gratton, C., and R. F. Denno. 2003. Inter-year carryover effects of a nutrient pulse on *Spartina* plants, herbivores, and natural enemies. 84(10):2692-2707.

Griffith, R. E. 1940. Waterfowl management on Atlantic coast refuges. Transactions of the Fifith North American Wildlife Conference 5:373-377.

Gusewell, S., U. Bollens, P. Ryser, and F. Klotzli. 2003. Contrasting effects of nitrogen, phosphorus and water regime on first- and second-year growth of 16 wetland plant species. Fuctional Ecology 17:754-765.

Hackney, C. T., and A. A. de la Cruz. 1983. Effects of winter fire on the productivity and species composition of two brackish marsh communities in Mississippi. International Journal of Ecology and Environmental Sciences 27:281-293.

Haraguchi, A., H. Kojima, C. Hasegawa, Y. Takahashi, and T. Iyobe. 2002. Decomposition of organic matter in peat soil in a minerotrophic mire. European Journal of Soil Biology 38: 89 – 95.

Hauer, F.R. and C. N. Spencer. 1998. Phosphorus and nitrogen dynamics in streams associated with wildfire: A study of immediate and longterm effects. International Journal of Wildland Fire 8:183-198.

Hernandez, M. E., and W. J. Mitsch. 2006. Influence of hydrologic pulses, flooding frequency, and vegetation on nitrous oxide emissions from created riparian marshes. Wetlands 26:862-877.

Hernandez, M. E., and W. J. Mitsch. 2007. Denitrification in created riverine wetlands: Influence of hydrology and season. Ecological Engineering 30:78-88.

Hinrichsen, D. 1998. Coastal waters of the world: Trends, threats, and strategies. Washington, DC: Island Press.

Howarth, R. W., A. Sharpley, and D. Walker. 2002. Sources of nutrient pollution to coastal waters in the United States: Implications for achieving coastal water quality goals. Estuaries 25:656-676.

Howes, B. L., R. W. Howarth, J. M. Teal, and I. Valiela. 1981. Oxidation-reduction potentials in a salt marsh: spatial patterns and interactions with primary production. Limnology and Oceanography 26:350–360.

Ilstedt, U., R. Giesler, A. Nordgren, and A. Malmer. 2003. Changes in soil chemical and microbial properties after a wildfire in a tropical rainforest in Sabah, Malaysia. Soil Biology and Biogeochemistry 35:1071-1078.

Jordan, T. E., D. L. Correll, and D. E. Weller. 1997. Effects of agriculture on discharges of nutrients from coastal plain watersheds of Chesapeake Bay. Journal of Environmental Quality 26:836-848.

Kearney, M. S., R. E. Grace, and J. C. Stevenson. 1998. Marsh Loss in Nanticoke Estuary, Chesapeake Bay. Geographical Review 78(2):205-220.

Kearney, M. S., and J. C. Stevenson. 1991. Island land loss and marsh vertical accretion rate evidence for historical sea-level changes in Chesapeake Bay. Journal of Coastal Research 7(2):403-415.

Kemp, W. M., W. R. Boynton, and J. E. Adolf. 2005. Eutrophication of Chesapeake Bay: historical trends and ecological interactions. Marine Ecology-Progress Series 303:1-29.

Knapp, A. K. and T. R. Seastedt. 1986. Detritus accumulation limits productivity of tallgrass praries. BioScience 36:662-668.

Latter, P. M., and A. F. Harrison. 1988. Decomposition of cellulose in relation to soil properties and plant growth. In: Harrison, A. F., Latter, P. M., Walton, D. W. H. (eds.) Cotton strip assay: an index of decomposition in soils. Grange-over-Sands, NERC/ITE, 68-71.

Laubhan, M. K. 1995. Effects of prescribed fire on moist-soil vegetation and soil macronutrients. Wetlands 15(2):159-166.

Leonard, C. A., C. Ahn, and D. Birch. 2010. Above- and below-ground vegetative responses to prescribed fire regimes in a Chesapeake Bay tidal brackish marsh. Journal of Ecology and Field Biology 33(4):351-361.

Levine, J. M., J. S. Brewer, and M. D. Bertness. 1998. Nutrients, competition and plant zonation in a New England salt marsh. Journal of Ecology 86:285-292.

Liu, G. D., J. Dunlop, T. Phung, and Y. C. Li. 2007. Physiological response of what phosphorus-effect and –inefficient genotypes in field and effects of mixing other nutrients on mobilization of insoluble phosphates in hydrophonics. Communications in Soil Science and Plant Analysis 38:2239-2256.

Liu, G. D., B. Gu, S. L. Miao, Y. C. Li, K. W. Migliaccio, and Y. Qian. 2010. Phosphorus release from ash and remaining tissues of two wetland species after a prescribed fire. Journal of Environmental Quality 29:1585-1593.

Liu, X., P. V. Espen, F. Adams, J. Cafmeyer, and W. Maenhaut. 2000. Biomass burning in southern Africa: Individual particle characterization of atmospheric aerosols and savanna fire samples. Journal of Atmospheric Chemistry 36:135-155.

Lynch, J. J. 1941. The place of burning in management of the Gulf Coast wildlife refuges. Journal of Wildlife Management 5:454-457.

Manning, D. A. C., and E. Lopez-Capel. 2009. Test procedures for determining the quantity of biochar within soils. In: J. Lehmann and S. Joseph, Editors, Biochar for Environmental Management Science and Technology, Earthscan, London, pp. 301-315.

Marion, G. M., J. M. Moren, and W. C. Oechel. 1991. Fire severity, ash deposition, and clipping effects on soil nutrient in chaparral. Soil Science Society of America Journal 55:235-240.

Matthews, E., and I. Fung. 1987. Methane emission from natural wetlands: global distribution, area, and environmental characteristics of sources. Global Biogeochemical Cycles 1:61-86.

McNaughton, S. J., N. R. H. Stronach, and N. J. Georgiadis. 1998. Combustion in natural fires and global emissions budgets. Ecological Applications 8:464-468.

Megonigal, J. P., M. E. Hines, and P. T. Visscher. 2004. Anaerobic metabolism: Linkages to trace gases and aerobic processes. In W. H. Schlesinger, ed. Biogeochemistry. Elsevier-Pergamon, Oxford, UK, pp. 317-424.

Mendelssohn, I. A. 1978. Eco-physiological aspects of the height forms of Spartina alterniflora in North Carolina: Nitrogen nutrition and soil waterlogging. Ph.D. Thesis. North Carolina State University. Pp. 142.

Mendelssohn, I. A. 1979. The influence of nitrogen level, form, and application method on the growth response of *Spartina alterniflora* in North Carolina. Estuaries 2(2):106-112.

Mendelssohn, I. A., and M. G. Slocum. 2004. Relationship between soil cellulose decomposition and oil contamination after an oil spill at Swanson Creek, Maryland. Marine Pollution Bulletin 48:359-370.

Mendelssohn, I. A., B. K. Sorrell, H. Brix, H. Schierup, B. Lorenzen, and E. Maltby. 1999. Controls on soil cellulose decomposition along a salinity gradient in a *Phragmites australis* wetland in Denmark. Aquatic Botany 64:381-398.

Mitchell, L. R., S. Gabrey, P. P. Marra, and R. M. Erwin. 2006. Impacts of marsh management on coastal-marsh bird habitats. In: Greenberg, R., Maldonado, J., Droege, S., McDonald, M.V. (eds.) Terrestrial vertebrates of tidal marshes: evolution, ecology, and conservation, studies in avian biology no. 32. Cooper Ornithological Society, Los Angeles, pp. 155-175.

Mitsch, W. J., and J. G. Gooselink. 2007. Wetlands, fourth ed. John Wiley and Sons Inc., New York.

Morris, J. T. 1991. Effects of nitrogen loading on wetland ecosystems with particular reference to atmospheric deposition. Annual Review of Ecology and Systematics 22:257-279.

Morris, J. T., and P. Bradley. 1999. Effects of nutrient loading on the carbon balance of coastal wetland environments. Limnology and Oceanography 44:699-702.

Murphy, J. D., D. W. Johnson, W. W. Miller, R. F. Walker, E. F. Carroll, and R. R. Blank. 2006. Wildfire effects on soil nutrients and leaching in a Tahoe basin watershed. Journal of Environmental Quality 35:479-489.

National Research Council. 2000. Clean Coastal Waters: Understanding and Reducing the Effects of Nutrient Pollution. National Academy Press, Washington, DC.

National Safety Council. 1998. Coastal challenges: A Guide to Coastal and Marine Issues. Environmental Health Center. Washington, DC: National Safety Council.

National Oceanic and Atmospheric Administration (NOAA). 1990. Estuaries of the United States: Vital Statistics of a National Resource Base. National Ocean Service, Ocean Assessments Division, Washington, DC, 79 p.

National Oceanic and Atmospheric Administration (NOAA). 2004. Population trends along the coastal United States: 1980-2008. National Oceanic and Atmospheric Administration, Rockville, MD.

National Wildlife Federation (NWF). 2008. Sea-level rise and coastal habitats in the Chesapeake Bay region. National Wildlife Federation, Reston, VA.

Nyman, J. A., and R. H. Chabreck. 1995. Fire in coastal marshes: history and recent concerns, in Fire in wetlands: a management perspective, edited by S. I, Cerulean and R. T. Engstrom, 134-141, Proceedings of the Tall Timbers Ecology Conference, Number 19, Tall Timbers Research Station, Tallahasssee, FL, USA.

O'Neil, T. 1949. The muskrat in the Louisiana coastal marshes. Federal Aid Section-Fish and Game Division, Louisiana Department of Wildlife and Fisheries, New Orleans, LA.

Owensby, C. E., and J. B. Wyrill. Effects of range burning on Kansas Flint Hills soil. Journal of Range Management 26:185-188.

Patrick, W. H., Jr., D. A. Antie, R. D. Delaune, and R. Engler. 1972. Nitrate removal from the water-mud interface in flooded soils and marsh sediments. Second National Coastal and Shallow Water Research Conference Abstract 174.

Packard, S., and C. Mutel. (eds.). 1997. The tallgrass restoration handbook. Island Press, Washington, DC.

Pendelton, E. C. and J. C. Stevenson. 1983. Investigations of marsh losses at Blackwater Refuge, Horn Point Environmental Laboratories, Center for Environmental and Estuarine Studies, University of Maryland, Cambridge, MD. 151p.

Penfound, W. T., and G. S. Hathaway. 1938. Plant communities in the marshland of southeastern Louisiana. Ecological Monitoring 8:1-56.

Phillips, J. D. 1986. Coastal submergence and marsh fringe erosion. Journal of Coastal Research 2(4):427-436.

Picone, L. I., G. Quaglia, F. O. Garcia, and P. Laterra. 2003. Biological and chemical response of a grassland to burning. Journal of Range Management 56:291-297.

Prestegaard, K. L., and M. O'Connell. 1995. Seasonal timing and process of nitrate delivery to streams in the Lower Chesapeake Bay drainage. P. 13-17. In University of Maryland, USA, Water Resources Research Center FY 94 Report to U. S. Dept. of Interior Grant No. 14-08-0001-G2024.

Pyne, S. J. 1995. World fire. Princeton University Press, Princeton, NJ.

Qian, Y., S. L. Miao, B. Gu, and Y. C. Li. 2009. Effects of burn temperature on ash nutrient forms and availability from cattail (*Typha domingensis*) and sawgrass (*Cladium jamaicense*) in the Florida everglades. Journal of Environmental Quality 38:451-464.

Qian, Y., S. L. Miao, B. Gu, and Y. C. Li. 2009. Estimation of postfire nutrient loss in the Florida everglades. Journal of Environmental Quality 38:1812-1820.

Raison, R. J., P. K. Khanna, and P. V. Woods. 1985. Mechanisms of element transfer to the atmosphere during vegetation fires. Canadian Journal for Restoration 15:132-140.

Rahmstorf, S. 2007. A semi-empirical approach to projecting future sea-level rise. Science 2007 315:368-370.

Reddy, K. R., and W. H. Patrick, Jr. 1984. Nitrogen transformations and loss in flooded soils and sediments. CRC Critical Reviews in Environmental Control 13:273-309.

Rhoades, C., T. Barnes, and B. Washburn. 2002. Prescribed fire and herbicide effects on soil processes during barrens restoration. Restoration Ecology 10(4):656-664.

Rice, C. W. 2000. Soil organic C and N in rangeland soils under elevated CO_2 and land management. In: Proc., Advances in Terrestrial Ecosystem Carbon Inventory, Measurements, and Monitoring. 3–5 October 2000. USDA-ARS, USDA-FS, USDA-NRCS, US Dept. Energy, NASA, and National Council for Air and Stream Improvement, Raleigh, NC, pp. 83.

Rice, C. W., and C. E. Owensby. 2000. The effects of fire and grazing on soil carbon in rangelands. Pgs. 323-343. In R.F. Follett et al., ed. The potential of U.S. Grazing lands to sequester carbon and mitigate the greenhouse effect. CRC Press, Boca Raton, FL.

Risser, P., and W. J. Parton. 1982. Ecological analysis of a tallgrass prairie: Nitrogen cycle. Ecology 63:1342-1351.

Rubio, G., and D. L. Childers. 2006. Controls on herbaceous litter decomposition in the estuarine ecotones of the Florida Everglades. Estuaries and Coasts 26(6):257-268.

Rybczyk, J. M., G. Garson, and J. W. Day Jr. 1996. Nutrient enrichment and decomposition in wetland ecosystems: models, analyses and effects. Current Topics in Wetland Biogeochemistry 2:52-72.

Saunders, C. J., J. P. Megonigal, and J. F. Reynolds. 2006. Comparison of belowground biomass in C3- and C4-dominated mixed communities in a Chesapeake Bay brackish marsh. Plant and Soil:305-322.

Schmitz, J. P. 2000. Meso-scale community organization and response to burning in mesocosms and a field salt marsh, M.S. Thesis, University of Maryland, Center for Environmental Studies, Horn Point Environmental Lab, Cambridge, MD, USA.

Schmalzner, P. A., and C. R. Hinkle. 1992. Soil dynamics following fire in *Juncus* and *Spartina* marshes. Wetlands 12:8-21.

Scudlark, J. R., and T. M. Church. 1989. The sedimentary flux of nutrients at a Delaware salt marsh site: a geochemical perspective. Biogeochemistry 7:55-75.

Sharrow, S. H. and H. A. Wright. 1977. Effects of fire, ash, and litter on soil nitrate, temperature, moisture and Tobosagrass production in the Rolling Plains. Journal of Range Management 30:266-270.

Sherman, L. A., K. R. Brye, D. E. Gill, and K. A. Koenig. 2005. Soil chemistry as affected by first-time prescribed burning of a grassland restoration on a coastal plain ultisol. Soil Science 170(11):913-927.

Sherr, B. F. and W. J. Payne. 1978. Effect of the *Spartina alterniflora* root-rhizome system on salt marsh soil denitrifying bacteria. Applied Environmental Microbiology 35:724–729.

Smith, R. H. 1942. Management of salt marshes on the Atlantic coast of the United States. Transactions of the 7th North American Wildlife Conference 7:272-277.

Smith, S. M., S. Newman, P. B. Garrett, and J. A. Leeds. 2001. Differential effects of surface and peat fire on soil constituents in a degraded wetland of the northern Florida Everglades. Journal of Environmental Quality 30:1998-2005.

The Scientific and Technical Advisory Committee (STAC). 2003. Chesapeake Futures: Choices for the 21st Century (Annapolis, MD: Chesapeake Bay Program).

Skjemstad, J. O., P. Clarke, J. A. Taylor, J. M. Oades, and S. J. McClure. 1996. The chemistry and nature of protected carbon in soil. Australian Journal of Soil Research 34:251–271.

Staver, K. W., and R. B. Brinsfield. 1990. Groundwater discharge patterns in Maryland coastal plain agriculture systems. P. 593-603. In New Perspectives in the Chesapeake System: a Research and Management Partnership. Chesapeake Research Consortium, Solomans, MD, USA, Publication No. 137.

Stephens, S. L., T. Meixner, M. Poth, B. MuGurk, and D. Payne. 2004. Prescribed fire, soils, and stream water chemistry in a watershed in the Lake Tahoe Basin, California. International Journal of Wildland Fire 13:27-35.

Stevenson, J. C., D. R. Heinle, D. A. Flemer, R. J. Small, R. A. Rowland, and J. F. Ustach. 1977. Nutrient exchanges between brackish water marshes and the estuary. P. 219-240. In M. Wiley (ed.) Estuarine Processes, Vol. II. Academic Press, New York, NY, USA.

Stevenson, J. C., M. S. Kearney, and E. C. Pendleton. 1985. Sedimentation and erosion in a Chesapeake Bay brackish marsh system. Marine Geology 67:213-235.

Stevenson, J. C. and M. S. Kearney. 2009. Impacts of global climate change and sea-level rise on tidal wetlands. Human Impacts on Salt Marshes (ed. By B. R.Silliman, E. D.Grosholz and M. D.Bertness), pp. 171–206. University of California Press, Berkeley, California.

Stribling, J. M., and J. C. Cornwell. 2001. Nitrogen, phosphorus, and sulfur dynamics in a low salinity marsh system dominated by *Spartina alterniflora*. Wetlands 21(4):629-638.

Thomas, A. D., R. P. D. Walsh, and R. A. Shakesby. 1999. Nutrient losses in eroded sediment after fire in eucalyptus and pine forests in the wet Mediterranean environment of northern Portugal. Catena 36:283-302.

Tilman, D. and D. Wedin. 1991. Plant traits and resource reduction for five grasses growing on a nitrogen gradient. Ecology 72:685-700.

Townsend, S. A., and M. M. Douglas. 2004. The effect of a wildfire on stream water quality and catchment water yield in a tropical savanna excluded from fire for 10 years (Kakadu National Park, North Australia). Water Resources 38:3051-3058.

Turitzin, S. N., and B. G. Drake. 1981. The effect of a seasonal change in canopy structure on the photosynthetic efficiency of a salt marsh. Oecologia 48:79-84.

Turner, R. E., E. M. Swenson, C. S. Milan, J. M. Lee, and T. A. Oswald. 2004. Below-ground biomass in healthy and impaired salt marshes. Ecological Research 19:29-35.

Ubeda, X., M. Lorca, L. R. Outeiro, S. Bernia, and M. Castellnou. 2005. Effects of prescribed fire on soil quality in Mediterranean grassland (Prades Mountains, north-east Spain). International Journal of Wildland Fire 14:379-384.

Uhler, F. M. 1944. Control of undesirable plants in waterfowl habitats. Transaction of the 9th North American Wildlife Conference 9:295-303.

UNEP/GPA. 2006. The State of the Marine Environment: Trends and Processes. UNEP/GPA, The Hague, 44 p.

U.S. Census Bureau. 2001. Statistical abstract of the United States: 2002 (122nd edition). Washington, DC: DOC, U.S. Census Bureau.

U.S. Climate Science Change Program (CCSP). 2009. Coastal Sensitivity to Sea-Level Rise: A Focus on the Mid-Atlantic Region. A report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. U.S. Environmental Protection Agency, Washington D.C., USA, 320 pp.

U.S. Department of the Interior. 2001. Fire program [Online]. Available at http://www.fws.gov/blackwater/pdf/fireprogram.pdf (accessed 1/26/2011). U.S. Fish and Wildlife Service, Cambridge, MD.

U.S. Department of the Interior. 2006. Scientific review of the prescribed burn program at Blackwater National Wildlife Refuge (Chesapeake Marshlands NWR Complexes) and Fishing Bay Wildlife Management Area. Feb. 22.

U.S. Department of the Interior. 2008. Wetland restoration {Online]. Available at http://www.fws.gov/blackwater/restore.html (accessed 1/26/2011). U.S. Fish and Wildlife Service, Cambridge, MD.

Valiela, I., and J. M. Teal. 1974. Nutrient limitation in salt marsh vegetation. Pages 574-563 in R.J. Reimold and W. H. Queen, editors. Ecology of halophytes. Academic Press, New York, New York, USA.

Van Wijnen, H. J., and J. P. Bakker. 1999. Nitrogen and phosphorus limitation in a coastal barrier salt marsh: the implication for vegetation succession. Journal of Ecology 87:265-272.

Vitousek, P. M., J. Abner, R. W. Howarth, G. E. Likens, P. A. Matson, D. W. Schindler, W. H. Schlesinger, and G. D. Tilman. 1997. Human alteration of the global nitrogen cycle: Causes and consequences. Issues in Ecology 1. Ecological Society of America, Washington, DC.

Waldbusser, G. G., E. R. Voigt, H. Bergschenider, M. A. Green, R. I. E. Newell. 2011. Biocalcification in the eastern oyster (Crassostrea virginica) in relation to long-term trends in Chesapeake Bay pH. Estuaries and Coasts 34:221-231.

Wan, S., D. Hui, and Y. Luo. 2001. Fire effects on nitrogen pools and dynamics in terrestrial ecosystems: A meta-analysis. Ecological Applications 11:1349-1365.

Weiss, T. E., Jr. 1980. The effects of nutrient availability on the pitcher plant Sarracenia flava L. Ph. D. Dissertation, University of Georgia, Athens, GA, USA.

Wilbur, R. B., and N. L. Christensen. 1983. Effects of fire on nutrient availability in a North Carolina coastal plain pocosin. American Midland Naturalist 110: 54-61.

White, D. S., and B. L. Howes. 1994. Translocation, mineralization, and turnover of nitrogen in the roots and rhizomes of *Spartina alternifora* (Gramineae). American Journal of Botany 81:1225–1234.

White, E. M., W. W. Thompson, and F. R. Gartner. 1973. Heat effects on nutrient release from soils under Ponderosa Pine. Journal of Range Management 26:22-24.

Wolaver, T. G., J. C. Zieman, R. Wetzel, and K. L. Webb. 1983. Tidal exchange of nitrogen and phosphorus between a mesohaline vegetated marsh and the surrounding estuary in the lower Chesapeake Bay. Estuarine, Coastal, and Shelf Science 16:321-332.

World Resources Institute (WRI). 2000. World Resources: 2000-2001. Washington, DC: World Resources.

Chapter 2: Nutrient Availability and Soil Organic Matter Decomposition Response to Prescribed Burns in Mid-Atlantic Brackish Marshes

1. Abstract

Prescribed fire commonly increases plant productivity, but the mechanisms of this response have not been well established. Two manipulative experiments were performed at the Blackwater National Wildlife Refuge in Cambridge, MD to study the effects of canopy removal and ash deposition on marsh plant-soil dynamics following burning. No-burn areas with canopy removal treatments showed significantly lower decomposition rates (66.5 ± 5.46% CTSL) than treatments with a canopy (74.1 ± 4.89% CTSL; P=0.04) in July. Porewater nutrient measurements at no-burn plots in July showed significantly lower amounts of NH_4^+ (P=0.04) and PO_4^{3+} (P=0.02) in sites with canopy removal (0.15 ± 0.06 mg NH_4^+/L and 0.04 ± 0.01 mg PO_4^{3+}/L) compared to sites with a canopy (0.73 ± 0.28 mg NH_4^+/L and 0.08 ± 0.02 mg PO_4^{3+}/L). Annually burned areas also had significantly lower porewater NH_4^+ readings in sites with the canopy removed by burning (0.13 ± 0.04 mg/L) in July compared with the canopy replacement treatment (0.79 ± 0.20 mg/L; P=0.005). Through the mechanism of canopy removal, organic matter decomposition rates in marsh areas tended to decrease later in the growing season, corresponding with a decrease in porewater ammonium and phosphate, which were taken up in much higher quantities in the biomass. Plant ash provided a fertilizer pulse of 0.22 ± 0.02 g N/m^2 and 0.16 ± 0.02 g P/m^2, which are amounts of nitrogen and phosphorus too small to increase plant productivity, and this likely holds true across all coastal marsh habitats.

2. Introduction

Fire is a natural component of wetland ecosystems (Lynch, 1941; Kirby et al., 1988; Nyman and Chabreck, 1995). Historically, prescribed fire has been used to remove vegetation to facilitate seasonal hunting and trapping in marsh ecosystems (O'Neil, 1949). In East Coast marshes, fire is used to facilitate the trapping of muskrat (*Ondatra zibethicus*) by making their lodges more visible to hunters (Lay, 1945). Furthermore, prescribed fire is an effective method in reducing the risk of unpredictable and/or uncontrollable wildfire which pose serious risks to property owner and the public (Nyman and Chabreck, 1995; Mitchel et al., 2006; Flores et al. 2011). Prescribed fire has recently become an integral part of resource management in coastal wetlands and is widely accepted as an effective technique to promote the growth of favorable wetland vegetation on the East and Gulf coast (Lynch, 1941; Nyman and Chabreck, 1995; Mitchell et al., 2006). While the general effects of prescribed burning are known, the mechanisms of ecosystem plant-soil dynamics following burns have not been thoroughly studied.

Fire represents an important role in nutrient cycling within ecosystems, directly or indirectly influencing many ecosystem properties, and has been understudied in wetlands (Faulkner and de la Cruz, 1982; Wilbur and Christensen, 1983; Schmalzer and Hinkle, 1992; Wan et al., 2001). Nutrients contained in surface vegetation are redistributed through particulate (ash) and non-particulate (volatilization) pathways following fire (Raison et al., 1985). Particulate material can be redistributed from a burn site to adjacent areas through wind, rainfall, erosion, runoff, and leaching, or can remain onsite and may have a significant impact on the soil nutrient status and water quality (Badia and Marti, 2003; Hauer and Spencer, 1998; Thomas et al., 1999; Townsend and Douglas, 2004). Increased post-fire nutrient concentrations in soil and nearby waters have been observed in numerous studies (Schmalzer and Hinkle, 1992; Ilstedt et al., 2003; Murphy et al., 2006; Ubeda et al., 2005). Nutrients with relatively low volatilization temperatures, such as carbon, nitrogen, and sulfur, may be removed from the burn site through volatilization and result in atmospheric pollution (Cachier et al., 1995; Liu et al., 2000; McNaughton et al., 1998; Wan et al., 2001). Removal of standing vegetation stock may also affect site microclimate and there may alter microbial activity and the forms and amounts of nutrients by affecting soil temperature (Schmalzer and Hinkle, 1992). The effects of fire on nutrient availability in coastal marshes are not well understood, although it may have significant implications to managing these threatened ecosystems.

Organic matter dynamics following prescribed fire events is poorly understood. Fire removes important plant biomass material from the marsh system, leading to a mineralization and volatilization of nutrients, which may or may not affect plant productivity and marsh accretion rates (Smith et al., 2001). However, burning may stimulate plant biomass production so that the net effect of is an increase in organic matter, lower organic matter decomposition rates, and associated increases in marsh elevation (Schmalzer and Hinkle, 1992; Nyman and Chabreck, 1995; Cahoon et al., 2004). Stimulation of belowground production has been observed following prescribed burning in coastal marshes and may play a key role in marsh accretion (Pendelton and Stevenson, 1983). Studies have shown burned marsh areas recovered elevation faster following a peat collapse and was attributed to an increase in soil organic matter volume (Cahoon et al., 2004). Thus, the overall effect of burning has not been well studied but is suspected to increase organic matter volume.

The effect of short term goals such as favorable vegetative species growth and fuel load management on long term coastal marsh sustainability has not been investigated at length (Nyman and Chabreck, 1995; Gabrey and Afton, 2001; Cahoon et al., 2004). Coastal marshes must accrete vertically to maintain existence in the intertidal zone or they will be lost to open water (Cahoon et al., 1998; Cahoon et al., 2006). Thus, the repeated removal of plant litter burning could lead to decreased vertical accretion and sediment elevation (Gabrey and Aftron, 2001). While plant production may increase after burning, it is unknown whether burned marshes export or accumulate the same amount of organic matter as unburned marshes (Nyman and Chabreck, 1995). Processes directly involving organic matter dynamics, such as decomposition, are important to understand as they may respond positively or negatively to this management practice (Cahoon et al., 2004). Increased organic matter decomposition may lead to elevation loss from these ecosystems, hindering their ability to keep pace with sea level rise. However, organic matter decomposition may also release plant nutrients, thereby stimulating increased biomass production and leading to a net organic matter increase and associated elevation gains (Cahoon et al., 2004). These highly organic soils are almost exclusively dependent on organic matter accumulation from root production and litter deposition for accretion, yet it is still unknown if burning is helpful or harmful to the future of coastal marsh ecosystems.

The objective of this study was to elucidate the organic matter decomposition and nutrient availability responses of coastal marsh ecosystems to two primary mechanisms of prescribed fire—ash deposition and canopy removal (Fig. 2-1). We used a one-year manipulative study across no burn and annual burn treatment islands at the Blackwater National Wildlife Refuge in Cambridge, MD.

3. Materials and Methods

Site Description

The study site was Blackwater National Wildlife Refuge (38° 27’ 0” N, 76° 7’ 12” W) located on the Eastern Shore of Maryland in Dorchester County (Fig. 2-2). The refuge is located 12 miles south of Cambridge, MD, USA and is managed by the U.S. Fish and Wildlife Services’ Chesapeake Marshlands Complex. It is over 109 km^2 in size, with approximately one-third of the refuge in fresh and brackish tidal wetlands.

Study sites were dominated primarily by the salt marsh vegetation species *Schoenoplectus americanus* (threesquare bulrush), *Spartina patens* (salt hay), *Distichlis spicata* (salt grass), and were near communities of *Spartina alterniflora* (smooth cordgrass) and *Juncus roemerianus* (black needlerush) in some cases (USDA, 2011). The dominant soil series in the study area were Bestpitch (Terric Sulfihemist) and Transquaking (Typic Sulfihemists), which are both characterized by thick organic surface deposits overlying loamy or fine mineral sediments, often at depths greater than a meter (Table 2-1). The horizons in these soils display a typical sequence of decomposition in salt marsh soils, with the less decomposed, fibric soil material near the surface, grading into hemic organic horizons above the mineral layer at depth. Soils which were present to a lesser extent were located on areas where the marsh was fringing on upland forest and were classified as Honga (Terric Sulfihemists) and Sunken (Typic Endoaqualfs) (Table 2-1). The tidal cycle at Blackwater is diurnal but strongly influenced by wind. Typically, water levels are maintained in the range of 10 cm above and below the marsh surface, although storm surges and other rare events can flux this range to 30 cm above and below (Sipple, 1979). Salinity measurements throughout the experiment ranged from 5 to 15 ppt, but more typical values were in the 8 to 12 ppt range, placing Blackwater in the mesohaline salinity range (Cowardin et al., 1979).

The study period was one year from January 2009 through January 2010. Blackwater NWR has been conducting annual burning of most marsh areas throughout the refuge from the 1970's through 1995, when management blocks of different fire frequencies were established. Thus, the No Burn sites have only been released from burning practices for 14 years (U.S. Dept. of Interior, 2006).

Site Selection

Two separate experiments were established in January of 2009 based on different blocks of a long-term fire management study being conducted at the refuge. The first experiment took place at four sites on "Annual Burn" islands while the second experiment took place at three sites on "No Burn" islands (one island could not be burned due to environmental conditions and was removed). Site summaries of the environmental variables pH, salinity, dominant soil series, percent sedge cover, and percent grass cover are provided in Table 2-1. Plot establishment and data collection were identical in each experiment. Selection of plots within each island was based on plant species composition and marsh topography, comparing potential sites with already established USGS Surface Elevation Table sites with the goal of matching our sites as closely to theirs as possible. This meant that ponds, holes, muskrat dens, and wildlife trails were avoided in site selection. Plot establishment took place before burning so that these considerations could be accounted for. Plots measured 3 by 4 meters and were selected to have the common species present in USGS sites (*S. americanus*, *S. patens*, and *D. spicata*), although percent cover varied and was essentially impossible to replicate.

No Burn Experiment

Four treatments were applied to each of the four no burn islands: Canopy Removal, Ash Deposition, Canopy Removal + Ash Deposition, and a Control treatment, which was left undisturbed. Treatments were randomly applied and replicated three times per island (n=12). Canopy Removal was applied on March 17, 2009 and involved clipping of senesced vegetation at ground level using hedge trimmers. Approximately 3 cm of plant shoot stubble was left protruding from the marsh surface following application of this treatment, accurately representing the aboveground plant conditions following a prescribed burn. The entire clipped aboveground biomass was removed from the plot and saved to make ash for plots with only Ash Deposition. This biomass was dried at 40°C for 24 hours and ignited in galvanized steel bins. After combustion, the ash was homogenized and spread evenly over Ash Deposition plots using a 1-mm sifter. This ash was deposited on the marsh soil surface of the Ash Deposition and Canopy Removal + Ash Deposition plots in April 2009. Water table levels were below the marsh surface during application to ensure that the ash would not simply wash out of the plot and that good soil contact would be made.

Hydrogen, carbon and nitrogen were measured in both the dried plant biomass and the plant ash using a LECO CHN2000 Analyzer (LECO Laboratory Equipment Corp., St. Joseph, Michigan). Samples of both plant biomass and ash were sent to the Penn State Agricultural Analytical Services Lab for elemental ICP analysis.

Annual Burn Experiment

Two treatments were applied to each of the three annual burn islands: Canopy Replacement, which consisted of construction of an artificial canopy being placed on the burned marsh surface, and a Control treatment, which was burned. Treatments were randomly applied and replicated three times per island (n=6). Following prescribed burning of each of the islands in February and April 2009, artificial canopies were constructed and put over plots receiving the Canopy Replacement treatment. Wood frames were constructed which measured 3 by 4 meters, and were covered with 6.35 mm hardware cloth. Wooden legs allowed the frame to be hammered securely into the marsh surface until the hardware cloth was 15 cm off of the ground. Marsh grasses were then transplanted into the hardware cloth using plant material clipped from nearby unburned marsh areas (Fig. 2-3). Notes on species richness, percent cover, and percent light penetration were taken pre-burn and were consulted throughout the transplantation process to mimic natural conditions. Light availability measurements were taken using a line quantum sensor with a 1 m long by 12.7 mm wide sensor (Model LI-191SA; LI-COR, Lincoln, NE) in the photosynthetically active light spectrum of 400 to 700 nm. After completion of the artificial canopies, it was noted that light penetration was slightly lower than the natural canopies, due to the slightly denser placement of vegetation in the mesh cloth compared with the natural system.

Data Collection

Decomposition of cellulose present in cotton fabric was used as an index for measuring the relative rates of decomposition of soil organic matter in study plots (Latter and Howson, 1977; Harrison et al. 1988). The cotton strip technique for measuring organic matter decomposition is based on the loss of tensile strength of a buried cotton fabric composed of cellulose fibers. Cellulose comprises about 70% of the organic carbon found in plant tissue, and therefore the rate of its decay is a key factor in plant matter decomposition (Mendelssohn et al., 1999; Mendelssohn and Slocum, 2004). The resulting cotton tensile strength loss gives a quantitative measurement of decomposition rates. This technique has been used in many different terrestrial environments, including wetlands, as a relative measure of soil decomposition (French, 1988; Harrison et al., 1988; Mendelssohn et al., 1999; Mendelssohn and Slocum, 2004).

At each plot, a strip of 10 x 35 cm of a 200-thread-count unbleached muslin fabric was inserted into the marsh soil by first making a pilot hole with the aid of a sharpshooter shovel, and then placing the fabric against the back of the shovel and inserting it into the hole. The saturated environment of the marsh soil provided enough suction to gently pull the cotton strip away from the shovel and into contact with the soil. The soil surface level was marked with a lateral cut into the fabric for future reference during analysis. The first set of cotton strips were placed into the center of plots on May 18th and 19th, and were retrieved from the ground on June 2nd and 3rd. The second set of cotton strips were deployed on June 30th through July 2nd and collected on July 15th through the 17th. The 15-day deployment period was similar to that used by Mendelssohn et al. 1999 in a *Phragmites australis* marsh in Denmark. Three reference cotton strips were inserted into the marsh and immediately removed at each deployment date. These strips were used to quantify the tensile strength of the non-decomposed cotton fabric, taking into account insertion and removal strength loss issues. Retrieval involved a mixture of light pulling on the exposed fabric and excavation around the strip. Immediately following retrieval, the strips were washed with freshwater to remove any attached soil particles or debris, and then were placed in bags for transport. Back in the laboratory, these strips were washed more thoroughly with deionized water and allowed to air dry for 72 hours. The strips were then cut laterally into 4 cm horizontal segments from 0 to 20 cm, giving strip segments representing 0 – 4, 4 – 8, 8 – 12, 12 – 16, and 16 – 20 cm. Hand fraying was used next to reduce the 4-cm strip segments down to the middle 2.5 cm of the strips, to ensure close to equal widths of all the strips and because this was the largest size the tensometer would accept. Tensile strength was measured with a Instron 4201 tensile strength machine with 2.5 cm x 2.5 cm clamp teeth spaced 5 cm apart. Measurements were made at lab room temperature (~24 °C) at 100% humidity attained by saturating the strips with de-ionized water before analysis. Individual strip segment tensile strength loss in kilograms-force was calculated relative to the mean of the reference cotton strips and expressed as a percent.

Porewater sampling was done using porewater wells (i.e. 'sippers') installed in each plot following a pilot hole. Wells were constructed as described in Marsh et al. 2005. The wells were Teflon tubing (9 mm outer diameter x 6 mm inner diameter) with perforations extending 2.5 cm above and below the sampling depths, and sealed at the bottom with silicone caulk. The top of the wells were capped with a 3-way stopcock which attached to a 30-mL plastic syringe which provided the suction for porewater withdrawal. Sampling took place twice during the growing season, once on May 21st and 22nd and again on July 9th and 10th, in conjunction with the middle of the two cotton strip deployment set dates. At each date, one 30-mL syringe sample of porewater was extracted from the marsh at each plot. The samples were filtered in the field through a 0.45 µm uniflow in-line filter and acidified with hydrochloric acid. The clear filtered samples were then used to measure ammonium (NH_4^+), orthophosphate (PO_4^{3-}), and hydrogen sulfide (H_2S) concentration in the marsh porewater.

Porewater ammonium and orthophosphate (Kuo, 1999) were frozen until analysis using an autoanalyzer. Sulfide was measured the same day as the sample was taken by using an ion specific electrode.

Aboveground biomass was sampled during the peak of the growing season in late July 2009, when plants were in the very early stages of senescence. Biomass was collected from two 0.25 m^2 quadrats in each plot. Biomass samples were dried at 60°C and weighed to obtain total aboveground biomass per unit area for each plot. Dried biomass samples were ground and passed through a No. 20 sieve, then sent to Penn State Agricultural Analytical Services Lab for ICP elemental analysis of carbon, nitrogen, phosphorus, potassium, calcium, magnesium, and sulfur.

Statistical Methods

The no-burn and annual burn studies represented two separate randomized complete block experiments. Blocks represented different sites at the refuge. The no-burn experiment was a two-way factorial arrangement consisting of 4 blocks with 3 replications per block. The annual burn experiment was a one-way arrangement consisting of 3 blocks with 3 replications per block. Environmental variables were tested using analysis of variance (ANOVA). Statistical analyses were performed using the "Proc Mixed" function in SAS (SAS Institute, Cary, North Carolina). Variations in marsh site conditions were analyzed statistically as the block variable.

Additionally, data at no burn sites were compared based on dominant species composition as established by Bickford, 2011. Species composition of sites 2D and 7D were dominated by a high percentage cover of the sedge *S. americanus*, which made up 83% of the total vegetative cover. Sites 1D and 3D were dominated by a high percentage cover of the grasses *S. patens* and *D. Spicata*, as the made up 88% of the vegetative cover. Therefore, sites 2D and 7D were grouped as sedge-dominated sites and sites 1D and 3D were grouped as grass-dominated sites.

4. Results

Organic Matter Decomposition

No-Burn Study, 0 – 20 cm Mean

In May, soil organic matter decomposition rates did not significantly differ between treatments in the no burn experiment for the 0 – 20 cm depth (Fig. 4A). In July, there was a significant canopy main effect (P=0.04, Fig. 2-4B), with 7.6% lower rates of decomposition with canopy removal. No ash main effects or site x ash interactions were significant. Decomposition rates were greater in July than in May, presumably due to warmer temperatures.

No-Burn Study, Sites Separated by Dominant Species, 0 – 20 cm Mean

When analyzed by dominant species, significant effects were not observed in grass-dominated sites (Fig. 2-5A & 2-6A) but were observed for sedge-dominated sites for decomposition from 0 – 20 cm in both May (Fig. 2-5B) and July (Fig. 2-6B). For these sedge-dominated sites, significant canopy and site X canopy interaction effects were observed; ash deposition effects were not significant. Canopy removal treatments had 11% lower decomposition rates than sites with a canopy (P=0.01) in July (Fig. 2-6B). The site X canopy interaction was present in July, when site 2D had a 14% difference between canopy and no canopy decomposition rates, while the effects at site 1D were less pronounced between canopy treatments at 2.8 %. A non-significant canopy effect trend was observed in the May sedge-dominated sites (P=0.07, Fig. 2-5B), with canopy removal sites trending towards lower rates of decomposition than sites with a canopy.

No-Burn Study, Depthwise Analysis from 0 – 20 cm

A general trend throughout all cotton strips was of highest decomposition rates near the surface and decreasing decomposition rates at depth. The May cotton strip set showed no significant main effects or interactions (Fig.2-7A). However, the July no burn study cotton strip set (Fig. 2-7B) showed a significant canopy effect (P=0.02) for the 0 – 4 cm depth, the 8 – 12 cm depth (P=0.02), and the 12 – 16 cm depth (P=0.03); no ash effects were observed. Additionally, the 0 – 4 cm depth had a significant site X canopy interaction (P=0.01), due to a relatively small difference in decomposition rates between canopy and no canopy treatments at site 1D (2.1% CTSL), while there was at least a 14% CTSL difference between treatments at the other three sites.

No-Burn Study, Sites Separated by Dominant Species, Depthwise Analysis from 0 – 20 cm

After separating the no burn sites by species dominance for depthwise examination, no depthwise ash effects or interactions were observed in either May or July for either grass- or sedge-dominated islands. The July sedge-dominated sites (Fig. 2-9B) showed a significant canopy effect at the 0 – 4 cm (P=0.01) depth, as canopy removal sites exhibited 19% lower decomposition rates than plots without a canopy. A significant canopy effect was also observed at the 8 – 12 cm depth (P=0.02), as canopy removal plots exhibited 16% lower decomposition rates than canopy sites. The May sedge-dominated sites showed no treatment or interaction effects at any depth (Fig. 2-8B).

Grass-dominated sites in May (Fig. 2-8A) showed a significant site X canopy interaction (P = 0.04), but no significant canopy main effect from 0 – 4 cm. Plots with canopy removal tended to have higher decomposition rates than sites with a canopy, especially at site 1D, in which the canopy removal plots showed 11% greater decomposition than canopy plots. However, cotton strip retrieval was especially difficult at this site, as 3 of the 12 strips were unable to be recovered. Therefore, this site X canopy interaction may have been false, resulting from the missing data. No site or treatment effects were observed for the grass-dominated sites in July (Fig. 2-9A).

Annual Burn Study, 0 – 20 cm Mean

The annual burn study did not have a significant canopy replacement main effect for the rate of decomposition in either May or July from 0 – 20 cm (Fig. 2-10A & B). Also, no site effect or site x island interactions were significant for either May or July data sets.

Annual Burn Study, Depthwise Analysis from 0 – 20 cm

The same general trend of higher decomposition rates at the surface and lowest at depths was observed for the annual burn study cotton strip sets (Fig. 2-11A & B). The July decomposition rates showed a significant (P=0.03) site X treatment effect from 0 – 4 cm, as site

3A had 21% lower rates of decomposition at sites for the canopy replacement treatment, while the other two sites did not show differences between treatments.

<u>Porewater Nutrients</u>

<u>No-Burn Study, Porewater Nutrients</u>

For no burn study porewater collection events, only the July porewater ammonium (P=0.0043) and phosphate (P=0.0188) had a significant canopy main effect; no ash effects were observed (Table 2-2). Sites with the canopy removal had lower porewater ammonium (0.15 ± 0.06 mg NH_4^+/L) than sites with a canopy (0.73 ± 0.28 mg NH_4^+/L). Additionally, porewater ammonium showed a significant site X canopy interaction (P=0.04), due to a relatively small difference in porewater ammonium between canopy and no canopy treatments at site 1D (0.02 mg NH_4^+/L, respectively), while there was at least a 0.29 mg NH_4^+/L difference between treatments existed at the other three sites. Porewater phosphorus was lower in than the canopy removal treatments (0.04 ± 0.01 mg PO_4^{3+}/L) than in sites with a canopy (0.08 ± 0.02 mg PO_4^{3+}/L).

A significant site x canopy effect (P=0.04) was also observed for May porewater ammonium. Sites with the canopy removed showed lower porewater ammonium for all sites except site 7D, where the canopy removal treatments were higher than the canopy removal treatments by 0.28 mg NH_4^+/L.

<u>No-Burn Study, Sites Separated by Dominant Species, Porewater Nutrients</u>

When analyzed by dominant species, only sedge-dominated sites showed significant nutrient responses to treatments (Table 2-4). The sedge-dominated sites showed a significant canopy effect for porewater ammonium (P=0.0055). Sites with canopy removal had lower amounts of ammonium present in July porewater than sites with a canopy (0.13 ± 0.05 vs. 0.70 ± 0.42 mg NH_4^+/L). Porewater phosphate almost had a significant canopy effect (P=0.058) as sites with a canopy had higher mean concentrations of phosphate (0.07 ± 0.02 mg PO_4^{3+}/L) than those without a canopy (0.04 ± 0.01 mg PO_4^{3+}/L).

No significant differences existed between treatments for porewater nutrients for either grass-dominated or sedge-dominated sites during May (Table 2-3). A significant canopy effect (P=0.048) existed only for porewater sulfide for the sedge-dominated sites. For these sites, canopy removal treatments had higher amounts of porewater sulfide (14.77 ± 6.29 mg H_2S/L) during May than sites with a canopy present (6.51 ± 3.91 mg H_2S /L). The increase in soil temperatures at these sites during the early growing season may have favored increased microbial sulfate reduction and caused a buildup of sulfides. However, this buildup was high enough to effect plant growth and levels (Koch et al. 1990) were similar again in July.

<u>Annual Burn Study, Porewater Nutrients</u>

A significant treatment (P=0.0141) effect existed for porewater ammonium in July, as control plots had less porewater ammonium than plots with canopy replacement (0.13 ± 0.04 vs. 0.79 ± 0.20 mg NH_4^+/L). A significant site X treatment interaction (P=0.01) existed for July porewater ammonium. Site 3A contained more ammonium (1.32 mg NH_4^+/L in canopy replacement treatment) than sites 1A and 2A (0. 36 mg NH_4^+/L mean of canopy replacement treatments), and therefore the magnitude of difference between treatments at site 3A was greater than at the other two sites.

Plant Elemental Content

Sites with canopy removal had significantly higher nutrient stocks in their plant tissue than plots with a canopy in the no-burn study (Table 2-6). This was a function of the higher biomass present in these plots, as summarized by Bickford et al., 2012. Aboveground biomass in the no-burn sites were 40% higher in plots with canopy removal (447 ± 16 g/m^2) than in plots without (320 ± 23 g/m^2). In the annual burn sites, aboveground biomass was 68% higher in control plots (525 ± 33 g/m^2) than in plots with replaced canopy (312 ± 33 g/m^2) Significant (P<0.05) canopy removal main effects were observed for total plant tissue elemental stocks in the no burn study for carbon, nitrogen, phosphorus, potassium, magnesium, and sulfur. Additionally, significant site x canopy (P<0.05) canopy effects were observed for these nutrients as the effects of canopy removal increasing plant tissue biomass stocks varied in magnitude across sites, specifically with respect to whether or not the site was dominated by sedge or grass species. Sites dominated more heavily by the sedge produced more of a biomass response to treatments, and therefore had higher nutrient stock differences than grass- dominated sites. Mean nitrogen to phosphorus ratios for grass vegetation were 9.4 ± 0.4, while sedge vegetation had higher N:P ratios of 10.9 ± 0.4.

A significant treatment effect (P<0.05) was observed for all elements (carbon, nitrogen, phosphorus, potassium, magnesium, and sulfur) examined in the annual burn study, with canopy replacement decreasing total plant tissue nutrient stocks (Table 2-7). A significant site X treatment effect (P<0.05) was observed for carbon and nitrogen. Sites with a canopy replacement had lower stocks of nutrients than sites with no canopy due to burning. Nitrogen to phosphorus ratios were similar to one another in both the grass and the sedge species. Mean nitrogen to phosphorus ratios for grass vegetation were 11.7 ± 0.6, while sedge vegetation N:P ratios were 11.2 ± 0.6.

Ash Characteristics

Following controlled combustion of senesced vegetation for the no burn experiment, 6.67 ± 0.45% percent of plant tissue dry-weight biomass was recovered as ash (Table 2-8). Both carbon and nitrogen were lost in amounts greater than 90% compared to original plant biomass stocks. Over 80% of the original stocks of sulfur was volatilized and lost to the atmosphere during combustion. Approximately half of the original phosphorus was lost due to particulate losses. Calcium, potassium, and magnesium were lost in only minor amounts.

5. Discussion

Nutrient and organic matter decomposition rate dynamics

The most substantial treatments effects observed in this study were the decrease of nutrient concentrations and organic matter decomposition rates in July through canopy removal (no burn experiment) and the corresponding increase of these values through canopy replacement (burn experiment). These effects appear to have been driven by increased nutrient uptake associated with increased above and belowground biomass production as discussed in Bickford et al., 2012. Porewater ammonium and phosphate concentrations were the nutrients found to be lower in sites without a canopy (canopy removal and canopy replacement) sites in July. Aboveground plant nitrogen stocks were substantially greater in these treatments, which was driven by greater biomass. This mechanism explains why nutrient effects were not observed early in the growing season (May) as nutrient depletion is not likely until the peak of the growing season (July). An alternative explanation for these nutrient effects is increased denitrification rates due to higher temperatures in sites without a canopy. Higher soil temperatures were observed at sites without a canopy (Miller et al. in review). However, these temperature differences were strongest from mid-April through mid-June and were minimal once the plant canopy had been re-established. If this denitrification mechanism were responsible for the nutrient changes, we should have seen the lower ammonium concentrations in the May set, when temperature gradients between the sites with and without canopies were greater, rather than in the July set, when the temperature gradients were less pronounced.

The lowered ammonium and phosphate concentrations in plots without a canopy likely caused the associated depressed decomposition rates. Plant litter decomposition in nutrient poor wetland ecosystems is generally slower than in nutrient-rich wetlands (Webster and Benfield, 1986), and higher availability of inorganic nutrients such as ammonium and phosphate to microbial decomposers can increase wetland plant biomass decomposition (Brinson et al., 1981; Mitsch and Gosselink, 2007).

These mechanisms are further supported when the data were analyzed separately for sedge-dominated and grass-dominated sites. Sedge-dominated sites with canopy removal had significantly lower decomposition rates from 0 – 20 cm in July and also had lower ammonium and almost (P=0.0584) lower phosphate concentrations in the porewater, but no nutrient effects were observed in the grass-dominated sites. These trends match the biomass response of these sites, with sedge-dominated sites showing substantially greater above and belowground biomass in canopy removal sites and grass-dominated sites showing no biomass effects except for a small increase in fine root production (Bickford et al., 2012). Depthwise analysis of the sedge-dominated sites showed that the decreased decomposition rates from 0 – 20 cm was due in large part from the surficial 0 – 4 cm zone, where environmental variables are more subject to dynamic change such wetting/drying cycles and daily temperature fluctuations. Porewater sulfide concentrations were also higher in sedge-dominated sites with canopy removal during July, although these concentrations of sulfides were still well below the 1 mM (30 mg H_2S/L) that has been found to cause plant toxicity in salt marshes (Koch et al., 1990).

Lack of ash deposition fertilization effect

Nutrient additions through ash deposition have been widely suggested as a possible cause for the increased plant productivity frequently observed in marshes following prescribed burns (Faulkner and de la Cruz, 1982; Wilbur and Christensen, 1983; Nyman and Chabreck, 1995; Cahoon et al., 2004). Several researchers have found that nutrient levels in marsh soils increase following a burn (Faulkner and de la Cruz, 1982; Schmalzer and Hinkle, 1992; Smith et al. 2001). However, plant responses to nutrient additions through ash deposition had not formally been separated out by researchers from the simultaneous effects of canopy removal. Plant dynamics following nutrient additions in marshes have been studied extensively, and are intrinsically tied to other ecosystem process such as organic matter decomposition and nutrient availability

(Mendelsshon et al., 1999). Our no burn experiment included the measurement of plant biomass and nutrient content before and after combustion in a controlled setting, which allows for nutrient inputs to be compared to those used in fertilization experiments within coastal marshes. We focused on nitrogen and phosphorus for this comparison because salt marshes are generally nitrogen limited ecosystems (Valiela and Teal, 1974), but may exhibit secondary phosphorus limitation (Crain, 2007). Our sites were likely nitrogen-limited because the nitrogen to phosphorus ratios of both the grass and sedge species analyzed across both of these studies were all less than 12, which is substantially lower than the threshold of 14 that been shown to indicate nitrogen limitation in wetland systems (Koerselman and Meuleman, 1996; Verhoeven et al., 1996). Nitrogen is used not only as a essential nutrient for photosynthesis, but for the production of amino acids which enable plants to deal with the large osmotic stress induced by high salinities in coastal marshes (Jefferies, 1981). Therefore, changes related to increased nitrogen availability may increase primary production at these sites, dependent on other non-nutritive growth limitations.

Our examination of the available literature on salt marsh nutrient additions and plant community responses showed that at least 5 g N/m^2/yr appears to be needed for a plant response to fertilization in marshes, with phosphorus being of secondary, if any, importance (Table 2-9). Even at this 5 g N/m^2/yr rate, plants do not consistently show a response, especially in older marsh areas that are high in natural nitrogen reserves and organic matter (van Wijnen and Bakker, 1999). Our ash data shows that approximately 0.22 g N/m^2 and 0.16 g P/m^2 were added to no burn study plots. This is probably not a sufficient dose of either of these nutrients, based on the available literature, to generate a plant biomass response based on a fertilizer effect.

We can extend our understanding of ash-deposited nutrient additions broadly using a model developed by Qian et al. 2009 for the estimation of post-fire nitrogen loss from cattail and sawgrass vegetation in the Everglades. This model estimates post-burn ash nutrient contents using the equation $y=0.01(x^{1.46})$ where y = % N loss and x = burn temperature (°C) ($r^2=0.83$). We applied this model using our initial biomass N contents and data from a Crain 2007 study in *Spartina patens* marshes in Maine and a Gratton and Denno 2003 study in *Spartina alterniflora* marshes in New Jersey (Fig. 2-12). Based on this analysis, standing plant nutrient stocks do not retain enough nitrogen following prescribed burns to provide N additions above the level (5 g N/m^2) found in our literature review to be needed to have a significant effect on biomass.

We observed a 90.6% loss of nitrogen in our study, which would equate to a burn temperature of 513 °C using the Qian et al. 2009 model. Our field measurements of burn temperatures exceeded the ~320 °C maximum of our IR temperature gun. Our method of outdoor combustion in small bins likely produced higher temperatures than natural ash production during fires due to a concentration of the fuel load.

Qian et al. 2009 also developed a model for ash total phosphorus:leaf total phosphorus vs. burn temperature of $y=5.96+3.25e^{0.004x}$ where y = ashTP:leafTP and x = burn temperature (°C) ($r^2=0.73$). Our observed ratio of ashTP:leafTP of 0.47 represented an unreasonably low burn temperature of approximately 171 °C, which would have been detected by our temperature gun, and therefore did not agree well with this model. However the authors noted that this relationship between ashTP:leafTP may hold true for only laboratory settings, as phosphorus is lost primarily through the fine particulate pathway, with the volatilization pathway as a relatively minor contributions (Raison et al. 1985). Nitrogen is lost through the volatilization pathway and therefore did not present an additional pathway to take into account for our homemade ash samples. The likely explanation for our low ashTP:leafTP ratio is that during the process of ash making in steel bins, convective currents were impossible to keep out and likely removed a significant amount of fine particulate P from our collected ash samples.

Further evidence for the absence of a significant ash effect is the timing of burning. Prescribed burning in this region is conducted during the winter months and is typically completed before the beginning of the growing season. During this time, deposited nutrients can be removed through tidal flushing and denitrification.

One major limitation to this study was the length. Due to examination of only one growing season worth of data, we cannot confidently say that marshes will always respond as described in this paper.

<u>Implications</u>

Prescribed fire in coastal marshes does not likely provide a fertilization effect for vegetation the following growing season. The lowered ammonium and phosphate concentrations late into the growing season that we observed, likely caused by increased plant biomass uptake of these nutrients in response to canopy removal, probably caused the depression of decomposition rates in the rooting zone from 0 – 20 cm by decreasing available nutrients for microbial decomposition. This decrease in decomposition from 0 – 20 cm due to lower available nutrients for microbial activity may have positive effects on marsh elevation trajectories. Cahoon et al. 2010 found that annually burned marshes had lower root zone subsidence than no burned areas (-0.4 ± 1.2 mm/yr vs. -6.2 ± 1.0 mm/yr). This difference is probably associated primarily with increases in belowground root and rhizome production, but could also be influenced by nutrient-related decreases in organic matter decomposition (Mendelsshon et al., 1999).

6. Conclusions

Through our manipulative study, we found that prescribed fire in coastal marshes does not likely provide a fertilization effect for vegetation through ash deposition due to the low amounts of nutrients remaining in ash following combustion. Also, the ash is applied during the winter, months before peak growing season when nutrients are in high demand. Modeling the biomass nutrient stocks in other marshes with similar vegetation types appears to show that this lack of a fertilization effect likely exists across marsh types. Through the mechanism of canopy removal, organic matter decomposition rates in marsh areas tended to decrease in July but not in May. This decrease in decomposition rates corresponded to a decrease in porewater ammonium and phosphate, which were taken up in much higher quantities in the biomass. Lower available nutrients later in the growing season likely provided resource stress for microbial decomposers, thereby lowering decomposition rates. These effects tended to be stronger and more consistent in areas dominated by the sedge *S. americanus*, as these areas showed more of a biomass response to canopy removal. Future research efforts should be aimed at coastal marsh fertilization studies with lower nutrient additions, in order to refine our proposed level of 5 g N/m^2/year as a critical level for plant response. Additionally, longer studies should be carried out (>1 year) investigating the effect of canopy removal on marsh plant-soil relationships so that the findings of this paper may be corroborated over multiple growing seasons.

7. Acknowledgements

The authors would like to thank the Maryland Sea Grant for project funding (Award Number NA10OAR4170072). The logistical support necessary for completion of this study would not have been possible without the help of Fish and Wildlife Service staff members located at the Blackwater National Wildlife Refuge, specifically Matt Whitbeck, Bill Giese, Leticia Melendez, Nate Carle, and Suzanne Baird. We would also like to thank the field and lab support work help which we received from members of the Soil and Water Geospatial Analysis Lab (SAWGAL) at the University of Maryland, especially Wesley Bickford, Amanda Garzio-Hadzick, Miriam Meyers, Emily Hutchins, Becca Mead, Michele Miller, Asia Vinnikova, and Joey Scholosnagle. We would like to thank J. Patrick J. Megonigal and his staff at the Smithsonian Environmental Research Center for his help with porewater sampling and analysis, as well as Dr. Anugrah Shaw at the University of Maryland Eastern Shore for allowing us to use her tensile strength testing machine. A special thanks goes out to Dennis Skultety at the Illinois Natural History Survey for help in making the GIS map for this paper. Finally, we thank Donald Cahoon and Jim Lynch of the USGS Patuxent Wildlife Research Center for collaborating and sharing data and methods used for the planning and implementation of this study.

8. References

Alberti, J., A. Mendez-Casariego, P. Daleo, E. Fanjul, B. Silliman, M. Bertness, O. Iribarne. 2010. Aboitc stress mediates top-down and bottom-up control in a Southwestern Atlantic salt marsh. Oecologia 163:181-191.

Anisfeld, S. C., and T. D. Hill. 2012. Fertilization effects of elevation change and belowground carbon balance in a Long Island Sound tidal marsh. Estuaries and Coasts 35:201-211.

Badia, D., and C. Marti. 2003. Plant ash and heat intensity effects on chemical and physical properties of two contrasting soils. Arid Land Resource Management 17:23-41.

Bickford, W. A. 2011. Plant productivity and competitive response to prescribed fire in mid-Atlantic brackish marshes. M.S. Thesis, University of Maryland, College Park, MD, USA. 229p.

Bickford, W. A., B. A. Needelman, R. R. Weil, and A. H. Baldwin. 2012. Vegetation response to prescribed fire in Mid-Atlantic brackish marshes. Estuaries and Coasts (In review)

Brinson, M. M., A. E. Lugo, and S. Brown. Primary productivity, decomposition and consumer activity in freshwater wetlands. Annual Review of Ecology and Systematics 12:123-161.

Buresh, R. J., R. D. DeLaune, and W. H. Patrick, Jr. 1980. Nitrogen and phosphorus distribution and utilization by *Spartina alterniflora* in a Louisiana gulf coast marsh. Estuaries 3(2):111-121.

Cachier, H., C. Liousse, and P. Buat-Menard. 1995. Particulate content of savanna fire emissions. Journal of Atmospheric Chemistry 22:123-148.

Cahoon, D. R., J. W. Day Jr., D. J. Reed, and R. S. Young. 1998. Global climate change and sea-level rise: estimating the potential for submergence of coastal wetlands. In: Vulnerability of Coastal Wetlands in the Southeastern United States: Climate Change Research Results, 1992 – 1997. G. R. Guntenspergen and B. A. Vairin (Eds.), 19 – 32, U.S. Geological Survey, Biological Resources Division Biological Sciences Report USGS/BRD/BSR – 1998 – 0002.

Cahoon, D. R., M. A. Ford, and P. F. Hensel. 2004. Ecogeomorphology of *Spartina patens*-dominated tidal marshes: Soil organic matter accumulation, marsh elevation dynamics, and disturbance. Coastal and Estuarine Studies 59:247-266.

Cahoon, D.R., P. F. Hensel, T. Spence, D. J. Reed, K. L. McKee, and N. Saintilan. 2006. Coastal wetland vulnerability to relative sea-level rise: Wetland elevation trends and process controls. Pp. 271-292. In Verhoeven, J.T.A., Beltman, B., Bobboink, R., and Whigham, D., ed. Wetlands and Natural Resource Management. Ecological Studies, Volume 190, Spring-Verlag, Berlin, Heidelberg.

Cahoon D. R., G. Guntenspergen, S. Baird, J. Nagel, P. Hensel, J. Lynch, D. Bishara, P. Brennan, J. Jones, and C. Otto. 2010. Do annual prescribed fires enhance or slow the loss of coastal marsh habitat at Blackwater National Wildlife Refuge? Final Project Report (JFSP Number: 06-2-1-35). March 31, 2010. Beltsville, MD.

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U. S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. 131 pp.

Crain, C. M. 2007. Shifting nutrient limitation and eutrophication effects in marsh vegetation across estuarine salinity gradients. Estuaries and Coasts 30:26-34.

Daleo, P., J. Alberti, A. Canepuccia, M. Escapa, E. Fanjul, B. R. Silliman, M. D. Bertness, O. Iribane. 2008. Mycorrhizal fungi determine salt-marsh plant zonation depending on nutrient supply. Journal of Ecology 96:431-437.

Darby, F. A., and R. E. Turner. 2008a. Effects of eutrophication on salt marsh roots, rhizomes, and soils. Marine Ecology Progress Series 363: 63-70.

Darby, F. A., and R. E. Turner. 2008b. Below- and aboveground biomass of *Spartina alterniflora*: response to nutrient addition in a Louisiana salt marsh. Estuaries and Coasts 31: 326-334.

DeLaune, R. D., S. R. Pezeshki, and A. Jugsujinda. 2005. Impact of Mississippi river freshwater reintroduction on Spartina patens marshes: responses to nutrient input and lowering of salinity. Wetlands 25:155-161.

Emery, N. C., P. J. Ewanchuk, and M. D. Bertness. 2001. Competition and salt-marsh plant zonation: stress tolerators may be dominant competitors. Ecology 82(9) :2471-2485.

Faulkner, S. P., and A. A. de la Cruz. 1982. Nutrient mobilization following winter fires in an irregularly flooded marsh. Journal of Environmental Quality 11:129-133.

French, D. D. 1988. Patterns of decomposition assessed by the use of litter bags and cotton strip assay on fertilized and unfertilized heather moor in Scotland. In: Harrison, A. F., Latter, P. M., Walton, D. W. H. (Eds.), Cotton Strip Assay: An Index of Decomposition in Soils.

Gabrey, S.W. and A. D. Afton. 2001. Plant community composition and biomass in Gulf Coast Chenier Plain marshes: responses to winter burning and structural marsh management. Environmental Management 27:281-293.

Gratton, C., and R. F. Denno. 2003. Inter-year carryover effects of a nutrient pulse on *Spartina* plants, herbivores, and natural enemies. Ecology 84(10):2692-2707.

Gusewell, S., U. Bollens, P. Ryser, F. Klotzli. 2003. Contrasting effects of nitrogen, phosphorus and water regime on first- and second-year growth of 16 wetland plant species. Fuctional Ecology 17:754-765.

Hackney, C. T., and A. A. de la Cruz. 1983. Effects of winter fire on the productivity and species composition of two brackish marsh communities in Mississippi. International Journal of Ecology and Environmental Sciences 27:281-293.

Harrison, A. F., P. M. Latter, P. M., and D. W. H. Walton (Eds.). 1988. Cotton Strip Assay: An index of Decomposition in Soils. ITE Symposium no. 24. Institute of Terrestrial Ecology, Grange-Over-Sands, Great Britian (176 p.).

Hauer, F. R. and C. N. Spencer. 1998. Phosphorus and nitrogen dynamics in streams associated with wildfire: A study of immediate and long term effects. International Journal of Wildland Fire 8:183-198.

Hoffpauir, C. M. 1967. Marsh burning. In: Newson J. D. (ed.) Proceedings of the Marsh and Estuary management symposium. Louisiana State University, Baton Rouge, pp. 134-139.

Ilstedt, U., R. Giesler, A. Nordgren, and A. Malmer. 2003. Changes in soil chemical and microbial properties after a wildfire in a tropical rainforest in Sabah, Malaysia. Soil Biology and Biogeochemistry 35:1071-1078.

Jefferies, R. L. 1981. Osmotic adjustment and the response of halophytic plants to salinity. Bioscience 31:42-46.

Johnson, S. R., and A. K. Knapp. 1995. The effect of fire on gas exchange and aboveground biomass production in annually vs. biennially burned *Spartina pectinata* wetlands. Wetlands 13: 299-303.

Kearney, M. S., R. E. Grace, and J. C. Stevenson. 1998. Marsh Loss in Nanticoke Estuary, Chesapeake Bay. Geographical Review 78(2):205-220.

Kearney, M. S., and J. C. Stevenson. 1991. Island land loss and marsh vertical accretion rate evidence for historical sea-level changes in Chesapeake Bay. Journal of Coastal Research 7(2):403-415.

Kirby, R. E., S. J. Lewis, and T. N. Sexson. 1988. Fire in North America wetland ecosystems and fire-wildlife relations: an annotated bibliography. U. S. Fish and Wildlife Service, Biological Report 88(1).

Koch, M. S., I. A. Mendelsshon, and K. L. McKee. 1990. Mechanism for the hydrogen sulfide-induced growth limitation in wetland macrophytes. Limnology and Oceanography 35(2):399-408.

Koerselman, W., and A. F. M. Mueleman. 1996. The vegetation N:P ratio: a new tool to detect the nature of nutrient limitation. Journal of Applied Ecology 33:1441-1450.

Kuo, S. 1996. Phosphorus. In: Sparks DL (Ed.) Methods of Soil Analysis, Part 3 – Chemical Methods. Soil Science Society of America, Madison, WI.

Latter, P. M., and A. F. Harrison. 1988. Decomposition of cellulose in relation to soil properties and plant growth. In: Harrison, A. F., Latter, P. M., Walton, D. W. H. (Eds.) Cotton strip assay: an index of decomposition in soils. Grange-over-Sands, NERC/ITE, 68-71.

Lay, D. W. 1945. Muskrat investigation in Texas. Journal of Wildlife Management 9: 56-76.

Levine, J. M., J. S. Brewer, and M. D. Bertness. 1998. Nutrients, competition and plant zonation in a New England salt marsh. Journal of Ecology 86:285-292.

Liu, X., P. V. Espen, F. Adams, J. Cafmeyer, and W. Maenhaut. 2000. Biomass burning in southern Africa: Individual particle characterization of atmospheric aerosols and savanna fire samples. Journal of Atmospheric Chemistry 36:135-155.

Lynch, J. J. 1941. The place of burning in management of the Gulf Coast wildlife refuges. Journal of Wildlife Management 5:454-457.

Marsh, A. S., D. P. Rasse, and B. G. Drake. 2005. Effect of elevated CO_2 on carbon pools and fluxes in a brackish marsh. Estuaries 28:694–704.

McNaughton, S. J., N. R. H. Stronach, and N. J. Georgiadis. 1998. Combustion in natural fires and global emissions budgets. Ecological Applications 8:464-468.

Mendelssohn, I. A. 1979. The influence of nitrogen level, form, and application method on the growth response of *Spartina alterniflora* in North Carolina. Estuaries 2(2):106-112.

Mendelssohn, I. A., B. K. Sorrell, H. Brix, H. Schierup, B. Lorenzen, and E. Maltby. 1999. Controls on soil cellulose decomposition along a salinity gradient in a *Phragmites australis* wetland in Denmark. Aquatic Botany 64:381-398.

Mendelssohn, I. A., and M. G. Slocum. 2004. Relationship between soil cellulose decomposition and oil contamination after an oil spill at Swanson Creek, Maryland. Marine Pollution Bulletin 48:359-370.

Miller, M. W., B. A. Needelman, W. A. Bickford, E. Hutchins. (in review) Prescribed fire increases soil temperature and light availabililty in a Mid-Atlantic brackish marsh.

Mitchell, L. R., S. Gabrey, P. P., Marra, R. M. Erwin. 2006. Impacts of marsh management on coastal-marsh bird habitats. In: Greenberg, R., Maldonado, J., Droege, S., McDonald, M.V. (eds.) Terrestrial vertebrates of tidal marshes: evolution, ecology, and conservation, studies in avian biology no. 32. Cooper Ornithological Society, Los Angeles, pp. 155-175.

Mitsch, W. J., and Gooselinnk, J.G. 2007. Wetlands, fourth ed. John Wiley and Sons Inc., New York.

Morris and Bradley. 1999. Effects of nutrient loading on the carbon balance of coastal wetland environments. Limnology and Oceanography 44:699-702.

Murphy, J. D., D. W. Johnson, W. W. Miller, R. F. Walker, E. F. Carroll, and R. R. Blank. 2006. Wildfire effects on soil nutrients and leaching in a Tahoe basin watershed. Journal of Environmental Quality 35:479-489.

Nyman, J. A. and R. H. Chabreck. 1995. Fire in coastal marshes: history and recent concerns, in Fire in wetlands: a management perspective, edited by S. I, Cerulean and R. T. Engstrom, 134-141, Proceedings of the Tall Timbers Ecology Conference, Number 19, Tall Timbers Research Station, Tallahasssee, FL, USA.

O'Neil, T. 1949. The muskrat in the Louisiana coastal marshes. Federal Aid Section-Fish and Game Division, Louisiana Department of Wildlife and Fisheries, New Orleans, LA.

Qian, Y., S. L. Miao, B. Gu, and Y. C. Li. 2009. Estimation of postfire nutrient loss in the Florida everglades. Journal of Environmental Quality 38:1812-1820.

Raison, R.J., P. K. Khanna, and P. V. Woods. 1985. Mechanisms of element transfer to the atmosphere during vegetation fires. Canadian Journal for Restoration 15:132-140.

Schmalzner, P. A., and Hinkle, C. R. 1992. Soil dynamics following fire in *Juncus* and *Spartina* marshes. Wetlands 12:8-21.

Sipple, W. S. 1979. A review of the biology, ecology, and management of Scirpus olneyi. Vol II: a synthesis of selected references. Wetland Publication No. 4. Annapolis, MD: Maryland Department of Natural Resources, Water Resources Administration, Wetlands Permit Division. 85 p.

Smith, S. M., S. Newman, P. B. Garrett, and J. A. Leeds. 2001. Differential effects of surface and peat fire on soil constituents in a degraded wetland of the Northern Florida Everglades. Journal of Environmental Quality 30:1998-2005.

Stevenson, J. C., M. S. Kearney, and E. C. Pendleton. 1985. Sedimentation and erosion in a Chesapeake Bay brackish marsh system. Marine Geology 67:213-235.

Tilman, D., and D. Wedin. 1991. Plant traits and resource reduction for five grasses growing on a nitrogen gradient. Ecology 72:685-700.

Thomas, A. D., R. P. D. Walsh, and R. A. Shakesby. 1999. Nutrient losses in eroded sediment after fire in eucalyptus and pine forests in the wet Mediterranean environment of northern Portugal. Catena 36:283-302.

Townsend, S. A., and M. M. Douglas. 2004. The effect of a wildfire on stream water quality and catchment water yield in a tropical savanna excluded from fire for 10 years (Kakadu National Park, North Australia). Water Resources 38:3051-3058.

Turner, R. E. 2011. Beneath the salt marsh canopy: loss of soil strength with increasing nutrient loads. Estuaries and Coasts 34(5): 1084-1093.

Ubeda, X., M. Lorca, L. R. Outeiro, S. Bernia, and M. Castellnou. 2005. Effects of prescribed fire on soil quality in Mediterranean grassland (Prades Mountains, north-east Spain). International Journal of Wildland Fire 14:379-384.

USDA, NRCS. 2011. The PLANTS Database (http://plants.usda.gov, 23 August 2011). National Plant Data Center, Baton Rouge, LA 70847-4490 USA.

U.S. Department of the Interior. 2006. Scientific review of the prescribed burn program at Blackwater National Wildlife Refuge (Chesapeake Marshlands NWR Complexes) and Fishing Bay Wildlife Management Area. Feb. 22.

U. S. Fish and Wildlife Service. 2011. Blackwater National Wildlife Refuge. http://www.fws.gov/blackwater/. Accessed September 23rd, 2011.

Valiela, I. and J.M. Teal. 1974. Nutrient limitation in salt marsh vegetation. Pages 574-563 in R.J. Reimold and W. H. Queen, editors. Ecology of halophytes. Academic Press, New York, New York, USA.

Van Wijnen, H. J., and J. P. Bakker. 1999. Nitrogen and phosphorus limitation in a coastal barrier salt marsh: the implication for vegetation succession. Journal of Ecology 87:265-272.

Verhoeven, J. T. A., W. Koerselman, and A. M. F. Meuleman. 1996. Nitrogen or phosphorus limited growth in herbaceous wet vegetation: Relations with atmospheric inputs and management regimes. Trends in Ecology & Evolution 11:494-497.

Wan, S., D. Hui, and Y. Luo. 2001. Fire effects on nitrogen pools and dynamics in terrestrial ecosystems: A meta-analysis. Ecological Applications 11:1349-1365.

Webster, J. R. and Benfield, E. F. 1986. Vascular plant breakdown in freshwater ecosystems. Annual Review of Ecology and Systematics 17: 567-594.

Wilbur, R. B. and N. L. Christensen. 1983. Effects of fire on nutrient availability in a North Carolina coastal plain pocosin. American Midland Naturalist 110: 54-61.

9. Tables and Figures

Table 2-1. Characteristics of sites in both the No-Burn and Annual Burn experiments. Salinity and pH values are the mean across the duration of the study.

Experiment	Site ID	pH	Salinity (ppt)	Dominant Soil Series	% cover *S. americanus* (sedge)	% cover *S. patens/D.spicata* (grasses)
No Burn	1D	6.6	8.9	Sunken	5 ± 2	47 ± 5
	2D	6.5	7.6	Bestpitch & Transquaking	43 ± 2	3 ± 1
	3D	6.6	8.8	Bestpitch & Transquaking	14 ± 4	31 ± 8
	7D	6.5	8.7	Bestpitch & Transquaking	28 ± 2	1 ± 0
Annual Burn	1A	6.4	12.7	Honga	30 ± 3	11 ± 2
	2A	6.4	10.2	Bestpitch & Transquaking	8 ± 1	38 ± 5
	3A	6.4	9.7	Bestpitch & Transquaking	10 ± 2	35 ± 3

Table 2-2. May and July no-burn site porewater nutrients with treatments. No letters at a nutrient measurement indicate that no pair of measurements were statistically different.

	Treatment			
	Grass-dominated islands		*Sedge-dominated islands*	
Nutrient (mg/L)	**Canopy**	**Canopy Removal**	**Canopy**	**Canopy Removal**
NH_4^+	0.52 ± 0.22	0.34 ± 0.13	0.73 ± 0.28	0.15 ± 0.06
PO_4^{3-}	0.06 ± 0.02	0.04 ± 0.01	0.08 ± 0.02	0.04 ± 0.01
S^{2-}	6.77 ± 3.18	8.00 ± 3.66	6.89 ± 1.39	7.32 ± 1.39

Table 2-3. May no-burn site porewater nutrients with treatments for grass- and sedge-dominated islands. No letters at a nutrient measurement indicate that no pair of measurements is statistically different.

	Treatment			
	Grass-dominated islands		*Sedge-dominated islands*	
Nutrient (mg/L)	**Canopy**	**Canopy Removal**	**Canopy**	**Canopy Removal**
NH_4^+	0.68 ± 0.25	0.19 ± 0.11	0.36 ± 0.21	0.49 ± 0.21
PO_4^{3-}	0.06 ± 0.03	0.04 ± 0.01	0.05 ± 0.02	0.05 ± 0.02
S^{2-}	4.58 ± 2.00	1.23 ± 0.87	6.51 ± 3.91	14.77 ± 6.29

Table 2-4. July no-burn site porewater nutrients with treatments for grass- and sedge-dominated islands. No letters at a nutrient measurement indicate that no pair of measurements is statistically different.

	Treatment			
	Grass-dominated islands		*Sedge-dominated islands*	
Nutrient (mg/L)	**Canopy**	**Canopy Removal**	**Canopy**	**Canopy Removal**
NH_4^+	0.75 ± 0.52	0.27 ± 0.10	0.70 ± 0.42	0.13 ± 0.05
PO_4^{3-}	0.08 ± 0.03	0.04 ± 0.01	0.07 ± 0.02	0.04 ± 0.01
S^{2-}	5.52 ± 2.14	6.25 ± 2.25	8.36 ± 1.67	8.38 ± 1.72

Table 2-5. May and July annual burn site porewater nutrients with treatments. Letters indicate the results of an ANOVA between measurements; means with the same letter are not significantly different from each other (α=0.05). No letters at a given nutrient measurement indicate that the pair of measurements is statistically different.

	Treatment			
	May		*July*	
Nutrient (mg/L)	**Control**	**Canopy Replacement**	**Control**	**Canopy Replacement**
NH_4^+	0.27 ± 0.14	0.43 ± 0.15	0.13a ± 0.04	0.79b ± 0.20
PO_4^{3-}	0.05 ± 0.02	0.05 ± 0.02	0.04 ± 0.01	0.08 ± 0.03
S^{2-}	2.82 ± 1.54	6.38 ± 2.86	6.32 ± 1.83	5.44 ± 1.85

Table 2-6. No-burn sites total plant tissue elemental content with treatments. No letters at an elemental measurement indicate that no pair of measurements is statistically different (P=0.05) between treatments.

	Treatment			
Element (g/m^2)	**Ash Deposition**	**Canopy Removal**	**Canopy Removal + Ash**	**Control**
C	148.72 ± 15.01	202.89 ± 28.58	184.69 ± 16.95	143.73 ± 33.96
N	3.96 ± 0.44	4.49 ± 0.54	4.66 ± 0.49	3.59 ± 0.82
P	0.40 ± 0.03	0.45 ± 0.05	0.48 ± 0.04	0.40 ± 0.09
K	4.86 ± 0.53	5.29 ± 0.75	5.34 ± 0.83	4.08 ± 1.18
Ca	0.82 ± 0.09	1.06 ± 0.12	0.99 ± 0.10	0.78 ± 0.17
Mg	1.29 ± 0.15	1.59 ± 0.14	1.49 ± 0.16	1.37 ± 0.28
S	3.63 ± 0.63	4.30 ± 0.77	3.79 ± 0.66	2.96 ± 0.82

Table 2-7. Annual burn sites total plant tissue elemental content with treatments. ANOVA indicated each pair of plant tissue elemental content measurements was significantly different (α=0.05).

	Treatment	
Element (g/m^2)	**Control**	**Canopy Replacement**
C	229.49 ± 21.80	146.13 ± 24.66
N	4.46 ± 0.36	2.92 ± 0.35
P	0.44 ± 0.05	0.29 ± 0.06
K	6.04 ± 0.42	3.53 ± 0.64
Ca	0.80 ± 0.07	0.53 ± 0.09
Mg	1.35 ± 0.12	0.87 ± 0.17
S	4.48 ± 0.63	3.19 ± 0.60

Table 2-8. Elemental standing stocks of sensced vegetation and ash constitutents applied to no-burn study sites along with percent volatilization. Standard error bars shown as well.

Element	Pre-Burn Biomass Constituents (g/m^2)	Percent Volatilized	Ash Constituents (g/m^2)
C	137.05 ± 11.73	93.87 ± 1.43	6.12 ± 0.67
N	3.46 ± 0.37	90.57 ± 2.14	0.22 ± 0.02
P	0.34 ± 0.03	50.55 ± 6.70	0.16 ± 0.02
K	5.13 ± 0.81	6.35 ± 4.51	4.96 ± 0.05
Ca	0.75 ± 0.08	4.67 ± 3.86	0.71 ± 0.06
Mg	1.20 ± 0.12	6.80 ± 7.36	1.10 ± 0.06
S	4.06 ± 0.60	84.82 ± 4.10	0.31 ± 0.03

Table 2-9. Summary chart detailing nutrient additions and resulting plant responses in coastal marshes.

Study	Nitrogen Added (g/m^2)	Phosphorus Added (g/m^2)	Increments	Yearly Nitrogen Addition ($g/m^2/yr$)	Yearly Phosphorus Addition ($g/m^2/yr$)	Findings
Crain, 2007	54.3	36.7	Monthly, May - July 2001	162.9	110.1	*S. patens* 50% biomass increase (N only), 75% biomass increase (N+P)
DeLaune et al., 2005	10	8.7	Single, 3 month greenhouse experiment	10	8.7	*S. patens* doubled in biomass production

Gusewell et al., 2003	0.95	0.06	Weekly, 15 weeks in 1998	14.25	0.9	Small increase in aboveground biomass of all 15 plant species examined
Alberti et al., 2009	8.7	1.5	Monthly, Jan. 2006 - June 2007	52.2	9.0	*S. densiflora* biomass 4.5 times increase (marsh edge), 6.5 times increase (low marsh)
Daleo et al., 2008	4.35	0.75	Biweekly, Dec. – April 1993, 1994	34.8	6.0	*S. alterniflora* aboveground biomass increase of 5.3 times, doubling of stem density, stem height increase of 1.65 times
Levine et al., 1998	4.35	0.45	Biweekly, April – Sept. 1993, 1994	43.5	4.50	Doubling of *S. alterniflora*, *S. patens*, and *D. spicata* biomass
Emery et al., 2001	4.35	0.45	Biweekly, mid-May – end Aug. 1997, 1998	30.45	3.15	Doubling of *S. alterniflora*, *S. patens*, and *D. spicata* biomass
Gratton and Denno, 2003	60	N/A	Biweekly, 4 weeks, mid-May start	240	N/A	3-fold increase in *S. alterniflora* biomass, 1.5 – 1.8% increase in plant tissue N content

Gratton and Denno, 2003	120	N/A	Biweekly, 8 weeks, mid-May start	960	N/A	2.5-fold increase in *S. alterniflora* biomass, 1.4% increase in plant tissue N content
Van Wijen and Bakker, 1999	5 (low) and 25 (high)	2 (low) and 10 (high)	Early May 1994, 1995, 1996	5 (low) and 25 (high)	2 (low) and 10 (high)	Low N application increased plant growth at some sites while high N increased plant growth at all sites. P application appeared negligible.
Mendelssohn, 1979	56	N/A	Twice, June and July 1976	112	N/A	Doubling of plant biomass
Buresh et al. 1980	20	20	Single, May 1976	20	20	N additions significantly increased total aboveground plant biomass and plant height. No effect of P additions.

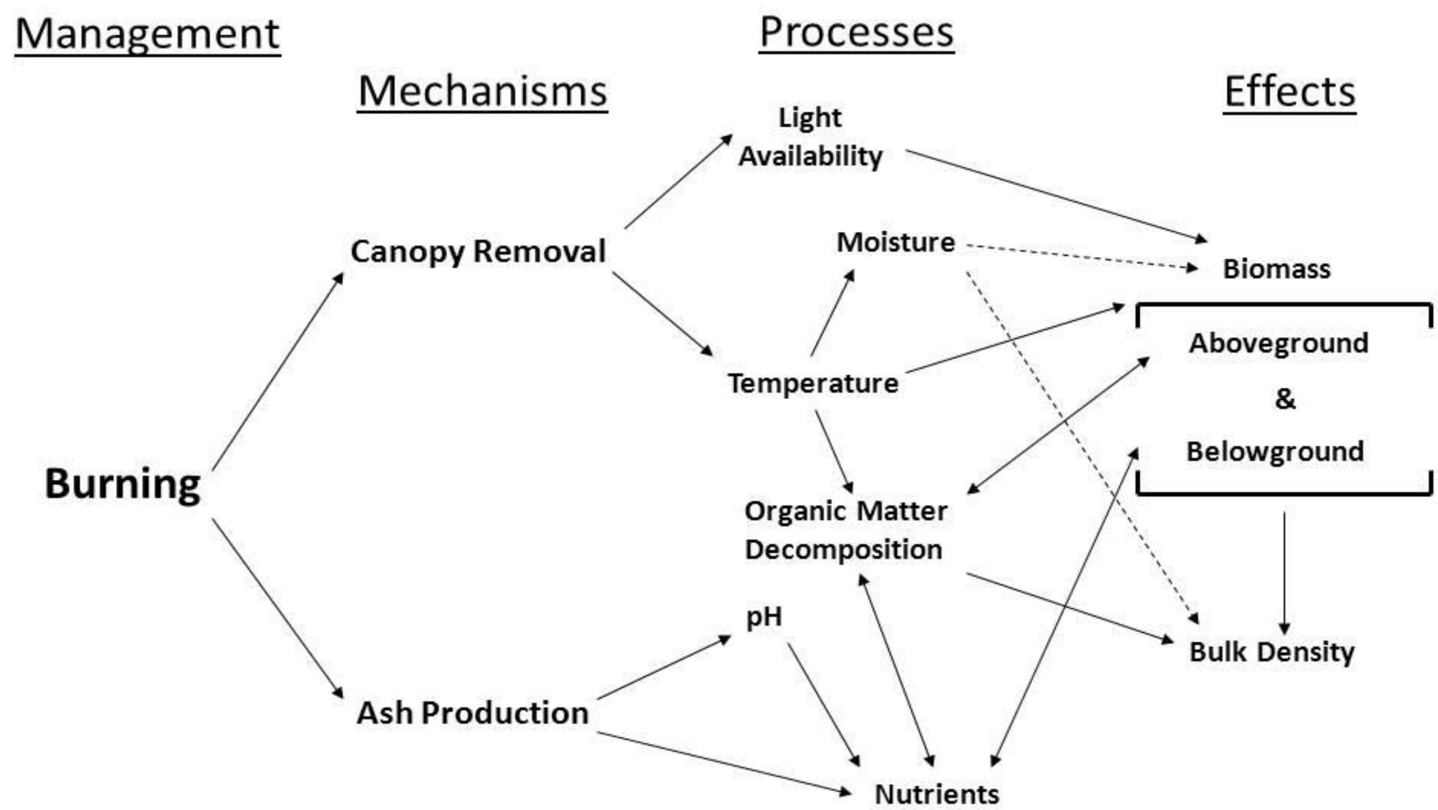

Figure 2-1. Systems diagram showing the effects of burning on coastal marsh ecosystem dynamics.

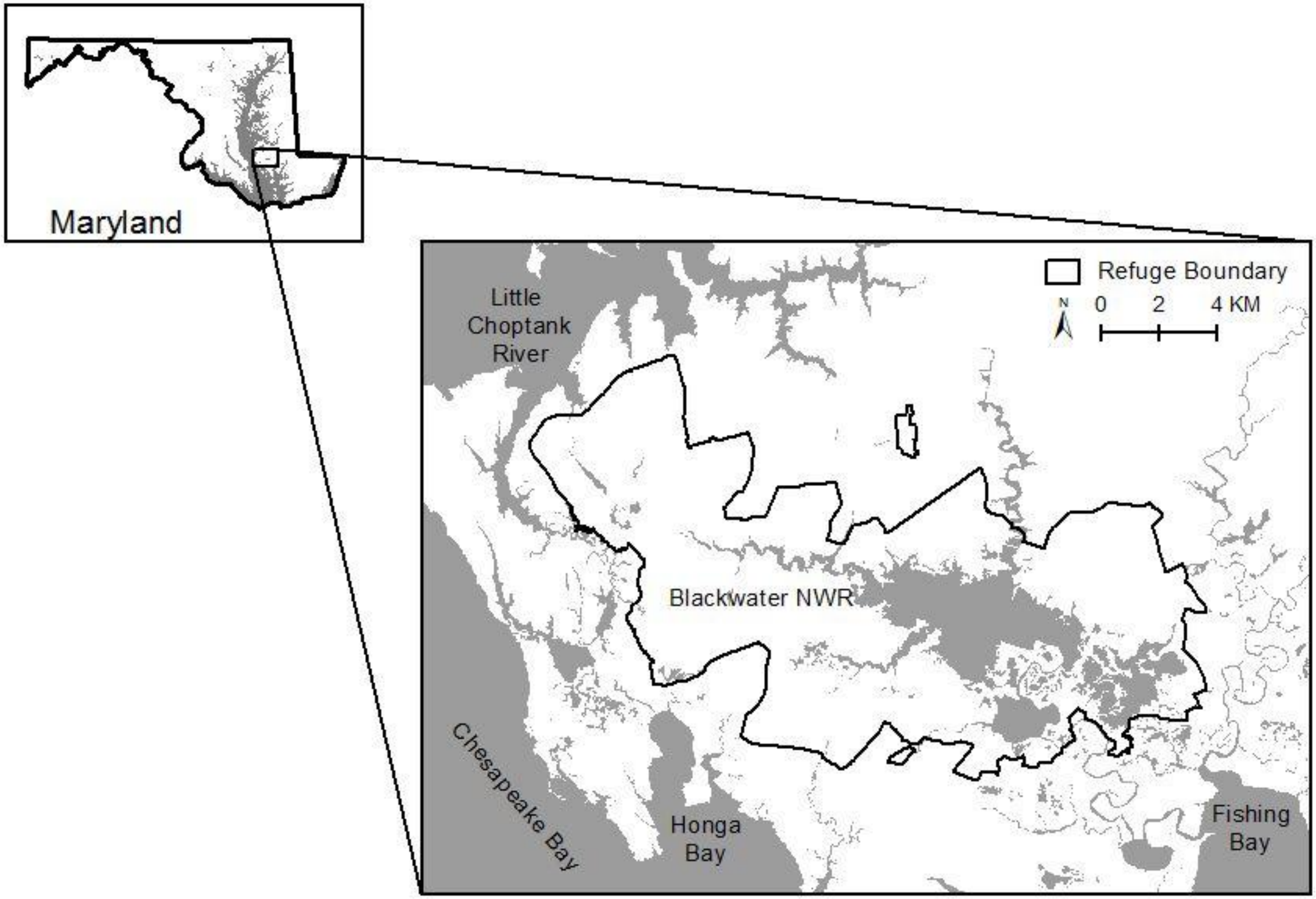

Figure 2-2. Map of Blackwater National Wildlife Refuge (NWR) and surrounding waters on the Eastern Shore of Maryland.

Figure 2-3. Photos of canopy replacement treatment applied to annually burned sites.

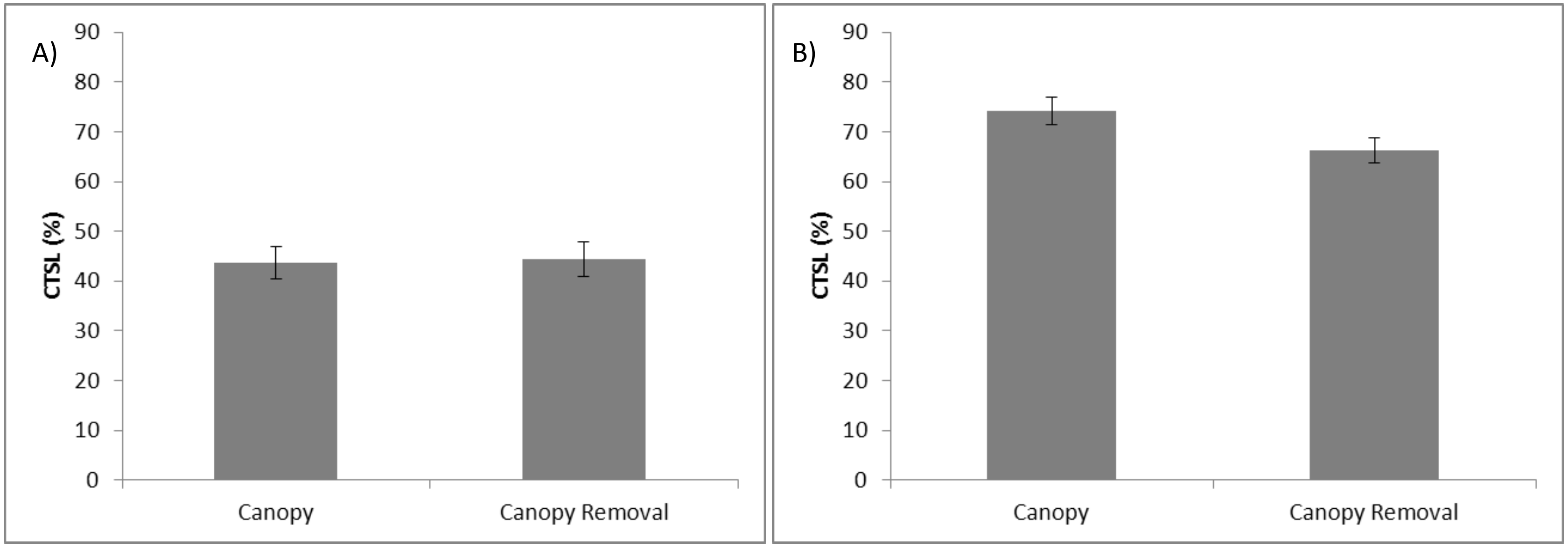

Figure 2-4. Mean cotton tensile strength loss (CTSL) for no burn sites from 0 – 20 cm depths for (A) May and (B) July sets. No pair of measurements were significantly different (α=0.05).

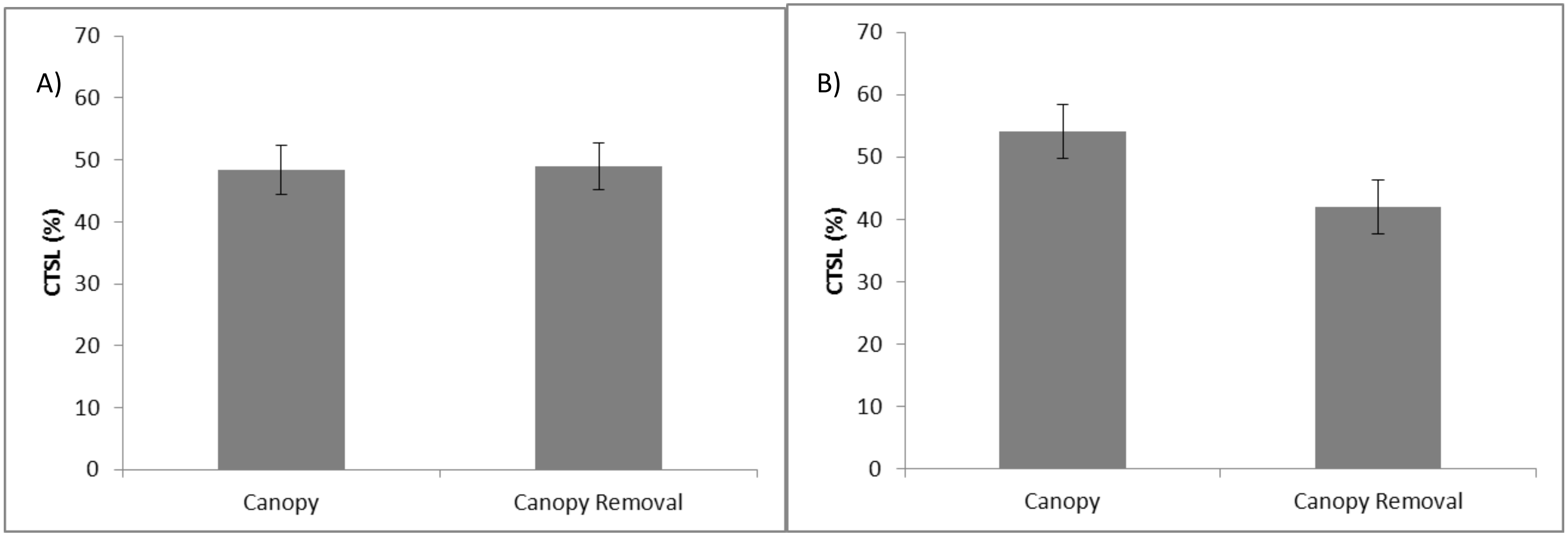

Figure 2-5. Mean cotton tensile strength loss (CTSL) for no burn islands from 0 – 20 cm depths for May sets separated by grass-dominated (A) and sedge-dominated (B) islands with standard error bars. No pair of measurements were significantly different (α=0.05).

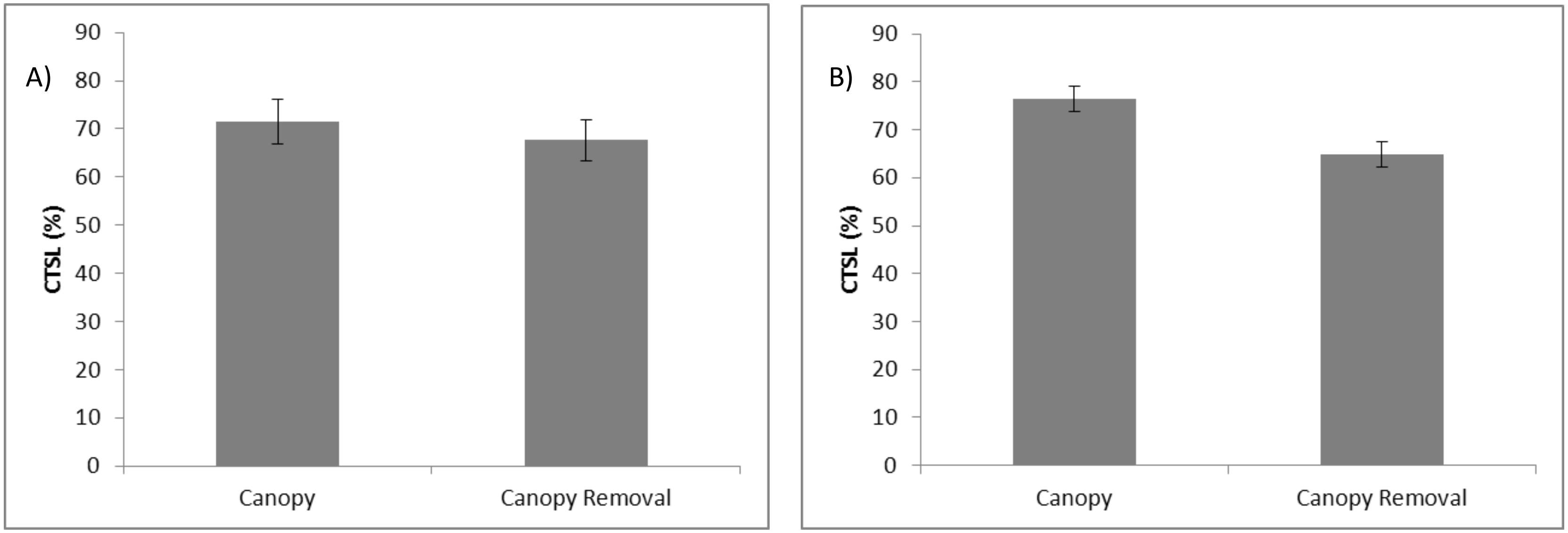

Figure 2-6. Mean cotton tensile strength loss (CTSL) for no burn islands from 0 – 20 cm depths for July sets separated by grass-dominated (A) and sedge-dominated (B) islands with standard error bars. No pair of measurements were significantly different (α=0.05).

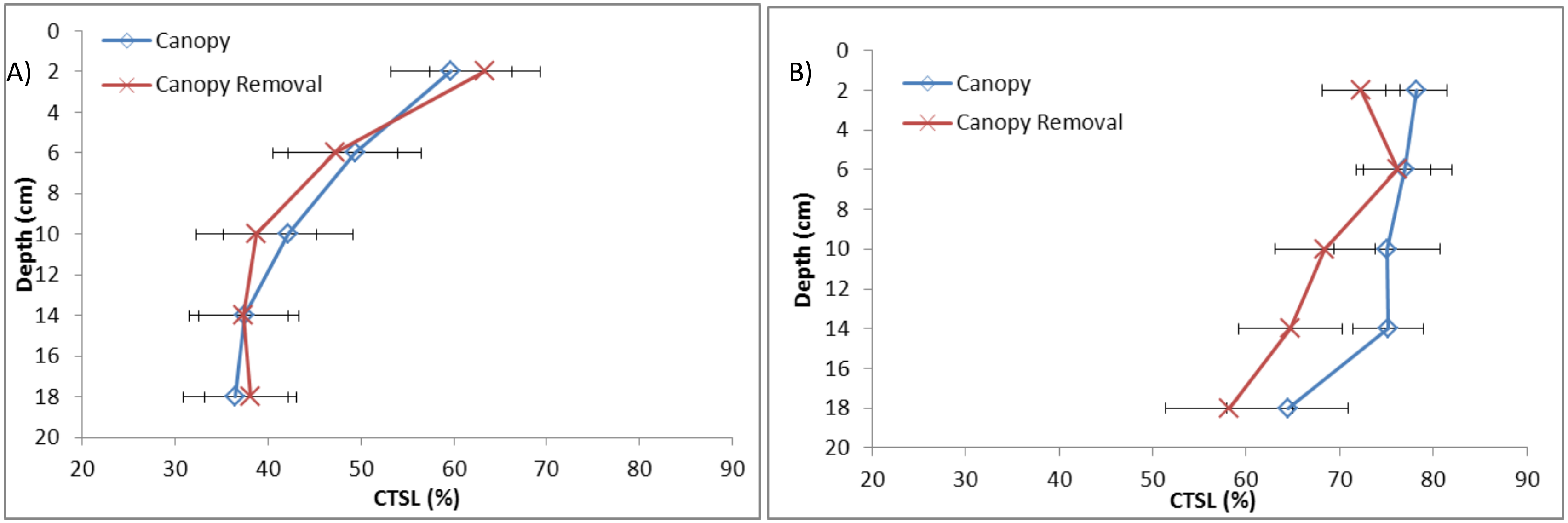

Figure 2-7. Cotton tensile strength loss (CTSL) by depth for no burn islands from 0 – 20 cm depths for May (A) and July (B) sets, with bars representing standard errors. No pair of measurements at any given depth were significantly different from each other (α=0.05).

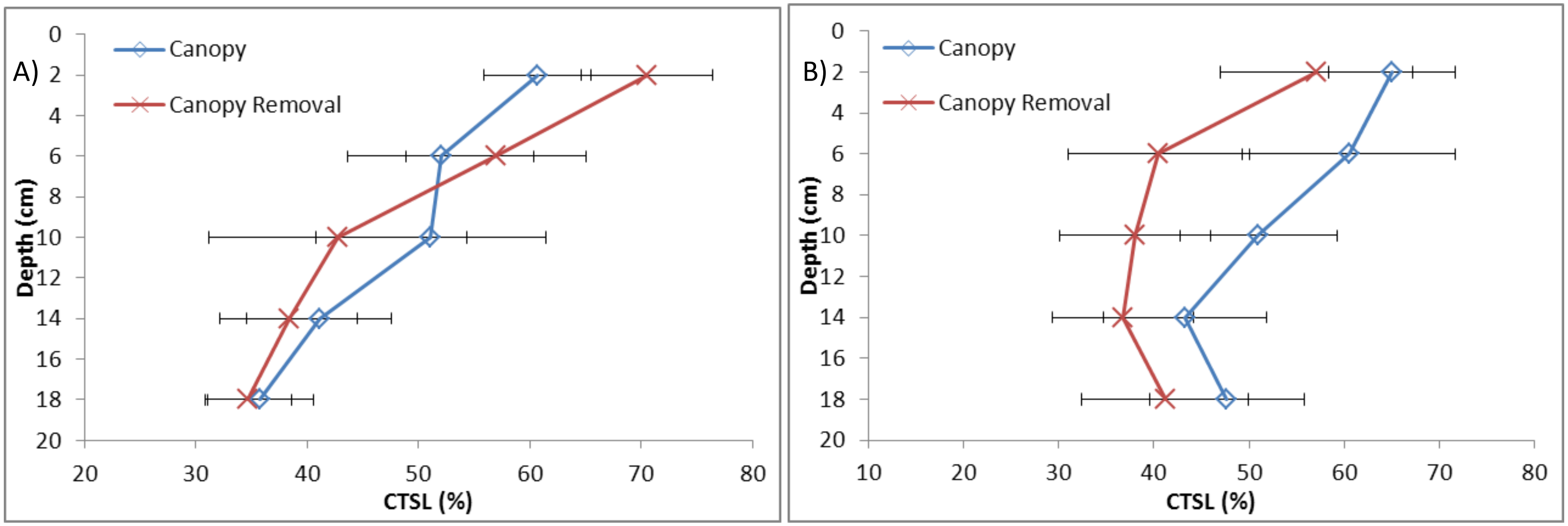

Figure 2-8. Cotton tensile strength loss (CTSL) by depth for no burn islands from 0 – 20 cm depths for May sets separated by grass dominated (A) and sedge dominated (B) islands, with bars representing standard errors. No pair of measurements at any given depth were significantly different from each other (α=0.05).

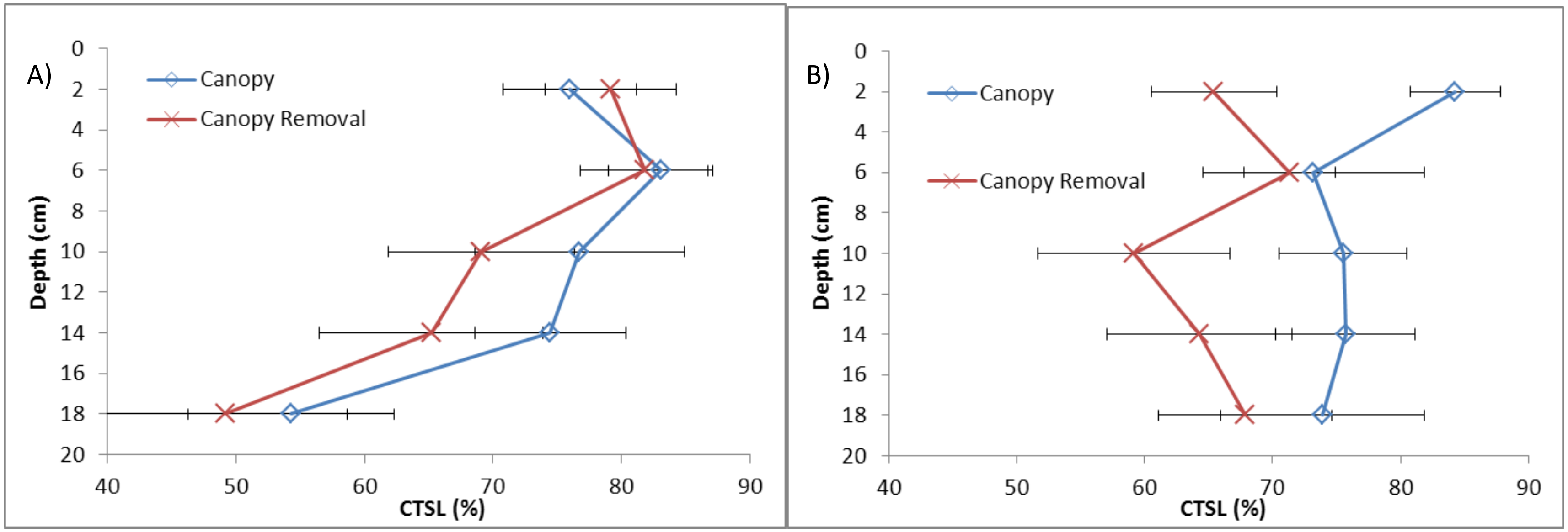

Figure 2-9. Cotton tensile strength loss (CTSL) by depth for no burn islands from 0 – 20 cm depths for July sets separated by grass dominated (A) and sedge dominated (B) islands, with bars representing standard errors. No pair of measurements at any given depth were significantly different from each other (α=0.05).

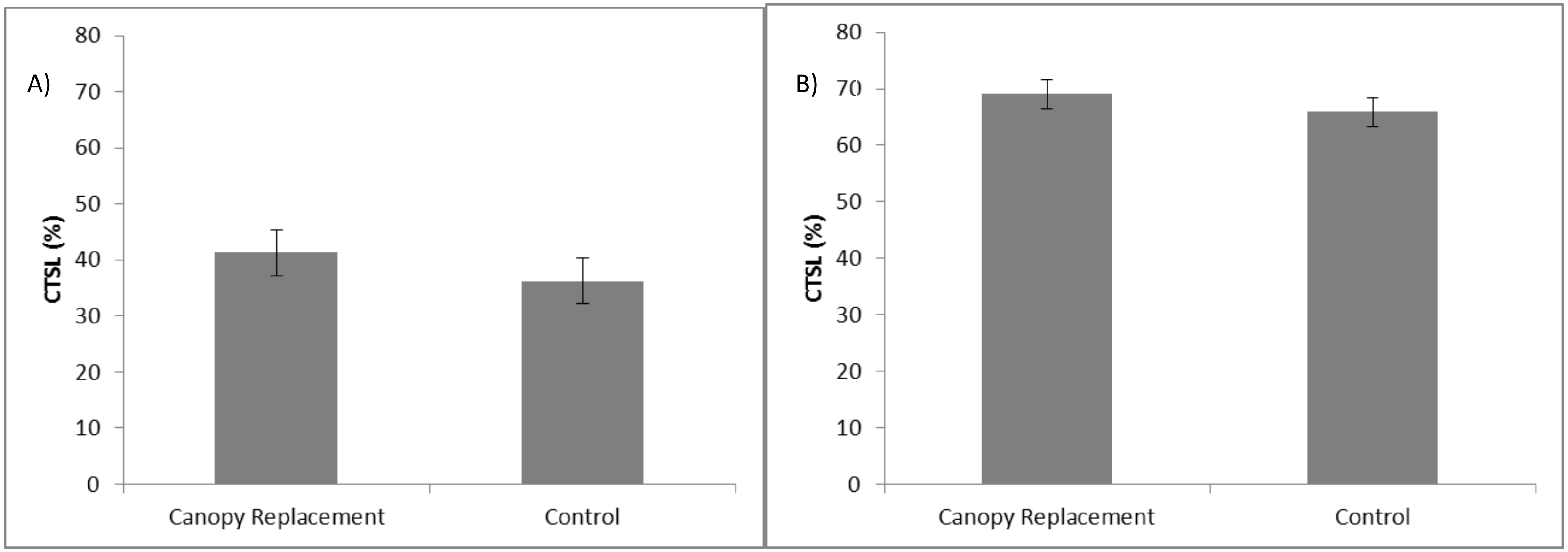

Figure 2-10. Mean cotton tensile strength loss (CTSL) for annual burn islands from 0 – 20 cm depths for May (A) and July (B) sets with standard error bars. No pair of measurements were significantly different (α=0.05).

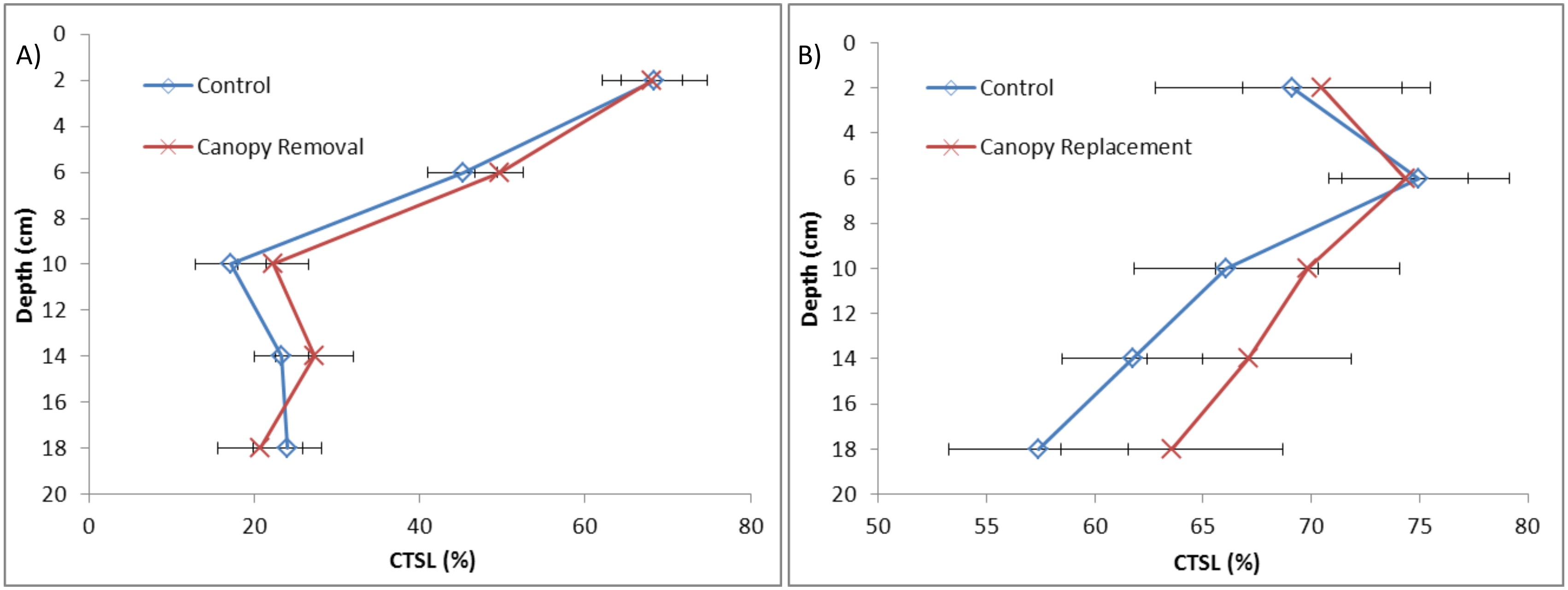

Figure 2-11. Cotton tensile strength loss (CTSL) by depth for annual burn islands from 0 – 20 cm depths for May (A) and July (B) sets, with bars representing standard errors. Results of a pre-planned contrast between treatments at the same depth measurements indicated that no pair of treatments were significantly different from each other (α=0.05).

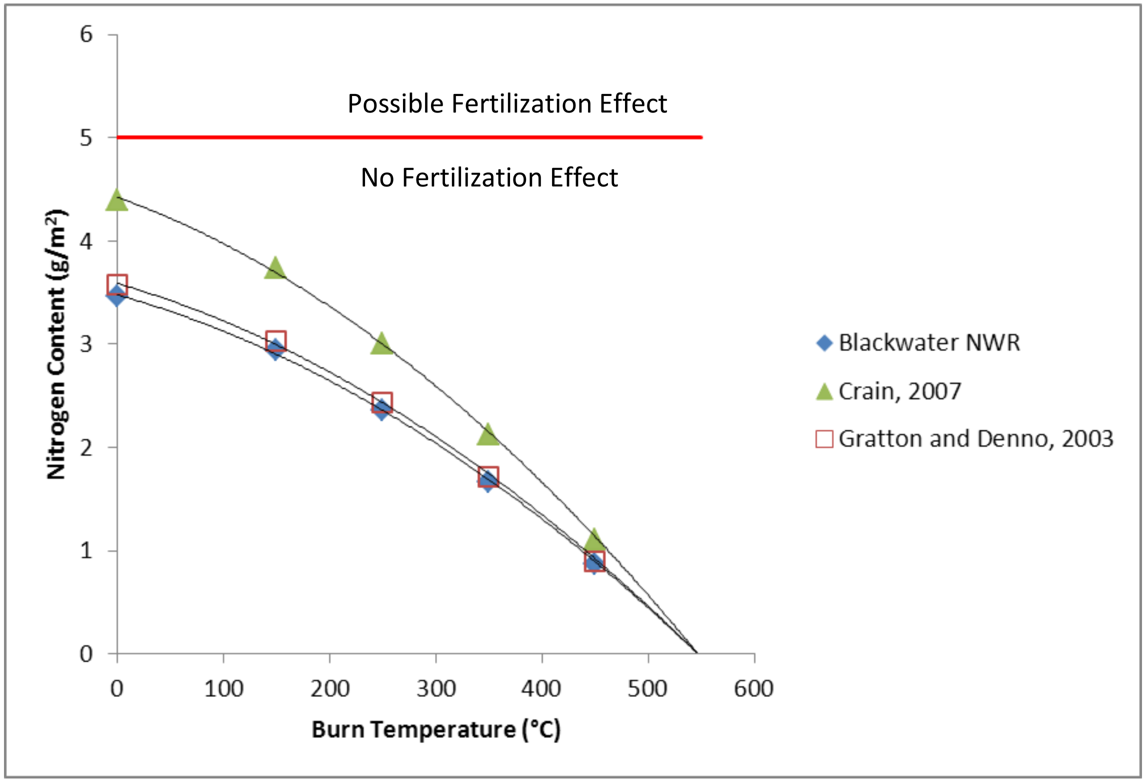

Figure 2-12. Estimated nitrogen content of ash a function of burn temperature and initial plant nitrogen content (values from our study and from two published studies) using the model $y=0.01(x^{1.46})$ where y = % N loss and x = burn temperature (°C) (r^2=0.83) developed by Qian et al. 2009. The horizontal line represents the minimum nitrogen application rate that has generated a plant response as determiend through a literature review (Table 9).

Chapter 3: Miscellaneous

Overview

This chapter contains methods, results, and a discussion of data that were not used in chapter 2.

Resin Capsules

1) *Methods*

Plant-available nutrients were assessed with Unibest PST-1 (Universal Bioavailability Environment/Soil Test) resin capsules (described in Skogley 1992). This method utilizes mixed-bed ion exchange resins which consist of strong base/strong acid active sites, with OH^- and H^+ as the initial saturation ions. The resin is encapsulated in a rigid, speherical, porous polyester which is inserted directly into the soil matrix. Two sets of resin capsules were deployed into the marsh soils at 5 cm during the growing season, once on May 21st and 22nd and again on July 9th and 10th (in conjunction with porewater sampling). Based on a pilot study, the capsules were deployed for a 3-day period, to allow sufficient absorption of ions in solution but to not allow for oversaturation of the ions common in seawater, such as chlorine and sodium. Recovered capsules were rinsed with deionized water twice in the field and transported on ice back to the lab where they were rinsed one final time. Cleaned capsules were sent to Unibest International Corporation (Pasco, Washington, USA) where ion extractions were performed using 2 N HCl.

2) *Results*

No-Burn Study, Resin Capsule Nutrients

Resin capsule nutrients showed no significant differences between treatments for the May and July deployments (Table 3-1) except for sulfur in July, which had a significant site x canopy x ash interaction (P=0.04).

No-Burn Study, Sites Separated by Dominant Species, Resin Capsule Nutrients

No significant differences existed between treatments for resin capsule nutrients for either grass-dominated or sedge-dominated sites during May (Table 3-2) or July (Table 3-3). A significant three way interaction (P=0.02) of site x canopy x ash interaction existed for resin capsule sulfur in July for grass-dominated sites.

Annual Burn Study, Resin Capsule Nutrients

The annual burn experiment showed no difference existed between treatments and resin capsule nutrients in May or July (Table 3-4). No additional interactions were observed.

3) *Discussion*

The resin capsule data did not show any significant relationships between treatments and nutrient status for this study. Two significant three way interactions were observed in the no-burn sites for July, although these difficult relationships were likely not able to tell us any significant ecological information. In high amounts (>1 mM), porewater sulfur may be converted to hydrogen sulfide which may cause toxicity in plants (Koch et al., 1990). Porewater sulfide measurements appear to have been more sensitive to treatment effects in this study.

Our use of the Unibest PST-1 Resin Capsules in wetlands was a trial run, as these were designed for use in agricultural and upland soils. The exchange surface of the resin became dominated by Na^+ ions, which are in very high abundance in saltwater. The concentration of these ions were at least one order of magnitude above any other ion measured.

Soil Nutrient Cores

1) *Methods*

Soil nutrient cores were taken in July of 2009 in conjunction with other sampling. These cores were taken by using a hail bail corer attached to an electric drill, and by sampling each plot 8 times, 2 on each side, by drilling randomly into the marsh surface at arm's length. Soil samples were collected to 5 cm depths, and stored at 35°F. The soils were stored for approximately one and a half years before they were dried at 35°C and ground using a coffee grinder and homogenized for each plot. The soils were analyzed for nitrate and ammonium content using methods described in Cataldo et al, 1975 and Carlson, 1978, respectively.

2) *Results and Discussion*

After plotting the resulting values (Fig. 3-1A&B), it became apparent that either the samples or the methodologies used in analysis were providing erroneous values. For 12 of the 47 sites measured, nitrate readings were greater than 10 mg/L and ammonium readings were greater than 20 mg/L. These results are too high to be accurate, and are likely due to the high organic matter content in the soils analyzed along with the long storage time. These readings are also much higher than what was found in the porewater and resin capsule readings, further indication of the inflated values provided.

References

Bickford, W. A. 2011. Plant productivity and competitive response to prescribed fire in mid-Atlantic brackish marshes. M.S. Thesis, University of Maryland, College Park, MD, USA.

Carlson, R. M. 1978. Automated separation and conductimetric determination of ammonia and dissolved carbon dioxide. Analytical Chemistry 50(11):1528-1531.

Cataldo, D. A., Haroon, M., Schrader, L. E., Young, V. L. 1975. Rapid Colorimetric Determination of Nitrate in Plant Tissue by Nitration of Salicylic Acid. Communications in Soil Science and Plant Analysis 6 (1):71-80.

Koch, M. S., I. A. Mendelsshon, and K. L. McKee. 1990. Mechanism for the hydrogen sulfide-induced growth limitation in wetland macrophytes. Limnology and Oceanography 35(2):399-408.

Skogley, E. O. 1992. The universal bioavailability environment/soil test unibest. Communications in Soil Science and Plant Analysis 23:17-20,2225-2246.

Tables and Figures

Table 3-1. May and July no-burn sites resin capsule nutrients with treatments.

	Treatment							
	May				*July*			
Nutrient (mg/L)	**Ash Deposition**	**Canopy Removal**	**Canopy Removal + Ash**	**Control**	**Ash Deposition**	**Canopy Removal**	**Canopy Removal + Ash**	**Control**
NO_3^-	0.29 ± 0.04	0.29 ± 0.04	0.26 ± 0.04	0.28 ± 0.04	0.10 ± 0.01	0.09 ± 0.01	0.09 ± 0.01	0.09 ± 0.01
NH_4^+	1.15 ± 0.12	1.25 ± 0.10	1.18 ± 0.12	1.30 ± 0.19	1.07 ± 0.21	0.94 ± 0.22	0.91 ± 0.11	1.00 ± 0.13
P	0.07 ± 0.02	0.08 ± 0.01	0.06 ± 0.01	0.08 ± 0.01	0.07 ± 0.01	0.07 ± 0.02	0.06 ± 0.01	0.06 ± 0.01
Ca	44.85 ± 7.59	41.47 ± 8.57	46.26 ± 7.84	54.05 ± 12.06	61.32 ± 6.70	72.05 ± 9.38	70.69 ± 5.67	66.84 ± 8.77
Mg	103.29 ± 16.59	89.13 ± 14.74	106.32 ± 16.07	106.37 ± 19.39	132.40 ± 6.81	142.83 ± 9.96	145.17 ± 7.20	133.73 ± 6.03
K	13.30 ± 0.97	11.45 ± 1.15	13.29 ± 0.66	12.12 ± 1.34	15.56 ± 0.53	13.87 ± 0.74	14.84 ± 0.48	15.27 ± 0.57
S	92.83 ± 10.43	80.62 ± 9.04	92.50 ± 8.60	84.49 ± 10.78	39.97 ± 4.03	43.45 ± 3.89	43.78 ± 3.38	44.15 ± 4.29

Table 3-2. May no-burn sites resin capsule nutrients with treatments for grass- and sedge-dominated islands.

	Treatment							
	Grass-dominated islands				*Sedge-dominated islands*			
Nutrient (mg/L)	**Ash Deposition**	**Canopy Removal**	**Canopy Removal + Ash**	**Control**	**Ash Deposition**	**Canopy Removal**	**Canopy Removal + Ash**	**Control**
NO_3^-	0.22 ± 0.04	0.21 ± 0.05	0.18 ± 0.04	0.22 ± 0.06	0.36 ± 0.07	0.37 ± 0.04	0.34 ± 0.04	0.33 ± 0.06
NH_4^+	1.14 ± 0.11	1.14 ± 0.14	1.06 ± 0.16	1.16 ± 0.23	1.18 ± 0.22	1.37 ± 0.15	1.32 ± 0.17	1.44 ± 0.30
P	0.05 ± 0.01	0.04 ± 0.02	0.04 ± 0.01	0.08 ± 0.01	0.08 ± 0.03	0.11 ± 0.02	0.09 ± 0.01	0.09 ± 0.02
Ca	58.28 ± 7.91	58.67 ± 12.29	62.64 ± 9.40	72.08 ± 20.15	31.43 ± 10.89	24.27 ± 7.34	26.60 ± 5.32	36.02 ± 10.17
Mg	136.58 ± 14.60	118.95 ± 16.99	141.86 ± 16.65	130.43 ± 30.12	70.00 ± 23.57	59.32 ± 17.66	63.68 ± 13.09	82.31 ± 22.72
K	15.37 ± 0.80	12.93 ± 1.00	13.93 ± 0.98	12.50 ± 1.59	11.24 ± 1.34	9.97 ± 1.99	12.52 ± 0.84	11.74 ± 2.30
S	112.16 ± 10.90	86.58 ± 9.64	99.15 ± 14.48	84.70 ± 16.71	73.50 ± 14.50	74.66 ± 15.89	84.51 ± 7.92	84.27 ± 15.24

Table 3-3. July no-burn sites resin capsule nutrients with treatments for grass- and sedge-dominated islands.

	Treatment							
	Grass-dominated islands				*Sedge-dominated islands*			
Nutrient (mg/L)	**Ash Deposition**	**Canopy Removal**	**Canopy Removal + Ash**	**Control**	**Ash Deposition**	**Canopy Removal**	**Canopy Removal + Ash**	**Control**
NO_3^-	0.10 ± 0.01	0.09 ± 0.00	0.09 ± 0.01	0.09 ± 0.02	0.10 ± 0.01	0.10 ± 0.02	0.09 ± 0.01	0.09 ± 0.01
NH_4^+	1.00 ± 0.41	0.52 ± 0.06	0.72 ± 0.16	0.86 ± 0.17	1.14 ± 0.14	1.36 ± 0.38	1.11 ± 0.13	1.15 ± 0.18
P	0.06 ± 0.01	0.05 ± 0.02	0.06 ± 0.01	0.07 ± 0.02	0.07 ± 0.01	0.08 ± 0.03	0.07 ± 0.02	0.06 ± 0.01
Ca	70.53 ± 12.36	86.50 ± 17.10	82.45 ± 9.02	80.79 ± 16.12	52.71 ± 3.58	57.61 ± 3.35	58.94 ± 2.16	52.88 ± 0.89
Mg	139.63 ± 10.48	150.27 ± 18.59	155.04 ± 12.59	143.74 ± 10.77	125.17 ± 8.56	135.39 ± 8.30	135.30 ± 5.53	123.73 ± 8.98
K	15.74 ± 1.02	12.50 ± 1.00	15.09 ± 0.74	15.49 ± 1.00	15.39 ± 0.44	15.24 ± 0.83	14.59 ± 0.66	15.06 ± 0.64
S	42.78 ± 5.95	45.23 ± 7.29	45.73 ± 6.49	54.30 ± 5.03	37.15 ± 5.74	41.67 ± 3.49	41.84 ± 2.56	34.00 ± 3.79

Table 3-4. May and July annual burn sites resin capsule nutrients with treatments.

	Treatment			
	May		*July*	
Nutrient (mg/L)	**Control**	**Canopy Replacement**	**Control**	**Canopy Replacement**
NO_3^-	0.32 ± 0.05	0.34 ± 0.04	0.08 ± 0.01	0.09 ± 0.01
NH_4^+	1.51 ± 0.15	1.61 ± 0.18	0.62 ± 0.12	0.69 ± 0.13
P	0.09 ± 0.02	0.08 ± 0.01	0.08 ± 0.01	0.06 ± 0.01
Ca	34.12 ± 11.67	29.66 ± 7.67	76.86 ± 10.26	69.51 ± 8.07
Mg	80.56 ± 26.63	72.23 ± 18.68	153.99 ± 6.90	148.74 ± 5.47
K	10.83 ± 2.02	11.08 ± 1.97	14.59 ± 0.58	15.86 ± 0.75
S	75.60 ± 16.11	73.83 ± 13.28	43.19 ± 3.80	52.34 ± 4.21

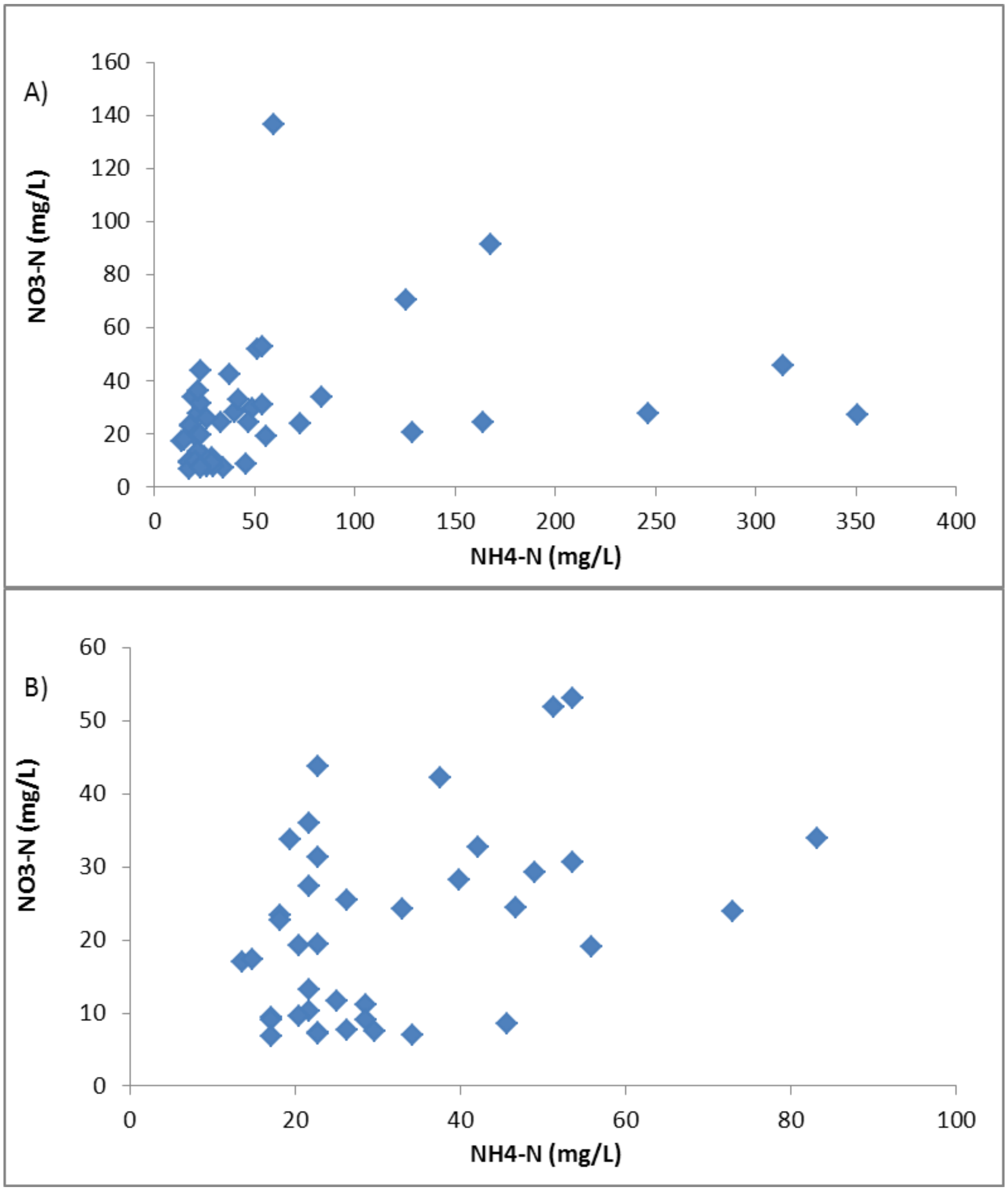

Figure 3-1. Scatter plot of all sites (A) and selected sites (B) showing nitrate-N vs. ammonium-N for soil nutrient cores.

Appendix A: Statistical Models and Analysis for Chapter 2

This appendix provides statistical model inputs and outputs from SAS for data used in Chapter II. Each program code is preceded by a title indicating the data it is intended to analyze and the corresponding table or figure.

May No Burn Study Cotton Strip Analyses

May No Burn Islands CTSL 0-20 cm Average (Figure 4A)

Program:

```
title 'Total Avg CTSL May';

proc mixed data=CTSL;
        class island treatment;
        model TotalAvgCTSL=treatment
        lsmeans treatment / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	26	0.03	0.8621
ash	1	26	1.16	0.2922
canopy*ash	1	26	3.14	0.0879
island	3	26	1.79	0.1743
island*canopy	3	26	0.77	0.5199
island*ash	3	26	0.18	0.9092
island*canopy*ash	3	26	0.28	0.8395

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		43.5861	3.2628	26	13.36	<.0001
canopy	NoCanopy		44.4167	3.4303	26	12.95	<.0001
ash		Ash	46.5462	3.5110	26	13.26	<.0001
ash		NoAsh	41.4566	3.1758	26	13.05	<.0001
canopy*ash	Canopy	Ash	50.3280	4.4913	26	11.21	<.0001
canopy*ash	Canopy	NoAsh	36.8441	4.7342	26	7.78	<.0001
canopy*ash	NoCanopy	Ash	42.7643	5.3978	26	7.92	<.0001
canopy*ash	NoCanopy	NoAsh	46.0691	4.2344	26	10.88	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		-0.8307	4.7342	26	-0.18	0.8621	Tukey-Kramer	0.8621
ash		Ash		NoAsh	5.0896	4.7342	26	1.08	0.2922	Tukey-Kramer	0.2922
canopy*ash	Canopy	Ash	Canopy	NoAsh	13.4839	6.5257	26	2.07	0.0489	Tukey-Kramer	0.1907
canopy*ash	Canopy	Ash	NoCanopy	Ash	7.5637	7.0220	26	1.08	0.2913	Tukey-Kramer	0.7062
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	4.2589	6.1727	26	0.69	0.4963	Tukey-Kramer	0.9000
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	-5.9203	7.1798	26	-0.82	0.4171	Tukey-Kramer	0.8423
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	-9.2250	6.3516	26	-1.45	0.1584	Tukey-Kramer	0.4795
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-3.3048	6.8605	26	-0.48	0.6340	Tukey-Kramer	0.9625

May No Burn Islands Depthwise CTSL (Figure 7A)

Program:

```
title 'May No Burn CTSL Depthwise';

proc mixed data=CTSL;
class canopy ash island depth;
model CTSLdepthwise = canopy|ash|depth;
random island;
repeated depth/subject = canopy*ash type=cs;
lsmeans depth|canopy|ash / adjust=tukey;

RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
canopy	1	195	0.02	0.8910
ash	1	195	2.08	0.1505
canopy*ash	1	195	4.47	0.0358
depth	4	195	9.18	<.0001
canopy*depth	4	195	0.81	0.5213
ash*depth	4	195	0.29	0.8854
canopy*ash*depth	4	195	0.41	0.7979

Least Squares Means								
Effect	canopy	ash	depth	Estimate	Standard Error	DF	t Value	Pr > |t|
depth			10	41.5429	4.0971	195	10.14	<.0001
depth			14	36.0771	4.0664	195	8.87	<.0001
depth			18	37.5082	4.2256	195	8.88	<.0001
depth			2	59.2692	4.0664	195	14.58	<.0001
depth			6	49.3240	4.0989	195	12.03	<.0001
canopy	Canopy			44.5479	3.2981	195	13.51	<.0001
canopy	NoCanopy			44.9407	3.2621	195	13.78	<.0001
canopy*depth	Canopy		10	44.6334	5.1808	195	8.62	<.0001
canopy*depth	Canopy		14	34.8441	5.1808	195	6.73	<.0001
canopy*depth	Canopy		18	36.6857	5.4929	195	6.68	<.0001

Least Squares Means								
Effect	canopy	ash	depth	Estimate	Standard Error	DF	t Value	Pr > |t|
canopy*depth	Canopy		2	55.1948	5.1808	195	10.65	<.0001
canopy*depth	Canopy		6	51.3813	5.2800	195	9.73	<.0001
canopy*depth	NoCanopy		10	38.4524	5.1973	195	7.40	<.0001
canopy*depth	NoCanopy		14	37.3101	5.0987	195	7.32	<.0001
canopy*depth	NoCanopy		18	38.3306	5.2800	195	7.26	<.0001
canopy*depth	NoCanopy		2	63.3437	5.0987	195	12.42	<.0001
canopy*depth	NoCanopy		6	47.2667	5.0987	195	9.27	<.0001
ash		Ash		46.8166	3.2960	195	14.20	<.0001
ash		NoAsh		42.6720	3.2675	195	13.06	<.0001
ash*depth		Ash	10	45.2373	5.2800	195	8.57	<.0001
ash*depth		Ash	14	39.7680	5.1836	195	7.67	<.0001
ash*depth		Ash	18	37.4507	5.4019	195	6.93	<.0001
ash*depth		Ash	2	61.6916	5.1836	195	11.90	<.0001
ash*depth		Ash	6	49.9351	5.1836	195	9.63	<.0001
ash*depth		NoAsh	10	37.8484	5.0987	195	7.42	<.0001
ash*depth		NoAsh	14	32.3862	5.0987	195	6.35	<.0001
ash*depth		NoAsh	18	37.5656	5.3739	195	6.99	<.0001
ash*depth		NoAsh	2	56.8469	5.0987	195	11.15	<.0001
ash*depth		NoAsh	6	48.7129	5.1972	195	9.37	<.0001
canopy*ash	Canopy	Ash		49.6466	3.8912	195	12.76	<.0001
canopy*ash	Canopy	NoAsh		39.4491	3.8830	195	10.16	<.0001
canopy*ash	NoCanopy	Ash		43.9865	3.8626	195	11.39	<.0001
canopy*ash	NoCanopy	NoAsh		45.8950	3.7874	195	12.12	<.0001
canopy*ash*depth	Canopy	Ash	10	53.9011	6.8594	195	7.86	<.0001
canopy*ash*depth	Canopy	Ash	14	39.7530	6.8594	195	5.80	<.0001
canopy*ash*depth	Canopy	Ash	18	37.4362	7.4971	195	4.99	<.0001
canopy*ash*depth	Canopy	Ash	2	62.2063	6.8594	195	9.07	<.0001
canopy*ash*depth	Canopy	Ash	6	54.9366	6.8594	195	8.01	<.0001
canopy*ash*depth	Canopy	NoAsh	10	35.3657	6.8592	195	5.16	<.0001
canopy*ash*depth	Canopy	NoAsh	14	29.9353	6.8592	195	4.36	<.0001
canopy*ash*depth	Canopy	NoAsh	18	35.9352	7.1490	195	5.03	<.0001

Least Squares Means								
Effect	canopy	ash	depth	Estimate	Standard Error	DF	t Value	Pr > |t|
canopy*ash*depth	Canopy	NoAsh	2	48.1833	6.8592	195	7.02	<.0001
canopy*ash*depth	Canopy	NoAsh	6	47.8260	7.1490	195	6.69	<.0001
canopy*ash*depth	NoCanopy	Ash	10	36.5736	7.1491	195	5.12	<.0001
canopy*ash*depth	NoCanopy	Ash	14	39.7831	6.8594	195	5.80	<.0001
canopy*ash*depth	NoCanopy	Ash	18	37.4652	6.8594	195	5.46	<.0001
canopy*ash*depth	NoCanopy	Ash	2	61.1768	6.8594	195	8.92	<.0001
canopy*ash*depth	NoCanopy	Ash	6	44.9336	6.8594	195	6.55	<.0001
canopy*ash*depth	NoCanopy	NoAsh	10	40.3311	6.6065	195	6.10	<.0001
canopy*ash*depth	NoCanopy	NoAsh	14	34.8372	6.6065	195	5.27	<.0001
canopy*ash*depth	NoCanopy	NoAsh	18	39.1961	7.1490	195	5.48	<.0001
canopy*ash*depth	NoCanopy	NoAsh	2	65.5105	6.6065	195	9.92	<.0001
canopy*ash*depth	NoCanopy	NoAsh	6	49.5999	6.6065	195	7.51	<.0001

Differences of Least Squares Means											
Effect	canopy	ash	depth	_canopy	_ash	_depth	Estimate	Standard Error	DF	t Value	Pr > |t|
depth			10			14	5.4658	4.4740	195	1.22	0.2233
depth			10			18	4.0347	4.6170	195	0.87	0.3833
depth			10			2	-17.7263	4.4740	195	-3.96	0.0001
depth			10			6	-7.7811	4.5026	195	-1.73	0.0855
depth			14			18	-1.4311	4.5892	195	-0.31	0.7555
depth			14			2	-23.1921	4.4454	195	-5.22	<.0001
depth			14			6	-13.2469	4.4740	195	-2.96	0.0034
depth			18			2	-21.7611	4.5892	195	-4.74	<.0001
depth			18			6	-11.8158	4.6152	195	-2.56	0.0112
depth			2			6	9.9452	4.4740	195	2.22	0.0274
canopy	Canopy			NoCanopy			-0.3928	2.8637	195	-0.14	0.8910
canopy*depth	Canopy		10	Canopy		14	9.7893	6.3533	195	1.54	0.1250
canopy*depth	Canopy		10	Canopy		18	7.9477	6.6086	195	1.20	0.2306
canopy*depth	Canopy		10	Canopy		2	-10.5614	6.3533	195	-1.66	0.0980
canopy*depth	Canopy		10	Canopy		6	-6.7479	6.4331	195	-1.05	0.2955
canopy*depth	Canopy		10	NoCanopy		10	6.1810	6.3687	195	0.97	0.3330
canopy*depth	Canopy		10	NoCanopy		14	7.3233	6.2875	195	1.16	0.2455
canopy*depth	Canopy		10	NoCanopy		18	6.3028	6.4353	195	0.98	0.3286
canopy*depth	Canopy		10	NoCanopy		2	-18.7102	6.2875	195	-2.98	0.0033

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*depth	Canopy		10	NoCanopy		6	-2.6333	6.2875	195	-0.42	0.6758
canopy*depth	Canopy		14	Canopy		18	-1.8416	6.6086	195	-0.28	0.7808
canopy*depth	Canopy		14	Canopy		2	-20.3507	6.3533	195	-3.20	0.0016
canopy*depth	Canopy		14	Canopy		6	-16.5372	6.4331	195	-2.57	0.0109
canopy*depth	Canopy		14	NoCanopy		10	-3.6082	6.3687	195	-0.57	0.5717
canopy*depth	Canopy		14	NoCanopy		14	-2.4660	6.2875	195	-0.39	0.6953
canopy*depth	Canopy		14	NoCanopy		18	-3.4865	6.4353	195	-0.54	0.5886
canopy*depth	Canopy		14	NoCanopy		2	-28.4995	6.2875	195	-4.53	<.0001
canopy*depth	Canopy		14	NoCanopy		6	-12.4226	6.2875	195	-1.98	0.0496
canopy*depth	Canopy		18	Canopy		2	-18.5091	6.6086	195	-2.80	0.0056
canopy*depth	Canopy		18	Canopy		6	-14.6955	6.6819	195	-2.20	0.0290
canopy*depth	Canopy		18	NoCanopy		10	-1.7666	6.6209	195	-0.27	0.7899
canopy*depth	Canopy		18	NoCanopy		14	-0.6244	6.5436	195	-0.10	0.9241
canopy*depth	Canopy		18	NoCanopy		18	-1.6449	6.6841	195	-0.25	0.8059
canopy*depth	Canopy		18	NoCanopy		2	-26.6579	6.5436	195	-4.07	<.0001
canopy*depth	Canopy		18	NoCanopy		6	-10.5810	6.5436	195	-1.62	0.1075
canopy*depth	Canopy		2	Canopy		6	3.8135	6.4331	195	0.59	0.5540
canopy*depth	Canopy		2	NoCanopy		10	16.7425	6.3687	195	2.63	0.0092
canopy*depth	Canopy		2	NoCanopy		14	17.8847	6.2875	195	2.84	0.0049
canopy*depth	Canopy		2	NoCanopy		18	16.8642	6.4353	195	2.62	0.0095
canopy*depth	Canopy		2	NoCanopy		2	-8.1488	6.2875	195	-1.30	0.1965
canopy*depth	Canopy		2	NoCanopy		6	7.9281	6.2875	195	1.26	0.2088
canopy*depth	Canopy		6	NoCanopy		10	12.9289	6.4484	195	2.00	0.0463
canopy*depth	Canopy		6	NoCanopy		14	14.0711	6.3677	195	2.21	0.0283
canopy*depth	Canopy		6	NoCanopy		18	13.0506	6.5125	195	2.00	0.0465
canopy*depth	Canopy		6	NoCanopy		2	-11.9624	6.3677	195	-1.88	0.0618
canopy*depth	Canopy		6	NoCanopy		6	4.1145	6.3677	195	0.65	0.5189
canopy*depth	NoCanopy		10	NoCanopy		14	1.1422	6.3009	195	0.18	0.8563
canopy*depth	NoCanopy		10	NoCanopy		18	0.1217	6.4484	195	0.02	0.9850
canopy*depth	NoCanopy		10	NoCanopy		2	-24.8913	6.3009	195	-3.95	0.0001
canopy*depth	NoCanopy		10	NoCanopy		6	-8.8144	6.3009	195	-1.40	0.1634
canopy*depth	NoCanopy		14	NoCanopy		18	-1.0205	6.3677	195	-0.16	0.8728
canopy*depth	NoCanopy		14	NoCanopy		2	-26.0335	6.2195	195	-4.19	<.0001
canopy*depth	NoCanopy		14	NoCanopy		6	-9.9566	6.2195	195	-1.60	0.1110
canopy*depth	NoCanopy		18	NoCanopy		2	-25.0130	6.3677	195	-3.93	0.0001
canopy*depth	NoCanopy		18	NoCanopy		6	-8.9361	6.3677	195	-1.40	0.1621
canopy*depth	NoCanopy		2	NoCanopy		6	16.0769	6.2195	195	2.58	0.0105
ash		Ash			NoAsh		4.1445	2.8711	195	1.44	0.1505
ash*depth		Ash	10		Ash	14	5.4693	6.4330	195	0.85	0.3963

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
ash*depth		Ash	10		Ash	18	7.7866	6.6056	195	1.18	0.2399
ash*depth		Ash	10		Ash	2	-16.4542	6.4330	195	-2.56	0.0113
ash*depth		Ash	10		Ash	6	-4.6978	6.4330	195	-0.73	0.4661
ash*depth		Ash	10		NoAsh	10	7.3889	6.3723	195	1.16	0.2477
ash*depth		Ash	10		NoAsh	14	12.8511	6.3723	195	2.02	0.0451
ash*depth		Ash	10		NoAsh	18	7.6717	6.5903	195	1.16	0.2458
ash*depth		Ash	10		NoAsh	2	-11.6096	6.3723	195	-1.82	0.0700
ash*depth		Ash	10		NoAsh	6	-3.4756	6.4485	195	-0.54	0.5905
ash*depth		Ash	14		Ash	18	2.3173	6.5292	195	0.35	0.7230
ash*depth		Ash	14		Ash	2	-21.9235	6.3533	195	-3.45	0.0007
ash*depth		Ash	14		Ash	6	-10.1671	6.3533	195	-1.60	0.1112
ash*depth		Ash	14		NoAsh	10	1.9196	6.2921	195	0.31	0.7606
ash*depth		Ash	14		NoAsh	14	7.3818	6.2921	195	1.17	0.2421
ash*depth		Ash	14		NoAsh	18	2.2024	6.5111	195	0.34	0.7355
ash*depth		Ash	14		NoAsh	2	-17.0789	6.2921	195	-2.71	0.0072
ash*depth		Ash	14		NoAsh	6	-8.9449	6.3686	195	-1.40	0.1618
ash*depth		Ash	18		Ash	2	-24.2409	6.5292	195	-3.71	0.0003
ash*depth		Ash	18		Ash	6	-12.4844	6.5292	195	-1.91	0.0573
ash*depth		Ash	18		NoAsh	10	-0.3977	6.4745	195	-0.06	0.9511
ash*depth		Ash	18		NoAsh	14	5.0645	6.4745	195	0.78	0.4350
ash*depth		Ash	18		NoAsh	18	-0.1149	6.6855	195	-0.02	0.9863
ash*depth		Ash	18		NoAsh	2	-19.3962	6.4745	195	-3.00	0.0031
ash*depth		Ash	18		NoAsh	6	-11.2622	6.5472	195	-1.72	0.0870
ash*depth		Ash	2		Ash	6	11.7565	6.3533	195	1.85	0.0658
ash*depth		Ash	2		NoAsh	10	23.8431	6.2921	195	3.79	0.0002
ash*depth		Ash	2		NoAsh	14	29.3053	6.2921	195	4.66	<.0001
ash*depth		Ash	2		NoAsh	18	24.1259	6.5111	195	3.71	0.0003
ash*depth		Ash	2		NoAsh	2	4.8447	6.2921	195	0.77	0.4423
ash*depth		Ash	2		NoAsh	6	12.9787	6.3686	195	2.04	0.0429
ash*depth		Ash	6		NoAsh	10	12.0867	6.2921	195	1.92	0.0562
ash*depth		Ash	6		NoAsh	14	17.5489	6.2921	195	2.79	0.0058
ash*depth		Ash	6		NoAsh	18	12.3695	6.5111	195	1.90	0.0589
ash*depth		Ash	6		NoAsh	2	-6.9118	6.2921	195	-1.10	0.2733
ash*depth		Ash	6		NoAsh	6	1.2222	6.3686	195	0.19	0.8480
ash*depth		NoAsh	10		NoAsh	14	5.4622	6.2195	195	0.88	0.3809
ash*depth		NoAsh	10		NoAsh	18	0.2828	6.4486	195	0.04	0.9651
ash*depth		NoAsh	10		NoAsh	2	-18.9985	6.2195	195	-3.05	0.0026
ash*depth		NoAsh	10		NoAsh	6	-10.8645	6.3011	195	-1.72	0.0863
ash*depth		NoAsh	14		NoAsh	18	-5.1794	6.4486	195	-0.80	0.4228

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
ash*depth		NoAsh	14		NoAsh	2	-24.4607	6.2195	195	-3.93	0.0001
ash*depth		NoAsh	14		NoAsh	6	-16.3267	6.3011	195	-2.59	0.0103
ash*depth		NoAsh	18		NoAsh	2	-19.2813	6.4486	195	-2.99	0.0031
ash*depth		NoAsh	18		NoAsh	6	-11.1473	6.5243	195	-1.71	0.0891
ash*depth		NoAsh	2		NoAsh	6	8.1340	6.3011	195	1.29	0.1983
canopy*ash	Canopy	Ash		Canopy	NoAsh		10.1975	4.1144	195	2.48	0.0140
canopy*ash	Canopy	Ash		NoCanopy	Ash		5.6602	4.0827	195	1.39	0.1672
canopy*ash	Canopy	Ash		NoCanopy	NoAsh		3.7517	4.0225	195	0.93	0.3521
canopy*ash	Canopy	NoAsh		NoCanopy	Ash		-4.5374	4.0875	195	-1.11	0.2683
canopy*ash	Canopy	NoAsh		NoCanopy	NoAsh		-6.4459	4.0172	195	-1.60	0.1102
canopy*ash	NoCanopy	Ash		NoCanopy	NoAsh		-1.9085	3.9953	195	-0.48	0.6334
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	14	14.1481	8.9849	195	1.57	0.1170
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	18	16.4648	9.4759	195	1.74	0.0839
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	2	-8.3052	8.9849	195	-0.92	0.3564
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	6	-1.0355	8.9849	195	-0.12	0.9084
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	10	18.5353	8.9910	195	2.06	0.0406
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	14	23.9658	8.9910	195	2.67	0.0083
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	18	17.9659	9.2091	195	1.95	0.0525
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	2	5.7178	8.9910	195	0.64	0.5256
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	6	6.0751	9.2091	195	0.66	0.5102
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	10	17.3275	9.2091	195	1.88	0.0614
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	14	14.1180	8.9849	195	1.57	0.1177
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	18	16.4359	8.9849	195	1.83	0.0689
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	2	-7.2757	8.9849	195	-0.81	0.4191
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	6	8.9675	8.9849	195	1.00	0.3195
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	10	13.5700	8.7981	195	1.54	0.1246
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	14	19.0639	8.7981	195	2.17	0.0315
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	18	14.7050	9.2090	195	1.60	0.1119
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	2	-11.6094	8.7981	195	-1.32	0.1885
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	6	4.3012	8.7981	195	0.49	0.6255
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	18	2.3167	9.4759	195	0.24	0.8071
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	2	-22.4533	8.9849	195	-2.50	0.0133
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	6	-15.1836	8.9849	195	-1.69	0.0926
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	10	4.3872	8.9910	195	0.49	0.6261
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	14	9.8177	8.9910	195	1.09	0.2762
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	18	3.8178	9.2091	195	0.41	0.6789
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	2	-8.4303	8.9910	195	-0.94	0.3496
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	6	-8.0730	9.2091	195	-0.88	0.3818
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	10	3.1794	9.2091	195	0.35	0.7303

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	14	-0.03010	8.9849	195	-0.00	0.9973
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	18	2.2878	8.9849	195	0.25	0.7993
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	2	-21.4238	8.9849	195	-2.38	0.0181
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	6	-5.1806	8.9849	195	-0.58	0.5649
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	10	-0.5781	8.7981	195	-0.07	0.9477
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	14	4.9158	8.7981	195	0.56	0.5770
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	18	0.5569	9.2090	195	0.06	0.9518
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	2	-25.7575	8.7981	195	-2.93	0.0038
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	6	-9.8469	8.7981	195	-1.12	0.2644
canopy*ash*depth	Canopy	Ash	18	Canopy	Ash	2	-24.7701	9.4759	195	-2.61	0.0096
canopy*ash*depth	Canopy	Ash	18	Canopy	Ash	6	-17.5004	9.4759	195	-1.85	0.0663
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	10	2.0705	9.4903	195	0.22	0.8275
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	14	7.5010	9.4903	195	0.79	0.4303
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	18	1.5010	9.6925	195	0.15	0.8771
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	2	-10.7471	9.4903	195	-1.13	0.2588
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	6	-10.3897	9.6925	195	-1.07	0.2851
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	10	0.8626	9.6854	195	0.09	0.9291
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	14	-2.3468	9.4759	195	-0.25	0.8047
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	18	-0.02896	9.4759	195	-0.00	0.9976
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	2	-23.7406	9.4759	195	-2.51	0.0131
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	6	-7.4974	9.4759	195	-0.79	0.4298
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	10	-2.8949	9.3038	195	-0.31	0.7560
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	14	2.5990	9.3038	195	0.28	0.7803
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	18	-1.7598	9.6922	195	-0.18	0.8561
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	2	-28.0742	9.3038	195	-3.02	0.0029
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	6	-12.1636	9.3038	195	-1.31	0.1926
canopy*ash*depth	Canopy	Ash	2	Canopy	Ash	6	7.2697	8.9849	195	0.81	0.4194
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	10	26.8406	8.9910	195	2.99	0.0032
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	14	32.2710	8.9910	195	3.59	0.0004
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	18	26.2711	9.2091	195	2.85	0.0048
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	2	14.0230	8.9910	195	1.56	0.1205
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	6	14.3804	9.2091	195	1.56	0.1200
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	10	25.6327	9.2091	195	2.78	0.0059
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	14	22.4232	8.9849	195	2.50	0.0134
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	18	24.7411	8.9849	195	2.75	0.0065
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	2	1.0295	8.9849	195	0.11	0.9089
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	6	17.2727	8.9849	195	1.92	0.0560
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	10	21.8752	8.7981	195	2.49	0.0137
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	14	27.3691	8.7981	195	3.11	0.0021

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	18	23.0103	9.2090	195	2.50	0.0133
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	2	-3.3042	8.7981	195	-0.38	0.7077
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	6	12.6064	8.7981	195	1.43	0.1535
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	10	19.5709	8.9910	195	2.18	0.0307
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	14	25.0013	8.9910	195	2.78	0.0060
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	18	19.0014	9.2091	195	2.06	0.0404
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	2	6.7533	8.9910	195	0.75	0.4535
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	6	7.1107	9.2091	195	0.77	0.4410
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	10	18.3630	9.2091	195	1.99	0.0475
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	14	15.1535	8.9849	195	1.69	0.0933
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	18	17.4714	8.9849	195	1.94	0.0533
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	2	-6.2402	8.9849	195	-0.69	0.4882
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	6	10.0030	8.9849	195	1.11	0.2669
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	10	14.6055	8.7981	195	1.66	0.0985
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	14	20.0994	8.7981	195	2.28	0.0234
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	18	15.7405	9.2090	195	1.71	0.0890
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	2	-10.5739	8.7981	195	-1.20	0.2309
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	6	5.3367	8.7981	195	0.61	0.5448
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	14	5.4305	8.9849	195	0.60	0.5463
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	18	-0.5695	9.2094	195	-0.06	0.9508
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	2	-12.8176	8.9849	195	-1.43	0.1553
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	6	-12.4602	9.2094	195	-1.35	0.1776
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	10	-1.2079	9.2155	195	-0.13	0.8959
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	14	-4.4173	8.9910	195	-0.49	0.6238
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	18	-2.0995	8.9910	195	-0.23	0.8156
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	2	-25.8111	8.9910	195	-2.87	0.0045
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	6	-9.5679	8.9910	195	-1.06	0.2886
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	10	-4.9654	8.7979	195	-0.56	0.5731
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	14	0.5285	8.7979	195	0.06	0.9522
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	18	-3.8303	9.2154	195	-0.42	0.6781
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	2	-30.1447	8.7979	195	-3.43	0.0007
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	6	-14.2342	8.7979	195	-1.62	0.1073
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	18	-6.0000	9.2094	195	-0.65	0.5155
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	2	-18.2480	8.9849	195	-2.03	0.0436
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	6	-17.8907	9.2094	195	-1.94	0.0535
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	10	-6.6383	9.2155	195	-0.72	0.4722
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	14	-9.8478	8.9910	195	-1.10	0.2747
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	18	-7.5299	8.9910	195	-0.84	0.4033
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	2	-31.2415	8.9910	195	-3.47	0.0006

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	6	-14.9983	8.9910	195	-1.67	0.0969
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	10	-10.3959	8.7979	195	-1.18	0.2388
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	14	-4.9019	8.7979	195	-0.56	0.5780
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	18	-9.2608	9.2154	195	-1.00	0.3162
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	2	-35.5752	8.7979	195	-4.04	<.0001
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	6	-19.6646	8.7979	195	-2.24	0.0265
canopy*ash*depth	Canopy	NoAsh	18	Canopy	NoAsh	2	-12.2481	9.2094	195	-1.33	0.1851
canopy*ash*depth	Canopy	NoAsh	18	Canopy	NoAsh	6	-11.8907	9.4234	195	-1.26	0.2085
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	10	-0.6384	9.4299	195	-0.07	0.9461
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	14	-3.8479	9.2091	195	-0.42	0.6765
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	18	-1.5300	9.2091	195	-0.17	0.8682
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	2	-25.2416	9.2091	195	-2.74	0.0067
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	6	-8.9984	9.2091	195	-0.98	0.3297
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	10	-4.3959	9.0257	195	-0.49	0.6268
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	14	1.0980	9.0257	195	0.12	0.9033
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	18	-3.2608	9.4298	195	-0.35	0.7299
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	2	-29.5753	9.0257	195	-3.28	0.0012
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	6	-13.6647	9.0257	195	-1.51	0.1317
canopy*ash*depth	Canopy	NoAsh	2	Canopy	NoAsh	6	0.3574	9.2094	195	0.04	0.9691
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	10	11.6097	9.2155	195	1.26	0.2092
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	14	8.4002	8.9910	195	0.93	0.3513
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	18	10.7181	8.9910	195	1.19	0.2347
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	2	-12.9935	8.9910	195	-1.45	0.1500
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	6	3.2497	8.9910	195	0.36	0.7182
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	10	7.8522	8.7979	195	0.89	0.3732
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	14	13.3461	8.7979	195	1.52	0.1309
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	18	8.9872	9.2154	195	0.98	0.3307
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	2	-17.3272	8.7979	195	-1.97	0.0503
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	6	-1.4166	8.7979	195	-0.16	0.8722
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	10	11.2523	9.4299	195	1.19	0.2342
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	14	8.0429	9.2091	195	0.87	0.3835
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	18	10.3608	9.2091	195	1.13	0.2619
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	2	-13.3509	9.2091	195	-1.45	0.1487
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	6	2.8924	9.2091	195	0.31	0.7538
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	10	7.4948	9.0257	195	0.83	0.4073
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	14	12.9888	9.0257	195	1.44	0.1517
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	18	8.6299	9.4298	195	0.92	0.3612
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	2	-17.6845	9.0257	195	-1.96	0.0515
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	6	-1.7739	9.0257	195	-0.20	0.8444

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	14	-3.2095	9.2091	195	-0.35	0.7278
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	18	-0.8916	9.2091	195	-0.10	0.9230
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	2	-24.6032	9.2091	195	-2.67	0.0082
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	6	-8.3600	9.2091	195	-0.91	0.3651
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	10	-3.7575	9.0257	195	-0.42	0.6776
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	14	1.7364	9.0257	195	0.19	0.8476
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	18	-2.6225	9.4297	195	-0.28	0.7812
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	2	-28.9369	9.0257	195	-3.21	0.0016
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	6	-13.0263	9.0257	195	-1.44	0.1506
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	18	2.3179	8.9849	195	0.26	0.7967
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	2	-21.3937	8.9849	195	-2.38	0.0182
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	6	-5.1505	8.9849	195	-0.57	0.5671
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	10	-0.5480	8.7981	195	-0.06	0.9504
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	14	4.9459	8.7981	195	0.56	0.5747
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	18	0.5870	9.2090	195	0.06	0.9492
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	2	-25.7274	8.7981	195	-2.92	0.0039
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	6	-9.8168	8.7981	195	-1.12	0.2659
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	Ash	2	-23.7116	8.9849	195	-2.64	0.0090
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	Ash	6	-7.4684	8.9849	195	-0.83	0.4069
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	10	-2.8659	8.7981	195	-0.33	0.7450
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	14	2.6280	8.7981	195	0.30	0.7655
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	18	-1.7309	9.2090	195	-0.19	0.8511
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	2	-28.0453	8.7981	195	-3.19	0.0017
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	6	-12.1347	8.7981	195	-1.38	0.1694
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	Ash	6	16.2432	8.9849	195	1.81	0.0722
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	10	20.8457	8.7981	195	2.37	0.0188
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	14	26.3396	8.7981	195	2.99	0.0031
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	18	21.9808	9.2090	195	2.39	0.0179
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	2	-4.3337	8.7981	195	-0.49	0.6229
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	6	11.5769	8.7981	195	1.32	0.1898
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	10	4.6025	8.7981	195	0.52	0.6015
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	14	10.0964	8.7981	195	1.15	0.2526
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	18	5.7375	9.2090	195	0.62	0.5340
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	2	-20.5769	8.7981	195	-2.34	0.0204
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	6	-4.6663	8.7981	195	-0.53	0.5965
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	14	5.4939	8.6023	195	0.64	0.5238
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	18	1.1351	9.0257	195	0.13	0.9001
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	2	-25.1794	8.6023	195	-2.93	0.0038
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	6	-9.2688	8.6023	195	-1.08	0.2826

Differences of Least Squares Means											
Effect	canopy	ash	depth	_canopy	_ash	_depth	Estimate	Standard Error	DF	t Value	Pr > |t|
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	18	-4.3589	9.0257	195	-0.48	0.6297
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	2	-30.6733	8.6023	195	-3.57	0.0005
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	6	-14.7627	8.6023	195	-1.72	0.0877
canopy*ash*depth	NoCanopy	NoAsh	18	NoCanopy	NoAsh	2	-26.3144	9.0257	195	-2.92	0.0040
canopy*ash*depth	NoCanopy	NoAsh	18	NoCanopy	NoAsh	6	-10.4038	9.0257	195	-1.15	0.2504
canopy*ash*depth	NoCanopy	NoAsh	2	NoCanopy	NoAsh	6	15.9106	8.6023	195	1.85	0.0659

Differences of Least Squares Means								
Effect	canopy	ash	depth	_canopy	_ash	_depth	Adjustment	Adj P
depth			10			14	Tukey-Kramer	0.7388
depth			10			18	Tukey-Kramer	0.9062
depth			10			2	Tukey-Kramer	0.0010
depth			10			6	Tukey-Kramer	0.4192
depth			14			18	Tukey-Kramer	0.9979
depth			14			2	Tukey-Kramer	<.0001
depth			14			6	Tukey-Kramer	0.0281
depth			18			2	Tukey-Kramer	<.0001
depth			18			6	Tukey-Kramer	0.0820
depth			2			6	Tukey-Kramer	0.1756
canopy	Canopy			NoCanopy			Tukey-Kramer	0.8910
canopy*depth	Canopy		10	Canopy		14	Tukey-Kramer	0.8739
canopy*depth	Canopy		10	Canopy		18	Tukey-Kramer	0.9712
canopy*depth	Canopy		10	Canopy		2	Tukey-Kramer	0.8150
canopy*depth	Canopy		10	Canopy		6	Tukey-Kramer	0.9887
canopy*depth	Canopy		10	NoCanopy		10	Tukey-Kramer	0.9936
canopy*depth	Canopy		10	NoCanopy		14	Tukey-Kramer	0.9767
canopy*depth	Canopy		10	NoCanopy		18	Tukey-Kramer	0.9931
canopy*depth	Canopy		10	NoCanopy		2	Tukey-Kramer	0.0928
canopy*depth	Canopy		10	NoCanopy		6	Tukey-Kramer	1.0000
canopy*depth	Canopy		14	Canopy		18	Tukey-Kramer	1.0000
canopy*depth	Canopy		14	Canopy		2	Tukey-Kramer	0.0496
canopy*depth	Canopy		14	Canopy		6	Tukey-Kramer	0.2389
canopy*depth	Canopy		14	NoCanopy		10	Tukey-Kramer	0.9999

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*depth	Canopy		14	NoCanopy		14	Tukey-Kramer	1.0000
canopy*depth	Canopy		14	NoCanopy		18	Tukey-Kramer	0.9999
canopy*depth	Canopy		14	NoCanopy		2	Tukey-Kramer	0.0004
canopy*depth	Canopy		14	NoCanopy		6	Tukey-Kramer	0.6170
canopy*depth	Canopy		18	Canopy		2	Tukey-Kramer	0.1435
canopy*depth	Canopy		18	Canopy		6	Tukey-Kramer	0.4608
canopy*depth	Canopy		18	NoCanopy		10	Tukey-Kramer	1.0000
canopy*depth	Canopy		18	NoCanopy		14	Tukey-Kramer	1.0000
canopy*depth	Canopy		18	NoCanopy		18	Tukey-Kramer	1.0000
canopy*depth	Canopy		18	NoCanopy		2	Tukey-Kramer	0.0027
canopy*depth	Canopy		18	NoCanopy		6	Tukey-Kramer	0.8384
canopy*depth	Canopy		2	Canopy		6	Tukey-Kramer	0.9999
canopy*depth	Canopy		2	NoCanopy		10	Tukey-Kramer	0.2115
canopy*depth	Canopy		2	NoCanopy		14	Tukey-Kramer	0.1292
canopy*depth	Canopy		2	NoCanopy		18	Tukey-Kramer	0.2152
canopy*depth	Canopy		2	NoCanopy		2	Tukey-Kramer	0.9535
canopy*depth	Canopy		2	NoCanopy		6	Tukey-Kramer	0.9609
canopy*depth	Canopy		6	NoCanopy		10	Tukey-Kramer	0.5966
canopy*depth	Canopy		6	NoCanopy		14	Tukey-Kramer	0.4537
canopy*depth	Canopy		6	NoCanopy		18	Tukey-Kramer	0.5973
canopy*depth	Canopy		6	NoCanopy		2	Tukey-Kramer	0.6835
canopy*depth	Canopy		6	NoCanopy		6	Tukey-Kramer	0.9997
canopy*depth	NoCanopy		10	NoCanopy		14	Tukey-Kramer	1.0000
canopy*depth	NoCanopy		10	NoCanopy		18	Tukey-Kramer	1.0000
canopy*depth	NoCanopy		10	NoCanopy		2	Tukey-Kramer	0.0042
canopy*depth	NoCanopy		10	NoCanopy		6	Tukey-Kramer	0.9264
canopy*depth	NoCanopy		14	NoCanopy		18	Tukey-Kramer	1.0000
canopy*depth	NoCanopy		14	NoCanopy		2	Tukey-Kramer	0.0017
canopy*depth	NoCanopy		14	NoCanopy		6	Tukey-Kramer	0.8464
canopy*depth	NoCanopy		18	NoCanopy		2	Tukey-Kramer	0.0046
canopy*depth	NoCanopy		18	NoCanopy		6	Tukey-Kramer	0.9250
canopy*depth	NoCanopy		2	NoCanopy		6	Tukey-Kramer	0.2320

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
ash		Ash			NoAsh		Tukey-Kramer	0.1505
ash*depth		Ash	10		Ash	14	Tukey-Kramer	0.9976
ash*depth		Ash	10		Ash	18	Tukey-Kramer	0.9748
ash*depth		Ash	10		Ash	2	Tukey-Kramer	0.2452
ash*depth		Ash	10		Ash	6	Tukey-Kramer	0.9993
ash*depth		Ash	10		NoAsh	10	Tukey-Kramer	0.9774
ash*depth		Ash	10		NoAsh	14	Tukey-Kramer	0.5884
ash*depth		Ash	10		NoAsh	18	Tukey-Kramer	0.9768
ash*depth		Ash	10		NoAsh	2	Tukey-Kramer	0.7206
ash*depth		Ash	10		NoAsh	6	Tukey-Kramer	0.9999
ash*depth		Ash	14		Ash	18	Tukey-Kramer	1.0000
ash*depth		Ash	14		Ash	2	Tukey-Kramer	0.0234
ash*depth		Ash	14		Ash	6	Tukey-Kramer	0.8466
ash*depth		Ash	14		NoAsh	10	Tukey-Kramer	1.0000
ash*depth		Ash	14		NoAsh	14	Tukey-Kramer	0.9756
ash*depth		Ash	14		NoAsh	18	Tukey-Kramer	1.0000
ash*depth		Ash	14		NoAsh	2	Tukey-Kramer	0.1753
ash*depth		Ash	14		NoAsh	6	Tukey-Kramer	0.9246
ash*depth		Ash	18		Ash	2	Tukey-Kramer	0.0098
ash*depth		Ash	18		Ash	6	Tukey-Kramer	0.6609
ash*depth		Ash	18		NoAsh	10	Tukey-Kramer	1.0000
ash*depth		Ash	18		NoAsh	14	Tukey-Kramer	0.9988
ash*depth		Ash	18		NoAsh	18	Tukey-Kramer	1.0000
ash*depth		Ash	18		NoAsh	2	Tukey-Kramer	0.0880
ash*depth		Ash	18		NoAsh	6	Tukey-Kramer	0.7828
ash*depth		Ash	2		Ash	6	Tukey-Kramer	0.7021
ash*depth		Ash	2		NoAsh	10	Tukey-Kramer	0.0075
ash*depth		Ash	2		NoAsh	14	Tukey-Kramer	0.0003
ash*depth		Ash	2		NoAsh	18	Tukey-Kramer	0.0101
ash*depth		Ash	2		NoAsh	2	Tukey-Kramer	0.9989
ash*depth		Ash	2		NoAsh	6	Tukey-Kramer	0.5735
ash*depth		Ash	6		NoAsh	10	Tukey-Kramer	0.6548

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
ash*depth		Ash	6		NoAsh	14	Tukey-Kramer	0.1475
ash*depth		Ash	6		NoAsh	18	Tukey-Kramer	0.6693
ash*depth		Ash	6		NoAsh	2	Tukey-Kramer	0.9844
ash*depth		Ash	6		NoAsh	6	Tukey-Kramer	1.0000
ash*depth		NoAsh	10		NoAsh	14	Tukey-Kramer	0.9970
ash*depth		NoAsh	10		NoAsh	18	Tukey-Kramer	1.0000
ash*depth		NoAsh	10		NoAsh	2	Tukey-Kramer	0.0752
ash*depth		NoAsh	10		NoAsh	6	Tukey-Kramer	0.7804
ash*depth		NoAsh	14		NoAsh	18	Tukey-Kramer	0.9985
ash*depth		NoAsh	14		NoAsh	2	Tukey-Kramer	0.0045
ash*depth		NoAsh	14		NoAsh	6	Tukey-Kramer	0.2290
ash*depth		NoAsh	18		NoAsh	2	Tukey-Kramer	0.0894
ash*depth		NoAsh	18		NoAsh	6	Tukey-Kramer	0.7894
ash*depth		NoAsh	2		NoAsh	6	Tukey-Kramer	0.9547
canopy*ash	Canopy	Ash		Canopy	NoAsh		Tukey-Kramer	0.0665
canopy*ash	Canopy	Ash		NoCanopy	Ash		Tukey-Kramer	0.5094
canopy*ash	Canopy	Ash		NoCanopy	NoAsh		Tukey-Kramer	0.7873
canopy*ash	Canopy	NoAsh		NoCanopy	Ash		Tukey-Kramer	0.6838
canopy*ash	Canopy	NoAsh		NoCanopy	NoAsh		Tukey-Kramer	0.3784
canopy*ash	NoCanopy	Ash		NoCanopy	NoAsh		Tukey-Kramer	0.9639
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	14	Tukey-Kramer	0.9901
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	18	Tukey-Kramer	0.9717
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	10	Tukey-Kramer	0.8717
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	14	Tukey-Kramer	0.4599
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	18	Tukey-Kramer	0.9175
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	10	Tukey-Kramer	0.9397
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	14	Tukey-Kramer	0.9903
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	18	Tukey-Kramer	0.9534

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	10	Tukey-Kramer	0.9922
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	14	Tukey-Kramer	0.8165
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	18	Tukey-Kramer	0.9884
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	2	Tukey-Kramer	0.9989
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	2	Tukey-Kramer	0.5861
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	6	Tukey-Kramer	0.9787
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	14	Tukey-Kramer	0.9999
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	2	Tukey-Kramer	0.6721
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	2	Tukey-Kramer	0.2833
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	6	Tukey-Kramer	0.9999
canopy*ash*depth	Canopy	Ash	18	Canopy	Ash	2	Tukey-Kramer	0.4985
canopy*ash*depth	Canopy	Ash	18	Canopy	Ash	6	Tukey-Kramer	0.9490
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	2	Tukey-Kramer	0.9999
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	6	Tukey-Kramer	0.9999

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	2	Tukey-Kramer	0.5813
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	2	Tukey-Kramer	0.2334
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	6	Tukey-Kramer	0.9990
canopy*ash*depth	Canopy	Ash	2	Canopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	10	Tukey-Kramer	0.2506
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	14	Tukey-Kramer	0.0506
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	18	Tukey-Kramer	0.3294
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	2	Tukey-Kramer	0.9911
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	6	Tukey-Kramer	0.9910
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	10	Tukey-Kramer	0.3755
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	14	Tukey-Kramer	0.5887
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	18	Tukey-Kramer	0.3962
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	6	Tukey-Kramer	0.9272
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	10	Tukey-Kramer	0.5958
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	14	Tukey-Kramer	0.1882
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	18	Tukey-Kramer	0.5864
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	6	Tukey-Kramer	0.9968
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	10	Tukey-Kramer	0.8108
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	14	Tukey-Kramer	0.3774
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	18	Tukey-Kramer	0.8709
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	10	Tukey-Kramer	0.9012

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	14	Tukey-Kramer	0.9791
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	18	Tukey-Kramer	0.9197
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	6	Tukey-Kramer	0.9999
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	10	Tukey-Kramer	0.9823
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	14	Tukey-Kramer	0.7426
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	18	Tukey-Kramer	0.9760
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	2	Tukey-Kramer	0.9997
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	2	Tukey-Kramer	0.9969
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	6	Tukey-Kramer	0.9984
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	2	Tukey-Kramer	0.3180
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	6	Tukey-Kramer	0.9999
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	2	Tukey-Kramer	0.0821
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	6	Tukey-Kramer	0.9866
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	2	Tukey-Kramer	0.8856
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	6	Tukey-Kramer	0.9203
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	14	Tukey-Kramer	0.9999
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	2	Tukey-Kramer	0.0714
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	6	Tukey-Kramer	0.9814
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	10	Tukey-Kramer	0.9998

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	2	Tukey-Kramer	0.0110
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	6	Tukey-Kramer	0.7750
canopy*ash*depth	Canopy	NoAsh	18	Canopy	NoAsh	2	Tukey-Kramer	0.9988
canopy*ash*depth	Canopy	NoAsh	18	Canopy	NoAsh	6	Tukey-Kramer	0.9994
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	2	Tukey-Kramer	0.4051
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	2	Tukey-Kramer	0.1240
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	6	Tukey-Kramer	0.9937
canopy*ash*depth	Canopy	NoAsh	2	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	10	Tukey-Kramer	0.9994
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	18	Tukey-Kramer	0.9997
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	2	Tukey-Kramer	0.9964
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	14	Tukey-Kramer	0.9936
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	2	Tukey-Kramer	0.9107
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	10	Tukey-Kramer	0.9997
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	18	Tukey-Kramer	0.9999
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	2	Tukey-Kramer	0.9963
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	6	Tukey-Kramer	1.0000

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	14	Tukey-Kramer	0.9966
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	2	Tukey-Kramer	0.9144
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	2	Tukey-Kramer	0.4554
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	2	Tukey-Kramer	0.1489
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	6	Tukey-Kramer	0.9965
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	2	Tukey-Kramer	0.6746
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	2	Tukey-Kramer	0.2853
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	6	Tukey-Kramer	0.9999
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	Ash	2	Tukey-Kramer	0.4796
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	2	Tukey-Kramer	0.1559
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	6	Tukey-Kramer	0.9980
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	Ash	6	Tukey-Kramer	0.9583
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	10	Tukey-Kramer	0.6831
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	14	Tukey-Kramer	0.2460

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	18	Tukey-Kramer	0.6703
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	6	Tukey-Kramer	0.9989
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	14	Tukey-Kramer	0.9998
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	2	Tukey-Kramer	0.7050
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	2	Tukey-Kramer	0.2836
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	6	Tukey-Kramer	0.9999
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	2	Tukey-Kramer	0.0544
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	6	Tukey-Kramer	0.9750
canopy*ash*depth	NoCanopy	NoAsh	18	NoCanopy	NoAsh	2	Tukey-Kramer	0.2905
canopy*ash*depth	NoCanopy	NoAsh	18	NoCanopy	NoAsh	6	Tukey-Kramer	0.9998
canopy*ash*depth	NoCanopy	NoAsh	2	NoCanopy	NoAsh	6	Tukey-Kramer	0.9484

May No Burn Grass Dominated Islands CTSL 0 – 20 cm AVG (Figure 5A)

Program:

```
title '0 - 20 cm CTSL Avg May Grass';

proc mixed data=CTSL;
        class island canopy ash;
        model TotalAvgCTSL=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	13	0.01	0.9164
ash	1	13	0.00	0.9782
canopy*ash	1	13	0.04	0.8410
island	1	13	0.03	0.8639
island*canopy	1	13	0.00	0.9604
island*ash	1	13	0.10	0.7528
island*canopy*ash	1	13	0.05	0.8326

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		48.3526	4.0110	13	12.05	<.0001
canopy	NoCanopy		48.9444	3.8052	13	12.86	<.0001
ash		Ash	48.7256	4.0110	13	12.15	<.0001
ash		NoAsh	48.5713	3.8052	13	12.76	<.0001
canopy*ash	Canopy	Ash	47.8641	5.6725	13	8.44	<.0001
canopy*ash	Canopy	NoAsh	48.8411	5.6725	13	8.61	<.0001
canopy*ash	NoCanopy	Ash	49.5872	5.6725	13	8.74	<.0001
canopy*ash	NoCanopy	NoAsh	48.3016	5.0736	13	9.52	<.0001

Differences of Least Squares Means											
Effect	canopy	ash	_canopy	_ash	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
canopy	Canopy		NoCanopy		-0.5918	5.5288	13	-0.11	0.9164	Tukey-Kramer	0.9164
ash		Ash		NoAsh	0.1543	5.5288	13	0.03	0.9782	Tukey-Kramer	0.9782
canopy*ash	Canopy	Ash	Canopy	NoAsh	-0.9770	8.0221	13	-0.12	0.9049	Tukey-Kramer	0.9993
canopy*ash	Canopy	Ash	NoCanopy	Ash	-1.7231	8.0221	13	-0.21	0.8333	Tukey-Kramer	0.9963
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	-0.4375	7.6104	13	-0.06	0.9550	Tukey-Kramer	0.9999
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	-0.7461	8.0221	13	-0.09	0.9273	Tukey-Kramer	0.9997
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	0.5395	7.6104	13	0.07	0.9446	Tukey-Kramer	0.9999
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	1.2856	7.6104	13	0.17	0.8685	Tukey-Kramer	0.9982

May No Burn Grass Dominated Islands Depthwise CTSL (Figure 8A)

Program:

```
title 'May No Burn Grass Dom CTSL Depthwise';


proc mixed data=CTSL;
class canopy ash island depth;
model CTSLdepthwise = canopy|ash|depth;
random island;
repeated depth/subject = canopy*ash type=cs;
lsmeans depth|canopy|ash / adjust=tukey;

RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	80	3.61	0.0609
ash	1	80	2.48	0.1189
canopy*ash	1	80	1.43	0.2356
depth	4	80	5.32	0.0007
canopy*depth	4	80	1.42	0.2356
ash*depth	4	80	0.36	0.8383
canopy*ash*depth	4	80	0.24	0.9125

Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
depth			10	44.8438	4.4636	80	10.05	<.0001
depth			14	35.2801	4.4636	80	7.90	<.0001
depth			18	33.6267	4.8362	80	6.95	<.0001
depth			2	58.3802	4.4636	80	13.08	<.0001
depth			6	51.5737	4.6068	80	11.20	<.0001
canopy	Canopy			40.8566	2.9899	80	13.66	<.0001
canopy	NoCanopy			48.6252	2.7859	80	17.45	<.0001
canopy*depth	Canopy		10	46.9801	6.4482	80	7.29	<.0001
canopy*depth	Canopy		14	32.2384	6.4482	80	5.00	<.0001

Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*depth	Canopy		18	32.5579	7.2093	80	4.52	<.0001
canopy*depth	Canopy		2	46.2947	6.4482	80	7.18	<.0001
canopy*depth	Canopy		6	46.2119	6.8394	80	6.76	<.0001
canopy*depth	NoCanopy		10	42.7075	6.1737	80	6.92	<.0001
canopy*depth	NoCanopy		14	38.3217	6.1737	80	6.21	<.0001
canopy*depth	NoCanopy		18	34.6954	6.4482	80	5.38	<.0001
canopy*depth	NoCanopy		2	70.4658	6.1737	80	11.41	<.0001
canopy*depth	NoCanopy		6	56.9354	6.1737	80	9.22	<.0001
ash		Ash		47.9618	2.9196	80	16.43	<.0001
ash		NoAsh		41.5200	2.8596	80	14.52	<.0001
ash*depth		Ash	10	48.1656	6.4482	80	7.47	<.0001
ash*depth		Ash	14	41.6325	6.4482	80	6.46	<.0001
ash*depth		Ash	18	32.5505	6.8394	80	4.76	<.0001
ash*depth		Ash	2	63.2450	6.4482	80	9.81	<.0001
ash*depth		Ash	6	54.2152	6.4482	80	8.41	<.0001
ash*depth		NoAsh	10	41.5221	6.1737	80	6.73	<.0001
ash*depth		NoAsh	14	28.9277	6.1737	80	4.69	<.0001
ash*depth		NoAsh	18	34.7028	6.8394	80	5.07	<.0001
ash*depth		NoAsh	2	53.5155	6.1737	80	8.67	<.0001
ash*depth		NoAsh	6	48.9321	6.5812	80	7.44	<.0001
canopy*ash	Canopy	Ash		46.5195	4.1789	80	11.13	<.0001
canopy*ash	Canopy	NoAsh		35.1937	4.2773	80	8.23	<.0001
canopy*ash	NoCanopy	Ash		49.4040	4.0782	80	12.11	<.0001
canopy*ash	NoCanopy	NoAsh		47.8464	3.7966	80	12.60	<.0001
canopy*ash*depth	Canopy	Ash	10	55.1325	9.1191	80	6.05	<.0001
canopy*ash*depth	Canopy	Ash	14	38.6026	9.1191	80	4.23	<.0001
canopy*ash*depth	Canopy	Ash	18	31.5977	10.1955	80	3.10	0.0027
canopy*ash*depth	Canopy	Ash	2	55.2715	9.1191	80	6.06	<.0001
canopy*ash*depth	Canopy	Ash	6	51.9934	9.1191	80	5.70	<.0001
canopy*ash*depth	Canopy	NoAsh	10	38.8278	9.1191	80	4.26	<.0001
canopy*ash*depth	Canopy	NoAsh	14	25.8742	9.1191	80	2.84	0.0058

Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*ash*depth	Canopy	NoAsh	18	33.5182	10.1955	80	3.29	0.0015
canopy*ash*depth	Canopy	NoAsh	2	37.3179	9.1191	80	4.09	0.0001
canopy*ash*depth	Canopy	NoAsh	6	40.4305	10.1955	80	3.97	0.0002
canopy*ash*depth	NoCanopy	Ash	10	41.1987	9.1191	80	4.52	<.0001
canopy*ash*depth	NoCanopy	Ash	14	44.6623	9.1191	80	4.90	<.0001
canopy*ash*depth	NoCanopy	Ash	18	33.5033	9.1191	80	3.67	0.0004
canopy*ash*depth	NoCanopy	Ash	2	71.2185	9.1191	80	7.81	<.0001
canopy*ash*depth	NoCanopy	Ash	6	56.4371	9.1191	80	6.19	<.0001
canopy*ash*depth	NoCanopy	NoAsh	10	44.2163	8.3246	80	5.31	<.0001
canopy*ash*depth	NoCanopy	NoAsh	14	31.9812	8.3246	80	3.84	0.0002
canopy*ash*depth	NoCanopy	NoAsh	18	35.8874	9.1191	80	3.94	0.0002
canopy*ash*depth	NoCanopy	NoAsh	2	69.7130	8.3246	80	8.37	<.0001
canopy*ash*depth	NoCanopy	NoAsh	6	57.4338	8.3246	80	6.90	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
depth			10			14	9.5637	6.3124	80	1.52	0.1337
depth			10			18	11.2172	6.5812	80	1.70	0.0922
depth			10			2	-13.5364	6.3124	80	-2.14	0.0350
depth			10			6	-6.7299	6.4145	80	-1.05	0.2973
depth			14			18	1.6534	6.5812	80	0.25	0.8023
depth			14			2	-23.1002	6.3124	80	-3.66	0.0005
depth			14			6	-16.2936	6.4145	80	-2.54	0.0130
depth			18			2	-24.7536	6.5812	80	-3.76	0.0003
depth			18			6	-17.9470	6.6792	80	-2.69	0.0088
depth			2			6	6.8066	6.4145	80	1.06	0.2918
canopy	Canopy			NoCanopy			-7.7685	4.0867	80	-1.90	0.0609
canopy*depth	Canopy		10	Canopy		14	14.7417	9.1191	80	1.62	0.1099
canopy*depth	Canopy		10	Canopy		18	14.4222	9.6723	80	1.49	0.1399
canopy*depth	Canopy		10	Canopy		2	0.6854	9.1191	80	0.08	0.9403
canopy*depth	Canopy		10	Canopy		6	0.7682	9.3998	80	0.08	0.9351
canopy*depth	Canopy		10	NoCanopy		10	4.2726	8.9271	80	0.48	0.6335
canopy*depth	Canopy		10	NoCanopy		14	8.6584	8.9271	80	0.97	0.3350
canopy*depth	Canopy		10	NoCanopy		18	12.2848	9.1191	80	1.35	0.1817

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*depth	Canopy		10	NoCanopy		2	-23.4857	8.9271	80	-2.63	0.0102
canopy*depth	Canopy		10	NoCanopy		6	-9.9553	8.9271	80	-1.12	0.2681
canopy*depth	Canopy		14	Canopy		18	-0.3195	9.6723	80	-0.03	0.9737
canopy*depth	Canopy		14	Canopy		2	-14.0563	9.1191	80	-1.54	0.1272
canopy*depth	Canopy		14	Canopy		6	-13.9735	9.3998	80	-1.49	0.1411
canopy*depth	Canopy		14	NoCanopy		10	-10.4691	8.9271	80	-1.17	0.2444
canopy*depth	Canopy		14	NoCanopy		14	-6.0833	8.9271	80	-0.68	0.4976
canopy*depth	Canopy		14	NoCanopy		18	-2.4570	9.1191	80	-0.27	0.7883
canopy*depth	Canopy		14	NoCanopy		2	-38.2274	8.9271	80	-4.28	<.0001
canopy*depth	Canopy		14	NoCanopy		6	-24.6970	8.9271	80	-2.77	0.0070
canopy*depth	Canopy		18	Canopy		2	-13.7368	9.6723	80	-1.42	0.1594
canopy*depth	Canopy		18	Canopy		6	-13.6540	9.9374	80	-1.37	0.1733
canopy*depth	Canopy		18	NoCanopy		10	-10.1496	9.4915	80	-1.07	0.2881
canopy*depth	Canopy		18	NoCanopy		14	-5.7638	9.4915	80	-0.61	0.5454
canopy*depth	Canopy		18	NoCanopy		18	-2.1374	9.6723	80	-0.22	0.8257
canopy*depth	Canopy		18	NoCanopy		2	-37.9078	9.4915	80	-3.99	0.0001
canopy*depth	Canopy		18	NoCanopy		6	-24.3775	9.4915	80	-2.57	0.0121
canopy*depth	Canopy		2	Canopy		6	0.08278	9.3998	80	0.01	0.9930
canopy*depth	Canopy		2	NoCanopy		10	3.5872	8.9271	80	0.40	0.6889
canopy*depth	Canopy		2	NoCanopy		14	7.9730	8.9271	80	0.89	0.3745
canopy*depth	Canopy		2	NoCanopy		18	11.5993	9.1191	80	1.27	0.2071
canopy*depth	Canopy		2	NoCanopy		2	-24.1711	8.9271	80	-2.71	0.0083
canopy*depth	Canopy		2	NoCanopy		6	-10.6407	8.9271	80	-1.19	0.2368
canopy*depth	Canopy		6	NoCanopy		10	3.5044	9.2137	80	0.38	0.7047
canopy*depth	Canopy		6	NoCanopy		14	7.8902	9.2137	80	0.86	0.3944
canopy*depth	Canopy		6	NoCanopy		18	11.5166	9.3998	80	1.23	0.2241
canopy*depth	Canopy		6	NoCanopy		2	-24.2539	9.2137	80	-2.63	0.0102
canopy*depth	Canopy		6	NoCanopy		6	-10.7235	9.2137	80	-1.16	0.2479
canopy*depth	NoCanopy		10	NoCanopy		14	4.3858	8.7309	80	0.50	0.6168
canopy*depth	NoCanopy		10	NoCanopy		18	8.0121	8.9271	80	0.90	0.3721
canopy*depth	NoCanopy		10	NoCanopy		2	-27.7583	8.7309	80	-3.18	0.0021
canopy*depth	NoCanopy		10	NoCanopy		6	-14.2279	8.7309	80	-1.63	0.1071
canopy*depth	NoCanopy		14	NoCanopy		18	3.6264	8.9271	80	0.41	0.6857
canopy*depth	NoCanopy		14	NoCanopy		2	-32.1440	8.7309	80	-3.68	0.0004
canopy*depth	NoCanopy		14	NoCanopy		6	-18.6137	8.7309	80	-2.13	0.0361
canopy*depth	NoCanopy		18	NoCanopy		2	-35.7704	8.9271	80	-4.01	0.0001
canopy*depth	NoCanopy		18	NoCanopy		6	-22.2401	8.9271	80	-2.49	0.0148
canopy*depth	NoCanopy		2	NoCanopy		6	13.5304	8.7309	80	1.55	0.1252
ash		Ash			NoAsh		6.4417	4.0867	80	1.58	0.1189

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
ash*depth		Ash	10		Ash	14	6.5331	9.1191	80	0.72	0.4758
ash*depth		Ash	10		Ash	18	15.6151	9.3998	80	1.66	0.1006
ash*depth		Ash	10		Ash	2	-15.0795	9.1191	80	-1.65	0.1021
ash*depth		Ash	10		Ash	6	-6.0497	9.1191	80	-0.66	0.5090
ash*depth		Ash	10		NoAsh	10	6.6435	8.9271	80	0.74	0.4589
ash*depth		Ash	10		NoAsh	14	19.2379	8.9271	80	2.15	0.0342
ash*depth		Ash	10		NoAsh	18	13.4627	9.3998	80	1.43	0.1560
ash*depth		Ash	10		NoAsh	2	-5.3499	8.9271	80	-0.60	0.5507
ash*depth		Ash	10		NoAsh	6	-0.7666	9.2137	80	-0.08	0.9339
ash*depth		Ash	14		Ash	18	9.0820	9.3998	80	0.97	0.3369
ash*depth		Ash	14		Ash	2	-21.6126	9.1191	80	-2.37	0.0202
ash*depth		Ash	14		Ash	6	-12.5828	9.1191	80	-1.38	0.1715
ash*depth		Ash	14		NoAsh	10	0.1104	8.9271	80	0.01	0.9902
ash*depth		Ash	14		NoAsh	14	12.7047	8.9271	80	1.42	0.1586
ash*depth		Ash	14		NoAsh	18	6.9296	9.3998	80	0.74	0.4632
ash*depth		Ash	14		NoAsh	2	-11.8830	8.9271	80	-1.33	0.1869
ash*depth		Ash	14		NoAsh	6	-7.2997	9.2137	80	-0.79	0.4305
ash*depth		Ash	18		Ash	2	-30.6945	9.3998	80	-3.27	0.0016
ash*depth		Ash	18		Ash	6	-21.6647	9.3998	80	-2.30	0.0238
ash*depth		Ash	18		NoAsh	10	-8.9716	9.2137	80	-0.97	0.3331
ash*depth		Ash	18		NoAsh	14	3.6228	9.2137	80	0.39	0.6952
ash*depth		Ash	18		NoAsh	18	-2.1523	9.6723	80	-0.22	0.8245
ash*depth		Ash	18		NoAsh	2	-20.9650	9.2137	80	-2.28	0.0256
ash*depth		Ash	18		NoAsh	6	-16.3816	9.4915	80	-1.73	0.0882
ash*depth		Ash	2		Ash	6	9.0298	9.1191	80	0.99	0.3251
ash*depth		Ash	2		NoAsh	10	21.7230	8.9271	80	2.43	0.0172
ash*depth		Ash	2		NoAsh	14	34.3173	8.9271	80	3.84	0.0002
ash*depth		Ash	2		NoAsh	18	28.5422	9.3998	80	3.04	0.0032
ash*depth		Ash	2		NoAsh	2	9.7296	8.9271	80	1.09	0.2790
ash*depth		Ash	2		NoAsh	6	14.3129	9.2137	80	1.55	0.1243
ash*depth		Ash	6		NoAsh	10	12.6932	8.9271	80	1.42	0.1590
ash*depth		Ash	6		NoAsh	14	25.2875	8.9271	80	2.83	0.0058
ash*depth		Ash	6		NoAsh	18	19.5124	9.3998	80	2.08	0.0411
ash*depth		Ash	6		NoAsh	2	0.6998	8.9271	80	0.08	0.9377
ash*depth		Ash	6		NoAsh	6	5.2831	9.2137	80	0.57	0.5680
ash*depth		NoAsh	10		NoAsh	14	12.5944	8.7309	80	1.44	0.1531
ash*depth		NoAsh	10		NoAsh	18	6.8193	9.2137	80	0.74	0.4614
ash*depth		NoAsh	10		NoAsh	2	-11.9934	8.7309	80	-1.37	0.1734
ash*depth		NoAsh	10		NoAsh	6	-7.4100	9.0237	80	-0.82	0.4140

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
ash*depth		NoAsh	14		NoAsh	18	-5.7751	9.2137	80	-0.63	0.5326
ash*depth		NoAsh	14		NoAsh	2	-24.5877	8.7309	80	-2.82	0.0061
ash*depth		NoAsh	14		NoAsh	6	-20.0044	9.0237	80	-2.22	0.0295
ash*depth		NoAsh	18		NoAsh	2	-18.8126	9.2137	80	-2.04	0.0445
ash*depth		NoAsh	18		NoAsh	6	-14.2293	9.4915	80	-1.50	0.1378
ash*depth		NoAsh	2		NoAsh	6	4.5833	9.0237	80	0.51	0.6129
canopy*ash	Canopy	Ash		Canopy	NoAsh		11.3258	5.9798	80	1.89	0.0618
canopy*ash	Canopy	Ash		NoCanopy	Ash		-2.8844	5.8391	80	-0.49	0.6227
canopy*ash	Canopy	Ash		NoCanopy	NoAsh		-1.3268	5.6460	80	-0.24	0.8148
canopy*ash	Canopy	NoAsh		NoCanopy	Ash		-14.2103	5.9099	80	-2.40	0.0185
canopy*ash	Canopy	NoAsh		NoCanopy	NoAsh		-12.6526	5.7192	80	-2.21	0.0298
canopy*ash	NoCanopy	Ash		NoCanopy	NoAsh		1.5576	5.5719	80	0.28	0.7805
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	14	16.5298	12.8964	80	1.28	0.2036
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	18	23.5348	13.6787	80	1.72	0.0892
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	2	-0.1391	12.8964	80	-0.01	0.9914
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	6	3.1391	12.8964	80	0.24	0.8083
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	10	16.3046	12.8964	80	1.26	0.2098
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	14	29.2583	12.8964	80	2.27	0.0260
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	18	21.6142	13.6787	80	1.58	0.1180
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	2	17.8146	12.8964	80	1.38	0.1710
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	6	14.7020	13.6787	80	1.07	0.2857
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	10	13.9338	12.8964	80	1.08	0.2832
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	14	10.4702	12.8964	80	0.81	0.4193
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	18	21.6291	12.8964	80	1.68	0.0974
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	2	-16.0861	12.8964	80	-1.25	0.2159
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	6	-1.3046	12.8964	80	-0.10	0.9197
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	10	10.9161	12.3474	80	0.88	0.3793
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	14	23.1512	12.3474	80	1.87	0.0644
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	18	19.2450	12.8964	80	1.49	0.1396
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	2	-14.5806	12.3474	80	-1.18	0.2412
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	6	-2.3013	12.3474	80	-0.19	0.8526
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	18	7.0050	13.6787	80	0.51	0.6100
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	2	-16.6689	12.8964	80	-1.29	0.1999
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	6	-13.3907	12.8964	80	-1.04	0.3022
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	10	-0.2252	12.8964	80	-0.02	0.9861
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	14	12.7285	12.8964	80	0.99	0.3266
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	18	5.0844	13.6787	80	0.37	0.7111
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	2	1.2848	12.8964	80	0.10	0.9209
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	6	-1.8278	13.6787	80	-0.13	0.8940

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	10	-2.5960	12.8964	80	-0.20	0.8410
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	14	-6.0596	12.8964	80	-0.47	0.6397
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	18	5.0993	12.8964	80	0.40	0.6936
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	2	-32.6159	12.8964	80	-2.53	0.0134
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	6	-17.8344	12.8964	80	-1.38	0.1705
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	10	-5.6137	12.3474	80	-0.45	0.6506
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	14	6.6214	12.3474	80	0.54	0.5933
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	18	2.7152	12.8964	80	0.21	0.8338
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	2	-31.1104	12.3474	80	-2.52	0.0137
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	6	-18.8311	12.3474	80	-1.53	0.1312
canopy*ash*depth	Canopy	Ash	18	Canopy	Ash	2	-23.6738	13.6787	80	-1.73	0.0874
canopy*ash*depth	Canopy	Ash	18	Canopy	Ash	6	-20.3957	13.6787	80	-1.49	0.1399
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	10	-7.2301	13.6787	80	-0.53	0.5986
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	14	5.7235	13.6787	80	0.42	0.6768
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	18	-1.9205	14.4186	80	-0.13	0.8944
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	2	-5.7202	13.6787	80	-0.42	0.6769
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	6	-8.8328	14.4186	80	-0.61	0.5419
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	10	-9.6010	13.6787	80	-0.70	0.4848
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	14	-13.0646	13.6787	80	-0.96	0.3424
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	18	-1.9056	13.6787	80	-0.14	0.8896
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	2	-39.6209	13.6787	80	-2.90	0.0049
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	6	-24.8394	13.6787	80	-1.82	0.0731
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	10	-12.6187	13.1624	80	-0.96	0.3406
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	14	-0.3836	13.1624	80	-0.03	0.9768
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	18	-4.2897	13.6787	80	-0.31	0.7546
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	2	-38.1153	13.1624	80	-2.90	0.0049
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	6	-25.8361	13.1624	80	-1.96	0.0531
canopy*ash*depth	Canopy	Ash	2	Canopy	Ash	6	3.2781	12.8964	80	0.25	0.8000
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	10	16.4437	12.8964	80	1.28	0.2060
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	14	29.3974	12.8964	80	2.28	0.0253
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	18	21.7533	13.6787	80	1.59	0.1157
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	2	17.9536	12.8964	80	1.39	0.1677
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	6	14.8411	13.6787	80	1.08	0.2812
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	10	14.0728	12.8964	80	1.09	0.2785
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	14	10.6093	12.8964	80	0.82	0.4132
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	18	21.7682	12.8964	80	1.69	0.0953
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	2	-15.9470	12.8964	80	-1.24	0.2199
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	6	-1.1656	12.8964	80	-0.09	0.9282
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	10	11.0552	12.3474	80	0.90	0.3733

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	14	23.2903	12.3474	80	1.89	0.0629
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	18	19.3841	12.8964	80	1.50	0.1368
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	2	-14.4415	12.3474	80	-1.17	0.2456
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	6	-2.1623	12.3474	80	-0.18	0.8614
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	10	13.1656	12.8964	80	1.02	0.3104
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	14	26.1192	12.8964	80	2.03	0.0462
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	18	18.4752	13.6787	80	1.35	0.1806
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	2	14.6755	12.8964	80	1.14	0.2585
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	6	11.5629	13.6787	80	0.85	0.4005
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	10	10.7947	12.8964	80	0.84	0.4051
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	14	7.3311	12.8964	80	0.57	0.5713
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	18	18.4901	12.8964	80	1.43	0.1555
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	2	-19.2252	12.8964	80	-1.49	0.1400
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	6	-4.4437	12.8964	80	-0.34	0.7313
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	10	7.7770	12.3474	80	0.63	0.5306
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	14	20.0121	12.3474	80	1.62	0.1090
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	18	16.1060	12.8964	80	1.25	0.2154
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	2	-17.7196	12.3474	80	-1.44	0.1552
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	6	-5.4404	12.3474	80	-0.44	0.6607
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	14	12.9536	12.8964	80	1.00	0.3182
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	18	5.3096	13.6787	80	0.39	0.6989
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	2	1.5099	12.8964	80	0.12	0.9071
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	6	-1.6026	13.6787	80	-0.12	0.9070
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	10	-2.3709	12.8964	80	-0.18	0.8546
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	14	-5.8344	12.8964	80	-0.45	0.6522
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	18	5.3245	12.8964	80	0.41	0.6808
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	2	-32.3907	12.8964	80	-2.51	0.0140
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	6	-17.6093	12.8964	80	-1.37	0.1759
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	10	-5.3885	12.3474	80	-0.44	0.6637
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	14	6.8466	12.3474	80	0.55	0.5808
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	18	2.9404	12.8964	80	0.23	0.8202
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	2	-30.8852	12.3474	80	-2.50	0.0144
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	6	-18.6060	12.3474	80	-1.51	0.1358
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	18	-7.6440	13.6787	80	-0.56	0.5778
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	2	-11.4437	12.8964	80	-0.89	0.3775
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	6	-14.5563	13.6787	80	-1.06	0.2905
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	10	-15.3245	12.8964	80	-1.19	0.2382
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	14	-18.7881	12.8964	80	-1.46	0.1491
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	18	-7.6291	12.8964	80	-0.59	0.5558

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	2	-45.3444	12.8964	80	-3.52	0.0007
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	6	-30.5629	12.8964	80	-2.37	0.0202
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	10	-18.3422	12.3474	80	-1.49	0.1413
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	14	-6.1071	12.3474	80	-0.49	0.6222
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	18	-10.0132	12.8964	80	-0.78	0.4398
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	2	-43.8389	12.3474	80	-3.55	0.0006
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	6	-31.5596	12.3474	80	-2.56	0.0125
canopy*ash*depth	Canopy	NoAsh	18	Canopy	NoAsh	2	-3.7997	13.6787	80	-0.28	0.7819
canopy*ash*depth	Canopy	NoAsh	18	Canopy	NoAsh	6	-6.9123	14.4186	80	-0.48	0.6330
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	10	-7.6805	13.6787	80	-0.56	0.5760
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	14	-11.1440	13.6787	80	-0.81	0.4177
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	18	0.01490	13.6787	80	0.00	0.9991
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	2	-37.7003	13.6787	80	-2.76	0.0072
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	6	-22.9189	13.6787	80	-1.68	0.0977
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	10	-10.6981	13.1624	80	-0.81	0.4188
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	14	1.5370	13.1624	80	0.12	0.9073
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	18	-2.3692	13.6787	80	-0.17	0.8629
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	2	-36.1948	13.1624	80	-2.75	0.0074
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	6	-23.9156	13.1624	80	-1.82	0.0730
canopy*ash*depth	Canopy	NoAsh	2	Canopy	NoAsh	6	-3.1126	13.6787	80	-0.23	0.8206
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	10	-3.8808	12.8964	80	-0.30	0.7643
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	14	-7.3444	12.8964	80	-0.57	0.5706
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	18	3.8146	12.8964	80	0.30	0.7682
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	2	-33.9007	12.8964	80	-2.63	0.0103
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	6	-19.1192	12.8964	80	-1.48	0.1421
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	10	-6.8985	12.3474	80	-0.56	0.5779
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	14	5.3366	12.3474	80	0.43	0.6668
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	18	1.4305	12.8964	80	0.11	0.9120
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	2	-32.3951	12.3474	80	-2.62	0.0104
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	6	-20.1159	12.3474	80	-1.63	0.1072
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	10	-0.7682	13.6787	80	-0.06	0.9554
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	14	-4.2318	13.6787	80	-0.31	0.7578
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	18	6.9272	13.6787	80	0.51	0.6140
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	2	-30.7881	13.6787	80	-2.25	0.0271
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	6	-16.0066	13.6787	80	-1.17	0.2454
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	10	-3.7859	13.1624	80	-0.29	0.7744
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	14	8.4492	13.1624	80	0.64	0.5228
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	18	4.5430	13.6787	80	0.33	0.7407
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	2	-29.2826	13.1624	80	-2.22	0.0289

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	6	-17.0033	13.1624	80	-1.29	0.2001
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	14	-3.4636	12.8964	80	-0.27	0.7890
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	18	7.6954	12.8964	80	0.60	0.5524
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	2	-30.0199	12.8964	80	-2.33	0.0225
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	6	-15.2384	12.8964	80	-1.18	0.2409
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	10	-3.0177	12.3474	80	-0.24	0.8075
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	14	9.2174	12.3474	80	0.75	0.4575
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	18	5.3113	12.8964	80	0.41	0.6816
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	2	-28.5143	12.3474	80	-2.31	0.0235
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	6	-16.2351	12.3474	80	-1.31	0.1923
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	18	11.1589	12.8964	80	0.87	0.3895
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	2	-26.5563	12.8964	80	-2.06	0.0427
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	6	-11.7748	12.8964	80	-0.91	0.3640
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	10	0.4459	12.3474	80	0.04	0.9713
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	14	12.6810	12.3474	80	1.03	0.3075
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	18	8.7748	12.8964	80	0.68	0.4982
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	2	-25.0508	12.3474	80	-2.03	0.0458
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	6	-12.7715	12.3474	80	-1.03	0.3041
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	Ash	2	-37.7152	12.8964	80	-2.92	0.0045
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	Ash	6	-22.9338	12.8964	80	-1.78	0.0792
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	10	-10.7130	12.3474	80	-0.87	0.3882
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	14	1.5221	12.3474	80	0.12	0.9022
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	18	-2.3841	12.8964	80	-0.18	0.8538
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	2	-36.2097	12.3474	80	-2.93	0.0044
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	6	-23.9305	12.3474	80	-1.94	0.0561
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	Ash	6	14.7815	12.8964	80	1.15	0.2551
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	10	27.0022	12.3474	80	2.19	0.0317
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	14	39.2373	12.3474	80	3.18	0.0021
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	18	35.3311	12.8964	80	2.74	0.0076
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	2	1.5055	12.3474	80	0.12	0.9033
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	6	13.7848	12.3474	80	1.12	0.2676
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	10	12.2208	12.3474	80	0.99	0.3253
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	14	24.4558	12.3474	80	1.98	0.0511
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	18	20.5497	12.8964	80	1.59	0.1150
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	2	-13.2759	12.3474	80	-1.08	0.2855
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	6	-0.9967	12.3474	80	-0.08	0.9359
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	14	12.2351	11.7728	80	1.04	0.3018
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	18	8.3289	12.3474	80	0.67	0.5019
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	2	-25.4967	11.7728	80	-2.17	0.0333

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	6	-13.2174	11.7728	80	-1.12	0.2649
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	18	-3.9062	12.3474	80	-0.32	0.7526
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	2	-37.7318	11.7728	80	-3.21	0.0019
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	6	-25.4525	11.7728	80	-2.16	0.0336
canopy*ash*depth	NoCanopy	NoAsh	18	NoCanopy	NoAsh	2	-33.8256	12.3474	80	-2.74	0.0076
canopy*ash*depth	NoCanopy	NoAsh	18	NoCanopy	NoAsh	6	-21.5464	12.3474	80	-1.75	0.0848
canopy*ash*depth	NoCanopy	NoAsh	2	NoCanopy	NoAsh	6	12.2792	11.7728	80	1.04	0.3001

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
depth			10			14	Tukey-Kramer	0.5559
depth			10			18	Tukey-Kramer	0.4371
depth			10			2	Tukey-Kramer	0.2119
depth			10			6	Tukey-Kramer	0.8316
depth			14			18	Tukey-Kramer	0.9991
depth			14			2	Tukey-Kramer	0.0040
depth			14			6	Tukey-Kramer	0.0920
depth			18			2	Tukey-Kramer	0.0029
depth			18			6	Tukey-Kramer	0.0648
depth			2			6	Tukey-Kramer	0.8257
canopy	Canopy			NoCanopy			Tukey-Kramer	0.0609
canopy*depth	Canopy		10	Canopy		14	Tukey-Kramer	0.8362
canopy*depth	Canopy		10	Canopy		18	Tukey-Kramer	0.8918
canopy*depth	Canopy		10	Canopy		2	Tukey-Kramer	1.0000
canopy*depth	Canopy		10	Canopy		6	Tukey-Kramer	1.0000
canopy*depth	Canopy		10	NoCanopy		10	Tukey-Kramer	1.0000
canopy*depth	Canopy		10	NoCanopy		14	Tukey-Kramer	0.9932
canopy*depth	Canopy		10	NoCanopy		18	Tukey-Kramer	0.9391
canopy*depth	Canopy		10	NoCanopy		2	Tukey-Kramer	0.2209
canopy*depth	Canopy		10	NoCanopy		6	Tukey-Kramer	0.9817
canopy*depth	Canopy		14	Canopy		18	Tukey-Kramer	1.0000
canopy*depth	Canopy		14	Canopy		2	Tukey-Kramer	0.8711
canopy*depth	Canopy		14	Canopy		6	Tukey-Kramer	0.8935

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*depth	Canopy		14	NoCanopy		10	Tukey-Kramer	0.9744
canopy*depth	Canopy		14	NoCanopy		14	Tukey-Kramer	0.9996
canopy*depth	Canopy		14	NoCanopy		18	Tukey-Kramer	1.0000
canopy*depth	Canopy		14	NoCanopy		2	Tukey-Kramer	0.0020
canopy*depth	Canopy		14	NoCanopy		6	Tukey-Kramer	0.1661
canopy*depth	Canopy		18	Canopy		2	Tukey-Kramer	0.9173
canopy*depth	Canopy		18	Canopy		6	Tukey-Kramer	0.9316
canopy*depth	Canopy		18	NoCanopy		10	Tukey-Kramer	0.9863
canopy*depth	Canopy		18	NoCanopy		14	Tukey-Kramer	0.9998
canopy*depth	Canopy		18	NoCanopy		18	Tukey-Kramer	1.0000
canopy*depth	Canopy		18	NoCanopy		2	Tukey-Kramer	0.0053
canopy*depth	Canopy		18	NoCanopy		6	Tukey-Kramer	0.2500
canopy*depth	Canopy		2	Canopy		6	Tukey-Kramer	1.0000
canopy*depth	Canopy		2	NoCanopy		10	Tukey-Kramer	1.0000
canopy*depth	Canopy		2	NoCanopy		14	Tukey-Kramer	0.9963
canopy*depth	Canopy		2	NoCanopy		18	Tukey-Kramer	0.9570
canopy*depth	Canopy		2	NoCanopy		2	Tukey-Kramer	0.1885
canopy*depth	Canopy		2	NoCanopy		6	Tukey-Kramer	0.9716
canopy*depth	Canopy		6	NoCanopy		10	Tukey-Kramer	1.0000
canopy*depth	Canopy		6	NoCanopy		14	Tukey-Kramer	0.9973
canopy*depth	Canopy		6	NoCanopy		18	Tukey-Kramer	0.9661
canopy*depth	Canopy		6	NoCanopy		2	Tukey-Kramer	0.2202
canopy*depth	Canopy		6	NoCanopy		6	Tukey-Kramer	0.9757
canopy*depth	NoCanopy		10	NoCanopy		14	Tukey-Kramer	1.0000
canopy*depth	NoCanopy		10	NoCanopy		18	Tukey-Kramer	0.9961
canopy*depth	NoCanopy		10	NoCanopy		2	Tukey-Kramer	0.0612
canopy*depth	NoCanopy		10	NoCanopy		6	Tukey-Kramer	0.8296
canopy*depth	NoCanopy		14	NoCanopy		18	Tukey-Kramer	1.0000
canopy*depth	NoCanopy		14	NoCanopy		2	Tukey-Kramer	0.0144
canopy*depth	NoCanopy		14	NoCanopy		6	Tukey-Kramer	0.5112
canopy*depth	NoCanopy		18	NoCanopy		2	Tukey-Kramer	0.0051
canopy*depth	NoCanopy		18	NoCanopy		6	Tukey-Kramer	0.2891

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*depth	NoCanopy		2	NoCanopy		6	Tukey-Kramer	0.8675
ash		Ash			NoAsh		Tukey-Kramer	0.1189
ash*depth		Ash	10		Ash	14	Tukey-Kramer	0.9993
ash*depth		Ash	10		Ash	18	Tukey-Kramer	0.8133
ash*depth		Ash	10		Ash	2	Tukey-Kramer	0.8173
ash*depth		Ash	10		Ash	6	Tukey-Kramer	0.9996
ash*depth		Ash	10		NoAsh	10	Tukey-Kramer	0.9991
ash*depth		Ash	10		NoAsh	14	Tukey-Kramer	0.4956
ash*depth		Ash	10		NoAsh	18	Tukey-Kramer	0.9133
ash*depth		Ash	10		NoAsh	2	Tukey-Kramer	0.9998
ash*depth		Ash	10		NoAsh	6	Tukey-Kramer	1.0000
ash*depth		Ash	14		Ash	18	Tukey-Kramer	0.9934
ash*depth		Ash	14		Ash	2	Tukey-Kramer	0.3576
ash*depth		Ash	14		Ash	6	Tukey-Kramer	0.9299
ash*depth		Ash	14		NoAsh	10	Tukey-Kramer	1.0000
ash*depth		Ash	14		NoAsh	14	Tukey-Kramer	0.9163
ash*depth		Ash	14		NoAsh	18	Tukey-Kramer	0.9992
ash*depth		Ash	14		NoAsh	2	Tukey-Kramer	0.9433
ash*depth		Ash	14		NoAsh	6	Tukey-Kramer	0.9985
ash*depth		Ash	18		Ash	2	Tukey-Kramer	0.0486
ash*depth		Ash	18		Ash	6	Tukey-Kramer	0.3975
ash*depth		Ash	18		NoAsh	10	Tukey-Kramer	0.9930
ash*depth		Ash	18		NoAsh	14	Tukey-Kramer	1.0000
ash*depth		Ash	18		NoAsh	18	Tukey-Kramer	1.0000
ash*depth		Ash	18		NoAsh	2	Tukey-Kramer	0.4162
ash*depth		Ash	18		NoAsh	6	Tukey-Kramer	0.7775
ash*depth		Ash	2		Ash	6	Tukey-Kramer	0.9921
ash*depth		Ash	2		NoAsh	10	Tukey-Kramer	0.3208
ash*depth		Ash	2		NoAsh	14	Tukey-Kramer	0.0086
ash*depth		Ash	2		NoAsh	18	Tukey-Kramer	0.0883
ash*depth		Ash	2		NoAsh	2	Tukey-Kramer	0.9844
ash*depth		Ash	2		NoAsh	6	Tukey-Kramer	0.8658

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
ash*depth		Ash	6		NoAsh	10	Tukey-Kramer	0.9167
ash*depth		Ash	6		NoAsh	14	Tukey-Kramer	0.1434
ash*depth		Ash	6		NoAsh	18	Tukey-Kramer	0.5496
ash*depth		Ash	6		NoAsh	2	Tukey-Kramer	1.0000
ash*depth		Ash	6		NoAsh	6	Tukey-Kramer	0.9999
ash*depth		NoAsh	10		NoAsh	14	Tukey-Kramer	0.9097
ash*depth		NoAsh	10		NoAsh	18	Tukey-Kramer	0.9991
ash*depth		NoAsh	10		NoAsh	2	Tukey-Kramer	0.9317
ash*depth		NoAsh	10		NoAsh	6	Tukey-Kramer	0.9980
ash*depth		NoAsh	14		NoAsh	18	Tukey-Kramer	0.9998
ash*depth		NoAsh	14		NoAsh	2	Tukey-Kramer	0.1488
ash*depth		NoAsh	14		NoAsh	6	Tukey-Kramer	0.4542
ash*depth		NoAsh	18		NoAsh	2	Tukey-Kramer	0.5729
ash*depth		NoAsh	18		NoAsh	6	Tukey-Kramer	0.8886
ash*depth		NoAsh	2		NoAsh	6	Tukey-Kramer	1.0000
canopy*ash	Canopy	Ash		Canopy	NoAsh		Tukey-Kramer	0.2388
canopy*ash	Canopy	Ash		NoCanopy	Ash		Tukey-Kramer	0.9602
canopy*ash	Canopy	Ash		NoCanopy	NoAsh		Tukey-Kramer	0.9954
canopy*ash	Canopy	NoAsh		NoCanopy	Ash		Tukey-Kramer	0.0844
canopy*ash	Canopy	NoAsh		NoCanopy	NoAsh		Tukey-Kramer	0.1287
canopy*ash	NoCanopy	Ash		NoCanopy	NoAsh		Tukey-Kramer	0.9923
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	14	Tukey-Kramer	0.9990
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	18	Tukey-Kramer	0.9711
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	10	Tukey-Kramer	0.9992
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	14	Tukey-Kramer	0.7490
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	18	Tukey-Kramer	0.9880
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	2	Tukey-Kramer	0.9975
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	6	Tukey-Kramer	0.9999
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	10	Tukey-Kramer	0.9999
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	14	Tukey-Kramer	1.0000

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	18	Tukey-Kramer	0.9776
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	2	Tukey-Kramer	0.9993
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	14	Tukey-Kramer	0.9365
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	18	Tukey-Kramer	0.9937
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	2	Tukey-Kramer	0.9997
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	2	Tukey-Kramer	0.9989
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	6	Tukey-Kramer	0.9999
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	2	Tukey-Kramer	0.5661
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	6	Tukey-Kramer	0.9974
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	2	Tukey-Kramer	0.5730
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	6	Tukey-Kramer	0.9919
canopy*ash*depth	Canopy	Ash	18	Canopy	Ash	2	Tukey-Kramer	0.9694
canopy*ash*depth	Canopy	Ash	18	Canopy	Ash	6	Tukey-Kramer	0.9937
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	2	Tukey-Kramer	1.0000

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	2	Tukey-Kramer	0.3154
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	6	Tukey-Kramer	0.9521
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	2	Tukey-Kramer	0.3158
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	6	Tukey-Kramer	0.9074
canopy*ash*depth	Canopy	Ash	2	Canopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	10	Tukey-Kramer	0.9991
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	14	Tukey-Kramer	0.7420
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	18	Tukey-Kramer	0.9871
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	2	Tukey-Kramer	0.9972
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	6	Tukey-Kramer	0.9999
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	10	Tukey-Kramer	0.9999
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	18	Tukey-Kramer	0.9761
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	2	Tukey-Kramer	0.9994
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	14	Tukey-Kramer	0.9332
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	18	Tukey-Kramer	0.9931
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	2	Tukey-Kramer	0.9997
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	14	Tukey-Kramer	0.8821
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	18	Tukey-Kramer	0.9981
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	2	Tukey-Kramer	0.9998
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	6	Tukey-Kramer	1.0000

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	18	Tukey-Kramer	0.9960
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	2	Tukey-Kramer	0.9937
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	14	Tukey-Kramer	0.9843
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	18	Tukey-Kramer	0.9993
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	2	Tukey-Kramer	0.9960
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	2	Tukey-Kramer	0.5789
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	6	Tukey-Kramer	0.9978
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	2	Tukey-Kramer	0.5864
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	6	Tukey-Kramer	0.9929
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	6	Tukey-Kramer	0.9999
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	10	Tukey-Kramer	0.9997
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	14	Tukey-Kramer	0.9952
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	2	Tukey-Kramer	0.0756
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	6	Tukey-Kramer	0.6809

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	10	Tukey-Kramer	0.9940
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	2	Tukey-Kramer	0.0689
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	6	Tukey-Kramer	0.5464
canopy*ash*depth	Canopy	NoAsh	18	Canopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	2	Tukey-Kramer	0.4046
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	6	Tukey-Kramer	0.9778
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	2	Tukey-Kramer	0.4088
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	6	Tukey-Kramer	0.9519
canopy*ash*depth	Canopy	NoAsh	2	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	2	Tukey-Kramer	0.4936
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	6	Tukey-Kramer	0.9941
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	2	Tukey-Kramer	0.4973
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	6	Tukey-Kramer	0.9834
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	2	Tukey-Kramer	0.7605

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	6	Tukey-Kramer	0.9997
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	2	Tukey-Kramer	0.7767
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	6	Tukey-Kramer	0.9989
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	2	Tukey-Kramer	0.7099
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	6	Tukey-Kramer	0.9997
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	2	Tukey-Kramer	0.7223
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	6	Tukey-Kramer	0.9987
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	2	Tukey-Kramer	0.8667
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	2	Tukey-Kramer	0.8805
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	Ash	2	Tukey-Kramer	0.2991
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	Ash	6	Tukey-Kramer	0.9605
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	2	Tukey-Kramer	0.2944
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	6	Tukey-Kramer	0.9163
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	Ash	6	Tukey-Kramer	0.9998
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	10	Tukey-Kramer	0.7994

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	14	Tukey-Kramer	0.1755
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	18	Tukey-Kramer	0.4158
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	6	Tukey-Kramer	0.9999
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	14	Tukey-Kramer	0.9005
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	18	Tukey-Kramer	0.9869
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	2	Tukey-Kramer	0.9999
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	14	Tukey-Kramer	0.9999
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	2	Tukey-Kramer	0.8115
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	6	Tukey-Kramer	0.9998
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	2	Tukey-Kramer	0.1649
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	6	Tukey-Kramer	0.8136
canopy*ash*depth	NoCanopy	NoAsh	18	NoCanopy	NoAsh	2	Tukey-Kramer	0.4158
canopy*ash*depth	NoCanopy	NoAsh	18	NoCanopy	NoAsh	6	Tukey-Kramer	0.9669
canopy*ash*depth	NoCanopy	NoAsh	2	NoCanopy	NoAsh	6	Tukey-Kramer	0.9999

May No Burn Sedge Dominated Islands CTSL 0 – 20 cm AVG (Figure 5B)

Program:

```
title '0 - 20 cm CTSL Avg May Sedge';

proc mixed data=CTSL;
        class island canopy ash;
        model TotalAvgCTSL=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	3.84	0.0676
ash	1	16	0.26	0.6142
canopy*ash	1	16	0.01	0.9277
island	1	16	2.12	0.1647
island*canopy	1	16	0.02	0.8777
island*ash	1	16	0.69	0.4200
island*canopy*ash	1	16	0.12	0.7301

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		54.0984	4.3788	16	12.35	<.0001
canopy	NoCanopy		41.9592	4.3788	16	9.58	<.0001
ash		Ash	46.4368	4.3788	16	10.60	<.0001
ash		NoAsh	49.6208	4.3788	16	11.33	<.0001
canopy*ash	Canopy	Ash	52.7919	6.1925	16	8.53	<.0001
canopy*ash	Canopy	NoAsh	55.4049	6.1925	16	8.95	<.0001
canopy*ash	NoCanopy	Ash	40.0817	6.1925	16	6.47	<.0001
canopy*ash	NoCanopy	NoAsh	43.8366	6.1925	16	7.08	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		12.1393	6.1925	16	1.96	0.0676	Tukey	0.0676
ash		Ash		NoAsh	-3.1840	6.1925	16	-0.51	0.6142	Tukey	0.6142
canopy*ash	Canopy	Ash	Canopy	NoAsh	-2.6130	8.7576	16	-0.30	0.7693	Tukey	0.9904
canopy*ash	Canopy	Ash	NoCanopy	Ash	12.7103	8.7576	16	1.45	0.1660	Tukey	0.4877
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	8.9553	8.7576	16	1.02	0.3217	Tukey	0.7390
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	15.3232	8.7576	16	1.75	0.0993	Tukey	0.3320
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	11.5682	8.7576	16	1.32	0.2051	Tukey	0.5636
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-3.7550	8.7576	16	-0.43	0.6738	Tukey	0.9727

May No Burn Sedge Dominated Islands Depthwise CTSL (Figure 8B)

Program:

```
title 'May No Burn Sedge Dom CTSL Depthwise';


proc mixed data=CTSL;
class canopy ash island depth;
model CTSLdepthwise = canopy|ash|depth;
random island;
repeated depth/subject = canopy*ash type=cs;
lsmeans depth|canopy|ash / adjust=tukey;

RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	96	1.98	0.1623
ash	1	96	0.38	0.5378
canopy*ash	1	96	3.10	0.0815
depth	4	96	4.30	0.0030
canopy*depth	4	96	0.64	0.6322
ash*depth	4	96	0.13	0.9702
canopy*ash*depth	4	96	0.17	0.9509

Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
depth			10	38.4012	8.1914	96	4.69	<.0001
depth			14	36.8626	8.1291	96	4.53	<.0001
depth			18	40.8107	8.2521	96	4.95	<.0001
depth			2	59.8372	8.1291	96	7.36	<.0001
depth			6	46.8336	8.1291	96	5.76	<.0001
canopy	Canopy			47.4180	7.3591	96	6.44	<.0001
canopy	NoCanopy			41.6801	7.3700	96	5.66	<.0001
canopy*depth	Canopy		10	42.6490	9.2859	96	4.59	<.0001
canopy*depth	Canopy		14	36.9868	9.2859	96	3.98	0.0001

Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*depth	Canopy		18	39.7941	9.5024	96	4.19	<.0001
canopy*depth	Canopy		2	62.5828	9.2859	96	6.74	<.0001
canopy*depth	Canopy		6	55.0773	9.2859	96	5.93	<.0001
canopy*depth	NoCanopy		10	34.1534	9.5024	96	3.59	0.0005
canopy*depth	NoCanopy		14	36.7384	9.2859	96	3.96	0.0001
canopy*depth	NoCanopy		18	41.8273	9.5024	96	4.40	<.0001
canopy*depth	NoCanopy		2	57.0916	9.2859	96	6.15	<.0001
canopy*depth	NoCanopy		6	38.5900	9.2859	96	4.16	<.0001
ash		Ash		45.8094	7.3704	96	6.22	<.0001
ash		NoAsh		43.2887	7.3591	96	5.88	<.0001
ash*depth		Ash	10	42.4012	9.5024	96	4.46	<.0001
ash*depth		Ash	14	38.2809	9.2859	96	4.12	<.0001
ash*depth		Ash	18	41.4663	9.5024	96	4.36	<.0001
ash*depth		Ash	2	60.4636	9.2859	96	6.51	<.0001
ash*depth		Ash	6	46.4349	9.2859	96	5.00	<.0001
ash*depth		NoAsh	10	34.4012	9.2859	96	3.70	0.0004
ash*depth		NoAsh	14	35.4443	9.2859	96	3.82	0.0002
ash*depth		NoAsh	18	40.1551	9.5024	96	4.23	<.0001
ash*depth		NoAsh	2	59.2108	9.2859	96	6.38	<.0001
ash*depth		NoAsh	6	47.2323	9.2859	96	5.09	<.0001
canopy*ash	Canopy	Ash		52.2653	7.9185	96	6.60	<.0001
canopy*ash	Canopy	NoAsh		42.5706	7.8773	96	5.40	<.0001
canopy*ash	NoCanopy	Ash		39.3534	7.9185	96	4.97	<.0001
canopy*ash	NoCanopy	NoAsh		44.0069	7.9185	96	5.56	<.0001
canopy*ash*depth	Canopy	Ash	10	52.9415	11.2481	96	4.71	<.0001
canopy*ash*depth	Canopy	Ash	14	40.7781	11.2481	96	3.63	0.0005
canopy*ash*depth	Canopy	Ash	18	42.0993	11.9495	96	3.52	0.0007
canopy*ash*depth	Canopy	Ash	2	68.0519	11.2481	96	6.05	<.0001
canopy*ash*depth	Canopy	Ash	6	57.4558	11.2481	96	5.11	<.0001
canopy*ash*depth	Canopy	NoAsh	10	32.3565	11.2481	96	2.88	0.0050
canopy*ash*depth	Canopy	NoAsh	14	33.1954	11.2481	96	2.95	0.0040

Least Squares Means								
Effect	canopy	ash	depth	Estimate	Standard Error	DF	t Value	Pr > |t|
canopy*ash*depth	Canopy	NoAsh	18	37.4890	11.2481	96	3.33	0.0012
canopy*ash*depth	Canopy	NoAsh	2	57.1137	11.2481	96	5.08	<.0001
canopy*ash*depth	Canopy	NoAsh	6	52.6987	11.2481	96	4.69	<.0001
canopy*ash*depth	NoCanopy	Ash	10	31.8608	11.9495	96	2.67	0.0090
canopy*ash*depth	NoCanopy	Ash	14	35.7837	11.2481	96	3.18	0.0020
canopy*ash*depth	NoCanopy	Ash	18	40.8333	11.2481	96	3.63	0.0005
canopy*ash*depth	NoCanopy	Ash	2	52.8753	11.2481	96	4.70	<.0001
canopy*ash*depth	NoCanopy	Ash	6	35.4139	11.2481	96	3.15	0.0022
canopy*ash*depth	NoCanopy	NoAsh	10	36.4459	11.2481	96	3.24	0.0016
canopy*ash*depth	NoCanopy	NoAsh	14	37.6932	11.2481	96	3.35	0.0012
canopy*ash*depth	NoCanopy	NoAsh	18	42.8213	11.9495	96	3.58	0.0005
canopy*ash*depth	NoCanopy	NoAsh	2	61.3079	11.2481	96	5.45	<.0001
canopy*ash*depth	NoCanopy	NoAsh	6	41.7660	11.2481	96	3.71	0.0003

Differences of Least Squares Means											
Effect	canopy	ash	depth	_canopy	_ash	_depth	Estimate	Standard Error	DF	t Value	Pr > |t|
depth			10			14	1.5386	6.4272	96	0.24	0.8113
depth			10			18	-2.4095	6.5821	96	-0.37	0.7151
depth			10			2	-21.4360	6.4272	96	-3.34	0.0012
depth			10			6	-8.4324	6.4272	96	-1.31	0.1927
depth			14			18	-3.9481	6.5044	96	-0.61	0.5453
depth			14			2	-22.9746	6.3476	96	-3.62	0.0005
depth			14			6	-9.9710	6.3476	96	-1.57	0.1195
depth			18			2	-19.0265	6.5044	96	-2.93	0.0043
depth			18			6	-6.0229	6.5044	96	-0.93	0.3568
depth			2			6	13.0036	6.3476	96	2.05	0.0432
canopy	Canopy			NoCanopy			5.7379	4.0746	96	1.41	0.1623
canopy*depth	Canopy		10	Canopy		14	5.6623	8.9769	96	0.63	0.5297
canopy*depth	Canopy		10	Canopy		18	2.8549	9.2007	96	0.31	0.7570
canopy*depth	Canopy		10	Canopy		2	-19.9338	8.9769	96	-2.22	0.0287
canopy*depth	Canopy		10	Canopy		6	-12.4283	8.9769	96	-1.38	0.1694
canopy*depth	Canopy		10	NoCanopy		10	8.4956	9.2007	96	0.92	0.3581
canopy*depth	Canopy		10	NoCanopy		14	5.9106	8.9769	96	0.66	0.5118
canopy*depth	Canopy		10	NoCanopy		18	0.8217	9.2007	96	0.09	0.9290

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*depth	Canopy		10	NoCanopy		2	-14.4426	8.9769	96	-1.61	0.1109
canopy*depth	Canopy		10	NoCanopy		6	4.0591	8.9769	96	0.45	0.6522
canopy*depth	Canopy		14	Canopy		18	-2.8074	9.2007	96	-0.31	0.7609
canopy*depth	Canopy		14	Canopy		2	-25.5960	8.9769	96	-2.85	0.0053
canopy*depth	Canopy		14	Canopy		6	-18.0905	8.9769	96	-2.02	0.0467
canopy*depth	Canopy		14	NoCanopy		10	2.8334	9.2007	96	0.31	0.7588
canopy*depth	Canopy		14	NoCanopy		14	0.2483	8.9769	96	0.03	0.9780
canopy*depth	Canopy		14	NoCanopy		18	-4.8405	9.2007	96	-0.53	0.6000
canopy*depth	Canopy		14	NoCanopy		2	-20.1049	8.9769	96	-2.24	0.0274
canopy*depth	Canopy		14	NoCanopy		6	-1.6032	8.9769	96	-0.18	0.8586
canopy*depth	Canopy		18	Canopy		2	-22.7887	9.2007	96	-2.48	0.0150
canopy*depth	Canopy		18	Canopy		6	-15.2832	9.2007	96	-1.66	0.1000
canopy*depth	Canopy		18	NoCanopy		10	5.6407	9.4151	96	0.60	0.5505
canopy*depth	Canopy		18	NoCanopy		14	3.0557	9.2007	96	0.33	0.7405
canopy*depth	Canopy		18	NoCanopy		18	-2.0332	9.4232	96	-0.22	0.8296
canopy*depth	Canopy		18	NoCanopy		2	-17.2975	9.2007	96	-1.88	0.0631
canopy*depth	Canopy		18	NoCanopy		6	1.2042	9.2007	96	0.13	0.8961
canopy*depth	Canopy		2	Canopy		6	7.5055	8.9769	96	0.84	0.4052
canopy*depth	Canopy		2	NoCanopy		10	28.4294	9.2007	96	3.09	0.0026
canopy*depth	Canopy		2	NoCanopy		14	25.8444	8.9769	96	2.88	0.0049
canopy*depth	Canopy		2	NoCanopy		18	20.7555	9.2007	96	2.26	0.0263
canopy*depth	Canopy		2	NoCanopy		2	5.4912	8.9769	96	0.61	0.5422
canopy*depth	Canopy		2	NoCanopy		6	23.9928	8.9769	96	2.67	0.0088
canopy*depth	Canopy		6	NoCanopy		10	20.9239	9.2007	96	2.27	0.0252
canopy*depth	Canopy		6	NoCanopy		14	18.3389	8.9769	96	2.04	0.0438
canopy*depth	Canopy		6	NoCanopy		18	13.2500	9.2007	96	1.44	0.1531
canopy*depth	Canopy		6	NoCanopy		2	-2.0143	8.9769	96	-0.22	0.8229
canopy*depth	Canopy		6	NoCanopy		6	16.4873	8.9769	96	1.84	0.0694
canopy*depth	NoCanopy		10	NoCanopy		14	-2.5850	9.2007	96	-0.28	0.7793
canopy*depth	NoCanopy		10	NoCanopy		18	-7.6739	9.4232	96	-0.81	0.4175
canopy*depth	NoCanopy		10	NoCanopy		2	-22.9382	9.2007	96	-2.49	0.0144
canopy*depth	NoCanopy		10	NoCanopy		6	-4.4366	9.2007	96	-0.48	0.6308
canopy*depth	NoCanopy		14	NoCanopy		18	-5.0889	9.2007	96	-0.55	0.5815
canopy*depth	NoCanopy		14	NoCanopy		2	-20.3532	8.9769	96	-2.27	0.0256
canopy*depth	NoCanopy		14	NoCanopy		6	-1.8515	8.9769	96	-0.21	0.8370
canopy*depth	NoCanopy		18	NoCanopy		2	-15.2643	9.2007	96	-1.66	0.1004
canopy*depth	NoCanopy		18	NoCanopy		6	3.2373	9.2007	96	0.35	0.7257
canopy*depth	NoCanopy		2	NoCanopy		6	18.5017	8.9769	96	2.06	0.0420
ash		Ash			NoAsh		2.5206	4.0761	96	0.62	0.5378

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
ash*depth		Ash	10		Ash	14	4.1203	9.2007	96	0.45	0.6553
ash*depth		Ash	10		Ash	18	0.9349	9.4151	96	0.10	0.9211
ash*depth		Ash	10		Ash	2	-18.0624	9.2007	96	-1.96	0.0525
ash*depth		Ash	10		Ash	6	-4.0337	9.2007	96	-0.44	0.6621
ash*depth		Ash	10		NoAsh	10	8.0000	9.2007	96	0.87	0.3867
ash*depth		Ash	10		NoAsh	14	6.9569	9.2007	96	0.76	0.4514
ash*depth		Ash	10		NoAsh	18	2.2461	9.4232	96	0.24	0.8121
ash*depth		Ash	10		NoAsh	2	-16.8096	9.2007	96	-1.83	0.0708
ash*depth		Ash	10		NoAsh	6	-4.8312	9.2007	96	-0.53	0.6007
ash*depth		Ash	14		Ash	18	-3.1854	9.2007	96	-0.35	0.7299
ash*depth		Ash	14		Ash	2	-22.1827	8.9769	96	-2.47	0.0152
ash*depth		Ash	14		Ash	6	-8.1540	8.9769	96	-0.91	0.3660
ash*depth		Ash	14		NoAsh	10	3.8797	8.9769	96	0.43	0.6666
ash*depth		Ash	14		NoAsh	14	2.8366	8.9769	96	0.32	0.7527
ash*depth		Ash	14		NoAsh	18	-1.8742	9.2007	96	-0.20	0.8390
ash*depth		Ash	14		NoAsh	2	-20.9299	8.9769	96	-2.33	0.0218
ash*depth		Ash	14		NoAsh	6	-8.9514	8.9769	96	-1.00	0.3212
ash*depth		Ash	18		Ash	2	-18.9973	9.2007	96	-2.06	0.0416
ash*depth		Ash	18		Ash	6	-4.9686	9.2007	96	-0.54	0.5904
ash*depth		Ash	18		NoAsh	10	7.0651	9.2007	96	0.77	0.4444
ash*depth		Ash	18		NoAsh	14	6.0220	9.2007	96	0.65	0.5143
ash*depth		Ash	18		NoAsh	18	1.3112	9.4232	96	0.14	0.8896
ash*depth		Ash	18		NoAsh	2	-17.7445	9.2007	96	-1.93	0.0567
ash*depth		Ash	18		NoAsh	6	-5.7660	9.2007	96	-0.63	0.5323
ash*depth		Ash	2		Ash	6	14.0287	8.9769	96	1.56	0.1214
ash*depth		Ash	2		NoAsh	10	26.0624	8.9769	96	2.90	0.0046
ash*depth		Ash	2		NoAsh	14	25.0193	8.9769	96	2.79	0.0064
ash*depth		Ash	2		NoAsh	18	20.3085	9.2007	96	2.21	0.0297
ash*depth		Ash	2		NoAsh	2	1.2528	8.9769	96	0.14	0.8893
ash*depth		Ash	2		NoAsh	6	13.2312	8.9769	96	1.47	0.1438
ash*depth		Ash	6		NoAsh	10	12.0337	8.9769	96	1.34	0.1832
ash*depth		Ash	6		NoAsh	14	10.9906	8.9769	96	1.22	0.2238
ash*depth		Ash	6		NoAsh	18	6.2798	9.2007	96	0.68	0.4965
ash*depth		Ash	6		NoAsh	2	-12.7759	8.9769	96	-1.42	0.1579
ash*depth		Ash	6		NoAsh	6	-0.7975	8.9769	96	-0.09	0.9294
ash*depth		NoAsh	10		NoAsh	14	-1.0430	8.9769	96	-0.12	0.9077
ash*depth		NoAsh	10		NoAsh	18	-5.7539	9.2007	96	-0.63	0.5332
ash*depth		NoAsh	10		NoAsh	2	-24.8096	8.9769	96	-2.76	0.0069
ash*depth		NoAsh	10		NoAsh	6	-12.8311	8.9769	96	-1.43	0.1562

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
ash*depth		NoAsh	14		NoAsh	18	-4.7109	9.2007	96	-0.51	0.6098
ash*depth		NoAsh	14		NoAsh	2	-23.7666	8.9769	96	-2.65	0.0095
ash*depth		NoAsh	14		NoAsh	6	-11.7881	8.9769	96	-1.31	0.1923
ash*depth		NoAsh	18		NoAsh	2	-19.0557	9.2007	96	-2.07	0.0410
ash*depth		NoAsh	18		NoAsh	6	-7.0772	9.2007	96	-0.77	0.4437
ash*depth		NoAsh	2		NoAsh	6	11.9785	8.9769	96	1.33	0.1852
canopy*ash	Canopy	Ash		Canopy	NoAsh		9.6947	5.7345	96	1.69	0.0942
canopy*ash	Canopy	Ash		NoCanopy	Ash		12.9119	5.7899	96	2.23	0.0281
canopy*ash	Canopy	Ash		NoCanopy	NoAsh		8.2585	5.7920	96	1.43	0.1572
canopy*ash	Canopy	NoAsh		NoCanopy	Ash		3.2172	5.7345	96	0.56	0.5761
canopy*ash	Canopy	NoAsh		NoCanopy	NoAsh		-1.4362	5.7345	96	-0.25	0.8028
canopy*ash	NoCanopy	Ash		NoCanopy	NoAsh		-4.6535	5.7920	96	-0.80	0.4237
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	14	12.1634	12.6953	96	0.96	0.3404
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	18	10.8422	13.3207	96	0.81	0.4177
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	2	-15.1104	12.6953	96	-1.19	0.2369
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	6	-4.5143	12.6953	96	-0.36	0.7229
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	10	20.5850	12.6953	96	1.62	0.1082
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	14	19.7461	12.6953	96	1.56	0.1231
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	18	15.4525	12.6953	96	1.22	0.2265
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	2	-4.1722	12.6953	96	-0.33	0.7431
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	6	0.2428	12.6953	96	0.02	0.9848
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	10	21.0807	13.3207	96	1.58	0.1168
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	14	17.1578	12.6953	96	1.35	0.1797
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	18	12.1082	12.6953	96	0.95	0.3426
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	2	0.06623	12.6953	96	0.01	0.9958
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	6	17.5276	12.6953	96	1.38	0.1706
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	10	16.4956	12.6953	96	1.30	0.1969
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	14	15.2483	12.6953	96	1.20	0.2327
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	18	10.1202	13.3207	96	0.76	0.4493
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	2	-8.3664	12.6953	96	-0.66	0.5115
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	6	11.1755	12.6953	96	0.88	0.3809
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	18	-1.3211	13.3207	96	-0.10	0.9212
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	2	-27.2737	12.6953	96	-2.15	0.0342
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	6	-16.6777	12.6953	96	-1.31	0.1921
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	10	8.4216	12.6953	96	0.66	0.5087
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	14	7.5828	12.6953	96	0.60	0.5517
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	18	3.2892	12.6953	96	0.26	0.7961
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	2	-16.3355	12.6953	96	-1.29	0.2013
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	6	-11.9205	12.6953	96	-0.94	0.3501

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	10	8.9173	13.3207	96	0.67	0.5048
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	14	4.9945	12.6953	96	0.39	0.6949
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	18	-0.05519	12.6953	96	-0.00	0.9965
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	2	-12.0971	12.6953	96	-0.95	0.3430
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	6	5.3642	12.6953	96	0.42	0.6736
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	10	4.3322	12.6953	96	0.34	0.7337
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	14	3.0850	12.6953	96	0.24	0.8085
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	18	-2.0431	13.3207	96	-0.15	0.8784
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	2	-20.5298	12.6953	96	-1.62	0.1091
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	6	-0.9879	12.6953	96	-0.08	0.9381
canopy*ash*depth	Canopy	Ash	18	Canopy	Ash	2	-25.9526	13.3207	96	-1.95	0.0543
canopy*ash*depth	Canopy	Ash	18	Canopy	Ash	6	-15.3566	13.3207	96	-1.15	0.2518
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	10	9.7427	13.3207	96	0.73	0.4663
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	14	8.9039	13.3207	96	0.67	0.5055
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	18	4.6103	13.3207	96	0.35	0.7300
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	2	-15.0144	13.3207	96	-1.13	0.2625
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	6	-10.5994	13.3207	96	-0.80	0.4282
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	10	10.2384	13.9070	96	0.74	0.4634
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	14	6.3156	13.3207	96	0.47	0.6365
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	18	1.2659	13.3207	96	0.10	0.9245
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	2	-10.7760	13.3207	96	-0.81	0.4205
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	6	6.6854	13.3207	96	0.50	0.6169
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	10	5.6533	13.3207	96	0.42	0.6722
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	14	4.4061	13.3207	96	0.33	0.7415
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	18	-0.7220	13.9289	96	-0.05	0.9588
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	2	-19.2087	13.3207	96	-1.44	0.1526
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	6	0.3333	13.3207	96	0.03	0.9801
canopy*ash*depth	Canopy	Ash	2	Canopy	Ash	6	10.5960	12.6953	96	0.83	0.4060
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	10	35.6954	12.6953	96	2.81	0.0060
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	14	34.8565	12.6953	96	2.75	0.0072
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	18	30.5629	12.6953	96	2.41	0.0180
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	2	10.9382	12.6953	96	0.86	0.3911
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	6	15.3532	12.6953	96	1.21	0.2295
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	10	36.1910	13.3207	96	2.72	0.0078
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	14	32.2682	12.6953	96	2.54	0.0126
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	18	27.2185	12.6953	96	2.14	0.0346
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	2	15.1766	12.6953	96	1.20	0.2349
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	6	32.6380	12.6953	96	2.57	0.0117
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	10	31.6060	12.6953	96	2.49	0.0145

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	14	30.3587	12.6953	96	2.39	0.0187
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	18	25.2306	13.3207	96	1.89	0.0612
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	2	6.7439	12.6953	96	0.53	0.5965
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	6	26.2859	12.6953	96	2.07	0.0411
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	10	25.0993	12.6953	96	1.98	0.0509
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	14	24.2605	12.6953	96	1.91	0.0590
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	18	19.9669	12.6953	96	1.57	0.1191
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	2	0.3422	12.6953	96	0.03	0.9786
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	6	4.7572	12.6953	96	0.37	0.7087
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	10	25.5950	13.3207	96	1.92	0.0576
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	14	21.6722	12.6953	96	1.71	0.0910
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	18	16.6225	12.6953	96	1.31	0.1935
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	2	4.5806	12.6953	96	0.36	0.7190
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	6	22.0419	12.6953	96	1.74	0.0857
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	10	21.0099	12.6953	96	1.65	0.1012
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	14	19.7627	12.6953	96	1.56	0.1228
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	18	14.6346	13.3207	96	1.10	0.2747
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	2	-3.8521	12.6953	96	-0.30	0.7622
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	6	15.6898	12.6953	96	1.24	0.2195
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	14	-0.8389	12.6953	96	-0.07	0.9475
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	18	-5.1325	12.6953	96	-0.40	0.6869
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	2	-24.7572	12.6953	96	-1.95	0.0541
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	6	-20.3422	12.6953	96	-1.60	0.1124
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	10	0.4957	13.3207	96	0.04	0.9704
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	14	-3.4272	12.6953	96	-0.27	0.7878
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	18	-8.4768	12.6953	96	-0.67	0.5059
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	2	-20.5188	12.6953	96	-1.62	0.1093
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	6	-3.0574	12.6953	96	-0.24	0.8102
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	10	-4.0894	12.6953	96	-0.32	0.7481
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	14	-5.3366	12.6953	96	-0.42	0.6752
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	18	-10.4648	13.3207	96	-0.79	0.4340
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	2	-28.9514	12.6953	96	-2.28	0.0248
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	6	-9.4095	12.6953	96	-0.74	0.4604
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	18	-4.2936	12.6953	96	-0.34	0.7359
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	2	-23.9183	12.6953	96	-1.88	0.0626
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	6	-19.5033	12.6953	96	-1.54	0.1278
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	10	1.3345	13.3207	96	0.10	0.9204
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	14	-2.5883	12.6953	96	-0.20	0.8389
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	18	-7.6380	12.6953	96	-0.60	0.5488

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	2	-19.6799	12.6953	96	-1.55	0.1244
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	6	-2.2185	12.6953	96	-0.17	0.8616
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	10	-3.2506	12.6953	96	-0.26	0.7985
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	14	-4.4978	12.6953	96	-0.35	0.7239
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	18	-9.6259	13.3207	96	-0.72	0.4717
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	2	-28.1126	12.6953	96	-2.21	0.0292
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	6	-8.5706	12.6953	96	-0.68	0.5012
canopy*ash*depth	Canopy	NoAsh	18	Canopy	NoAsh	2	-19.6247	12.6953	96	-1.55	0.1254
canopy*ash*depth	Canopy	NoAsh	18	Canopy	NoAsh	6	-15.2097	12.6953	96	-1.20	0.2338
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	10	5.6281	13.3207	96	0.42	0.6736
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	14	1.7053	12.6953	96	0.13	0.8934
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	18	-3.3444	12.6953	96	-0.26	0.7928
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	2	-15.3863	12.6953	96	-1.21	0.2285
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	6	2.0751	12.6953	96	0.16	0.8705
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	10	1.0430	12.6953	96	0.08	0.9347
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	14	-0.2042	12.6953	96	-0.02	0.9872
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	18	-5.3323	13.3207	96	-0.40	0.6898
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	2	-23.8190	12.6953	96	-1.88	0.0637
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	6	-4.2770	12.6953	96	-0.34	0.7369
canopy*ash*depth	Canopy	NoAsh	2	Canopy	NoAsh	6	4.4150	12.6953	96	0.35	0.7288
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	10	25.2528	13.3207	96	1.90	0.0610
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	14	21.3300	12.6953	96	1.68	0.0962
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	18	16.2804	12.6953	96	1.28	0.2028
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	2	4.2384	12.6953	96	0.33	0.7392
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	6	21.6998	12.6953	96	1.71	0.0906
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	10	20.6678	12.6953	96	1.63	0.1068
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	14	19.4205	12.6953	96	1.53	0.1294
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	18	14.2924	13.3207	96	1.07	0.2860
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	2	-4.1943	12.6953	96	-0.33	0.7418
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	6	15.3477	12.6953	96	1.21	0.2297
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	10	20.8378	13.3207	96	1.56	0.1210
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	14	16.9150	12.6953	96	1.33	0.1859
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	18	11.8653	12.6953	96	0.93	0.3523
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	2	-0.1766	12.6953	96	-0.01	0.9889
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	6	17.2848	12.6953	96	1.36	0.1765
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	10	16.2528	12.6953	96	1.28	0.2036
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	14	15.0055	12.6953	96	1.18	0.2401
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	18	9.8774	13.3207	96	0.74	0.4602
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	2	-8.6093	12.6953	96	-0.68	0.4993

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	6	10.9327	12.6953	96	0.86	0.3913
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	14	-3.9228	13.3207	96	-0.29	0.7690
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	18	-8.9725	13.3207	96	-0.67	0.5022
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	2	-21.0144	13.3207	96	-1.58	0.1180
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	6	-3.5531	13.3207	96	-0.27	0.7902
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	10	-4.5851	13.3207	96	-0.34	0.7314
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	14	-5.8323	13.3207	96	-0.44	0.6625
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	18	-10.9604	13.9289	96	-0.79	0.4333
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	2	-29.4471	13.3207	96	-2.21	0.0294
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	6	-9.9052	13.3207	96	-0.74	0.4589
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	18	-5.0497	12.6953	96	-0.40	0.6917
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	2	-17.0916	12.6953	96	-1.35	0.1814
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	6	0.3698	12.6953	96	0.03	0.9768
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	10	-0.6623	12.6953	96	-0.05	0.9585
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	14	-1.9095	12.6953	96	-0.15	0.8808
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	18	-7.0376	13.3207	96	-0.53	0.5985
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	2	-25.5243	12.6953	96	-2.01	0.0472
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	6	-5.9823	12.6953	96	-0.47	0.6385
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	Ash	2	-12.0419	12.6953	96	-0.95	0.3452
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	Ash	6	5.4194	12.6953	96	0.43	0.6704
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	10	4.3874	12.6953	96	0.35	0.7304
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	14	3.1402	12.6953	96	0.25	0.8052
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	18	-1.9879	13.3207	96	-0.15	0.8817
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	2	-20.4746	12.6953	96	-1.61	0.1101
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	6	-0.9327	12.6953	96	-0.07	0.9416
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	Ash	6	17.4614	12.6953	96	1.38	0.1722
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	10	16.4294	12.6953	96	1.29	0.1987
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	14	15.1821	12.6953	96	1.20	0.2347
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	18	10.0540	13.3207	96	0.75	0.4522
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	2	-8.4327	12.6953	96	-0.66	0.5081
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	6	11.1093	12.6953	96	0.88	0.3837
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	10	-1.0320	12.6953	96	-0.08	0.9354
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	14	-2.2792	12.6953	96	-0.18	0.8579
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	18	-7.4074	13.3207	96	-0.56	0.5794
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	2	-25.8940	12.6953	96	-2.04	0.0441
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	6	-6.3521	12.6953	96	-0.50	0.6180
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	14	-1.2472	12.6953	96	-0.10	0.9219
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	18	-6.3754	13.3207	96	-0.48	0.6333
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	2	-24.8620	12.6953	96	-1.96	0.0531

Differences of Least Squares Means											
Effect	canopy	ash	depth	_canopy	_ash	_depth	Estimate	Standard Error	DF	t Value	Pr > |t|
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	6	-5.3201	12.6953	96	-0.42	0.6761
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	18	-5.1281	13.3207	96	-0.38	0.7011
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	2	-23.6148	12.6953	96	-1.86	0.0659
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	6	-4.0728	12.6953	96	-0.32	0.7490
canopy*ash*depth	NoCanopy	NoAsh	18	NoCanopy	NoAsh	2	-18.4867	13.3207	96	-1.39	0.1684
canopy*ash*depth	NoCanopy	NoAsh	18	NoCanopy	NoAsh	6	1.0553	13.3207	96	0.08	0.9370
canopy*ash*depth	NoCanopy	NoAsh	2	NoCanopy	NoAsh	6	19.5419	12.6953	96	1.54	0.1270

Differences of Least Squares Means								
Effect	canopy	ash	depth	_canopy	_ash	_depth	Adjustment	Adj P
depth			10			14	Tukey-Kramer	0.9993
depth			10			18	Tukey-Kramer	0.9961
depth			10			2	Tukey-Kramer	0.0104
depth			10			6	Tukey-Kramer	0.6845
depth			14			18	Tukey-Kramer	0.9737
depth			14			2	Tukey-Kramer	0.0042
depth			14			6	Tukey-Kramer	0.5196
depth			18			2	Tukey-Kramer	0.0341
depth			18			6	Tukey-Kramer	0.8862
depth			2			6	Tukey-Kramer	0.2512
canopy	Canopy			NoCanopy			Tukey-Kramer	0.1623
canopy*depth	Canopy		10	Canopy		14	Tukey-Kramer	0.9998
canopy*depth	Canopy		10	Canopy		18	Tukey-Kramer	1.0000
canopy*depth	Canopy		10	Canopy		2	Tukey-Kramer	0.4503
canopy*depth	Canopy		10	Canopy		6	Tukey-Kramer	0.9291
canopy*depth	Canopy		10	NoCanopy		10	Tukey-Kramer	0.9953
canopy*depth	Canopy		10	NoCanopy		14	Tukey-Kramer	0.9997
canopy*depth	Canopy		10	NoCanopy		18	Tukey-Kramer	1.0000
canopy*depth	Canopy		10	NoCanopy		2	Tukey-Kramer	0.8406
canopy*depth	Canopy		10	NoCanopy		6	Tukey-Kramer	1.0000
canopy*depth	Canopy		14	Canopy		18	Tukey-Kramer	1.0000
canopy*depth	Canopy		14	Canopy		2	Tukey-Kramer	0.1345
canopy*depth	Canopy		14	Canopy		6	Tukey-Kramer	0.5907

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*depth	Canopy		14	NoCanopy		10	Tukey-Kramer	1.0000
canopy*depth	Canopy		14	NoCanopy		14	Tukey-Kramer	1.0000
canopy*depth	Canopy		14	NoCanopy		18	Tukey-Kramer	0.9999
canopy*depth	Canopy		14	NoCanopy		2	Tukey-Kramer	0.4377
canopy*depth	Canopy		14	NoCanopy		6	Tukey-Kramer	1.0000
canopy*depth	Canopy		18	Canopy		2	Tukey-Kramer	0.2943
canopy*depth	Canopy		18	Canopy		6	Tukey-Kramer	0.8140
canopy*depth	Canopy		18	NoCanopy		10	Tukey-Kramer	0.9998
canopy*depth	Canopy		18	NoCanopy		14	Tukey-Kramer	1.0000
canopy*depth	Canopy		18	NoCanopy		18	Tukey-Kramer	1.0000
canopy*depth	Canopy		18	NoCanopy		2	Tukey-Kramer	0.6822
canopy*depth	Canopy		18	NoCanopy		6	Tukey-Kramer	1.0000
canopy*depth	Canopy		2	Canopy		6	Tukey-Kramer	0.9978
canopy*depth	Canopy		2	NoCanopy		10	Tukey-Kramer	0.0747
canopy*depth	Canopy		2	NoCanopy		14	Tukey-Kramer	0.1261
canopy*depth	Canopy		2	NoCanopy		18	Tukey-Kramer	0.4271
canopy*depth	Canopy		2	NoCanopy		2	Tukey-Kramer	0.9998
canopy*depth	Canopy		2	NoCanopy		6	Tukey-Kramer	0.1999
canopy*depth	Canopy		6	NoCanopy		10	Tukey-Kramer	0.4152
canopy*depth	Canopy		6	NoCanopy		14	Tukey-Kramer	0.5716
canopy*depth	Canopy		6	NoCanopy		18	Tukey-Kramer	0.9112
canopy*depth	Canopy		6	NoCanopy		2	Tukey-Kramer	1.0000
canopy*depth	Canopy		6	NoCanopy		6	Tukey-Kramer	0.7104
canopy*depth	NoCanopy		10	NoCanopy		14	Tukey-Kramer	1.0000
canopy*depth	NoCanopy		10	NoCanopy		18	Tukey-Kramer	0.9982
canopy*depth	NoCanopy		10	NoCanopy		2	Tukey-Kramer	0.2855
canopy*depth	NoCanopy		10	NoCanopy		6	Tukey-Kramer	1.0000
canopy*depth	NoCanopy		14	NoCanopy		18	Tukey-Kramer	0.9999
canopy*depth	NoCanopy		14	NoCanopy		2	Tukey-Kramer	0.4197
canopy*depth	NoCanopy		14	NoCanopy		6	Tukey-Kramer	1.0000
canopy*depth	NoCanopy		18	NoCanopy		2	Tukey-Kramer	0.8151
canopy*depth	NoCanopy		18	NoCanopy		6	Tukey-Kramer	1.0000

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*depth	NoCanopy		2	NoCanopy		6	Tukey-Kramer	0.5590
ash		Ash			NoAsh		Tukey-Kramer	0.5378
ash*depth		Ash	10		Ash	14	Tukey-Kramer	1.0000
ash*depth		Ash	10		Ash	18	Tukey-Kramer	1.0000
ash*depth		Ash	10		Ash	2	Tukey-Kramer	0.6264
ash*depth		Ash	10		Ash	6	Tukey-Kramer	1.0000
ash*depth		Ash	10		NoAsh	10	Tukey-Kramer	0.9970
ash*depth		Ash	10		NoAsh	14	Tukey-Kramer	0.9990
ash*depth		Ash	10		NoAsh	18	Tukey-Kramer	1.0000
ash*depth		Ash	10		NoAsh	2	Tukey-Kramer	0.7166
ash*depth		Ash	10		NoAsh	6	Tukey-Kramer	1.0000
ash*depth		Ash	14		Ash	18	Tukey-Kramer	1.0000
ash*depth		Ash	14		Ash	2	Tukey-Kramer	0.2974
ash*depth		Ash	14		Ash	6	Tukey-Kramer	0.9959
ash*depth		Ash	14		NoAsh	10	Tukey-Kramer	1.0000
ash*depth		Ash	14		NoAsh	14	Tukey-Kramer	1.0000
ash*depth		Ash	14		NoAsh	18	Tukey-Kramer	1.0000
ash*depth		Ash	14		NoAsh	2	Tukey-Kramer	0.3789
ash*depth		Ash	14		NoAsh	6	Tukey-Kramer	0.9918
ash*depth		Ash	18		Ash	2	Tukey-Kramer	0.5564
ash*depth		Ash	18		Ash	6	Tukey-Kramer	0.9999
ash*depth		Ash	18		NoAsh	10	Tukey-Kramer	0.9989
ash*depth		Ash	18		NoAsh	14	Tukey-Kramer	0.9997
ash*depth		Ash	18		NoAsh	18	Tukey-Kramer	1.0000
ash*depth		Ash	18		NoAsh	2	Tukey-Kramer	0.6498
ash*depth		Ash	18		NoAsh	6	Tukey-Kramer	0.9998
ash*depth		Ash	2		Ash	6	Tukey-Kramer	0.8623
ash*depth		Ash	2		NoAsh	10	Tukey-Kramer	0.1190
ash*depth		Ash	2		NoAsh	14	Tukey-Kramer	0.1558
ash*depth		Ash	2		NoAsh	18	Tukey-Kramer	0.4591
ash*depth		Ash	2		NoAsh	2	Tukey-Kramer	1.0000
ash*depth		Ash	2		NoAsh	6	Tukey-Kramer	0.8991

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
ash*depth		Ash	6		NoAsh	10	Tukey-Kramer	0.9414
ash*depth		Ash	6		NoAsh	14	Tukey-Kramer	0.9666
ash*depth		Ash	6		NoAsh	18	Tukey-Kramer	0.9996
ash*depth		Ash	6		NoAsh	2	Tukey-Kramer	0.9169
ash*depth		Ash	6		NoAsh	6	Tukey-Kramer	1.0000
ash*depth		NoAsh	10		NoAsh	14	Tukey-Kramer	1.0000
ash*depth		NoAsh	10		NoAsh	18	Tukey-Kramer	0.9998
ash*depth		NoAsh	10		NoAsh	2	Tukey-Kramer	0.1642
ash*depth		NoAsh	10		NoAsh	6	Tukey-Kramer	0.9149
ash*depth		NoAsh	14		NoAsh	18	Tukey-Kramer	1.0000
ash*depth		NoAsh	14		NoAsh	2	Tukey-Kramer	0.2107
ash*depth		NoAsh	14		NoAsh	6	Tukey-Kramer	0.9483
ash*depth		NoAsh	18		NoAsh	2	Tukey-Kramer	0.5521
ash*depth		NoAsh	18		NoAsh	6	Tukey-Kramer	0.9989
ash*depth		NoAsh	2		NoAsh	6	Tukey-Kramer	0.9430
canopy*ash	Canopy	Ash		Canopy	NoAsh		Tukey-Kramer	0.3343
canopy*ash	Canopy	Ash		NoCanopy	Ash		Tukey-Kramer	0.1225
canopy*ash	Canopy	Ash		NoCanopy	NoAsh		Tukey-Kramer	0.4865
canopy*ash	Canopy	NoAsh		NoCanopy	Ash		Tukey-Kramer	0.9433
canopy*ash	Canopy	NoAsh		NoCanopy	NoAsh		Tukey-Kramer	0.9944
canopy*ash	NoCanopy	Ash		NoCanopy	NoAsh		Tukey-Kramer	0.8527
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	2	Tukey-Kramer	0.9997
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	10	Tukey-Kramer	0.9848
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	14	Tukey-Kramer	0.9903
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	18	Tukey-Kramer	0.9995
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	10	Tukey-Kramer	0.9883
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	14	Tukey-Kramer	0.9982

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	6	Tukey-Kramer	0.9976
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	10	Tukey-Kramer	0.9989
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	14	Tukey-Kramer	0.9996
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	2	Tukey-Kramer	0.8228
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	6	Tukey-Kramer	0.9987
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	2	Tukey-Kramer	0.9990
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	2	Tukey-Kramer	0.9852
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	Canopy	Ash	2	Tukey-Kramer	0.9143
canopy*ash*depth	Canopy	Ash	18	Canopy	Ash	6	Tukey-Kramer	0.9998
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	2	Tukey-Kramer	0.9998

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	2	Tukey-Kramer	0.9960
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	2	Canopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	10	Tukey-Kramer	0.3648
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	14	Tukey-Kramer	0.4090
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	18	Tukey-Kramer	0.6546
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	6	Tukey-Kramer	0.9996
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	10	Tukey-Kramer	0.4289
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	14	Tukey-Kramer	0.5559
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	18	Tukey-Kramer	0.8252
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	2	Tukey-Kramer	0.9996
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	6	Tukey-Kramer	0.5344
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	10	Tukey-Kramer	0.5945
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	14	Tukey-Kramer	0.6661
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	18	Tukey-Kramer	0.9322
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	6	Tukey-Kramer	0.8630
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	10	Tukey-Kramer	0.9036
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	14	Tukey-Kramer	0.9270
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	18	Tukey-Kramer	0.9891
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	6	Tukey-Kramer	1.0000

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	10	Tukey-Kramer	0.9235
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	14	Tukey-Kramer	0.9741
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	18	Tukey-Kramer	0.9988
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	6	Tukey-Kramer	0.9694
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	10	Tukey-Kramer	0.9811
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	14	Tukey-Kramer	0.9902
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	18	Tukey-Kramer	0.9999
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	6	Tukey-Kramer	0.9994
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	2	Tukey-Kramer	0.9136
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	6	Tukey-Kramer	0.9866
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	2	Tukey-Kramer	0.9853
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	2	Tukey-Kramer	0.7424
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	2	Tukey-Kramer	0.9353
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	6	Tukey-Kramer	0.9916
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	2	Tukey-Kramer	0.9907
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	6	Tukey-Kramer	1.0000

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	2	Tukey-Kramer	0.7843
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	Canopy	NoAsh	2	Tukey-Kramer	0.9910
canopy*ash*depth	Canopy	NoAsh	18	Canopy	NoAsh	6	Tukey-Kramer	0.9996
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	2	Tukey-Kramer	0.9996
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	2	Tukey-Kramer	0.9376
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	2	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	10	Tukey-Kramer	0.9317
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	14	Tukey-Kramer	0.9780
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	18	Tukey-Kramer	0.9991
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	6	Tukey-Kramer	0.9738
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	10	Tukey-Kramer	0.9841
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	14	Tukey-Kramer	0.9920
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	18	Tukey-Kramer	0.9999
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	6	Tukey-Kramer	0.9996
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	10	Tukey-Kramer	0.9897
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	14	Tukey-Kramer	0.9985
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	2	Tukey-Kramer	1.0000

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	6	Tukey-Kramer	0.9980
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	10	Tukey-Kramer	0.9991
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	14	Tukey-Kramer	0.9997
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	2	Tukey-Kramer	0.9887
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	2	Tukey-Kramer	0.7866
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	2	Tukey-Kramer	0.9983
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	2	Tukey-Kramer	0.8900
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	2	Tukey-Kramer	0.9856
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	Ash	6	Tukey-Kramer	0.9977
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	10	Tukey-Kramer	0.9990

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	14	Tukey-Kramer	0.9996
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	2	Tukey-Kramer	0.8774
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	2	Tukey-Kramer	0.9106
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	2	Tukey-Kramer	0.9421
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	NoAsh	18	NoCanopy	NoAsh	2	Tukey-Kramer	0.9975
canopy*ash*depth	NoCanopy	NoAsh	18	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	NoAsh	2	NoCanopy	NoAsh	6	Tukey-Kramer	0.9914

July No Burn Study Cotton Strip Analyses

July No Burn Islands CTSL 0-20 cm Average (Figure 4B)

Program:

```
title 'Total Avg CTSL July;

proc mixed data=CTSL;
        class island canopy ash;
        model TotalAvgCTSL=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
canopy	1	26	4.45	0.0448
ash	1	26	3.19	0.0860
canopy*ash	1	26	0.57	0.4557
island	3	26	0.14	0.9345
island*canopy	3	26	1.49	0.2397
island*ash	3	26	0.38	0.7666
island*canopy*ash	3	26	0.39	0.7598

Least Squares Means							
Effect	canopy	ash	Estimate	Standard Error	DF	t Value	Pr > |t|
canopy	Canopy		74.1875	2.7293	26	27.18	<.0001
canopy	NoCanopy		66.2545	2.5893	26	25.59	<.0001
ash		Ash	73.5782	2.7293	26	26.96	<.0001
ash		NoAsh	66.8638	2.5893	26	25.82	<.0001
canopy*ash	Canopy	Ash	78.9691	3.8598	26	20.46	<.0001
canopy*ash	Canopy	NoAsh	69.4059	3.8598	26	17.98	<.0001
canopy*ash	NoCanopy	Ash	68.1874	3.8598	26	17.67	<.0001
canopy*ash	NoCanopy	NoAsh	64.3217	3.4523	26	18.63	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		7.9330	3.7621	26	2.11	0.0448	Tukey-Kramer	0.0448
ash		Ash		NoAsh	6.7144	3.7621	26	1.78	0.0860	Tukey-Kramer	0.0860
canopy*ash	Canopy	Ash	Canopy	NoAsh	9.5631	5.4586	26	1.75	0.0916	Tukey-Kramer	0.3185
canopy*ash	Canopy	Ash	NoCanopy	Ash	10.7817	5.4586	26	1.98	0.0590	Tukey-Kramer	0.2231
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	14.6474	5.1785	26	2.83	0.0089	Tukey-Kramer	0.0415
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	1.2186	5.4586	26	0.22	0.8251	Tukey-Kramer	0.9960
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	5.0842	5.1785	26	0.98	0.3353	Tukey-Kramer	0.7609
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	3.8656	5.1785	26	0.75	0.4621	Tukey-Kramer	0.8773

July No Burn Islands Depthwise CTSL (Figure 7B)

Program:

```
title 'July No Burn CTSL Depthwise';


proc mixed data=CTSL;
class canopy ash island depth;
model CTSLdepthwise = canopy|ash|depth;
random island;
repeated depth/subject = canopy*ash type=cs;
lsmeans depth|canopy|ash / adjust=tukey;

RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	186	53.08	<.0001
ash	1	186	27.61	<.0001
canopy*ash	1	186	1.70	0.1940
depth	4	186	6.53	<.0001
canopy*depth	4	186	0.91	0.4575
ash*depth	4	186	0.20	0.9365
canopy*ash*depth	4	186	0.41	0.8040

Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
depth			10	69.7485	2.2256	186	31.34	<.0001
depth			14	68.7073	2.2697	186	30.27	<.0001
depth			18	61.3162	2.2697	186	27.01	<.0001
depth			2	76.2739	2.1714	186	35.13	<.0001
depth			6	76.7845	2.4658	186	31.14	<.0001
canopy	Canopy			74.6752	0.8211	186	90.94	<.0001
canopy	NoCanopy			66.4570	0.7734	186	85.93	<.0001
canopy*depth	Canopy		10	76.0651	3.1017	186	24.52	<.0001
canopy*depth	Canopy		14	75.1923	3.1925	186	23.55	<.0001
canopy*depth	Canopy		18	64.4410	3.1925	186	20.19	<.0001

Least Squares Means								
Effect	canopy	ash	depth	Estimate	Standard Error	DF	t Value	Pr > |t|
canopy*depth	Canopy		2	80.2650	3.0240	186	26.54	<.0001
canopy*depth	Canopy		6	77.4125	3.7292	186	20.76	<.0001
canopy*depth	NoCanopy		10	63.4318	3.1925	186	19.87	<.0001
canopy*depth	NoCanopy		14	62.2223	3.2271	186	19.28	<.0001
canopy*depth	NoCanopy		18	58.1913	3.2271	186	18.03	<.0001
canopy*depth	NoCanopy		2	72.2829	3.1170	186	23.19	<.0001
canopy*depth	NoCanopy		6	76.1564	3.2271	186	23.60	<.0001
ash		Ash		73.5298	0.8718	186	84.34	<.0001
ash		NoAsh		67.6024	0.7158	186	94.44	<.0001
ash*depth		Ash	10	72.2664	3.1925	186	22.64	<.0001
ash*depth		Ash	14	73.6146	3.3001	186	22.31	<.0001
ash*depth		Ash	18	63.6921	3.3001	186	19.30	<.0001
ash*depth		Ash	2	79.1449	3.1925	186	24.79	<.0001
ash*depth		Ash	6	78.9309	3.6102	186	21.86	<.0001
ash*depth		NoAsh	10	67.2305	3.1017	186	21.68	<.0001
ash*depth		NoAsh	14	63.8000	3.1170	186	20.47	<.0001
ash*depth		NoAsh	18	58.9402	3.1170	186	18.91	<.0001
ash*depth		NoAsh	2	73.4029	2.9441	186	24.93	<.0001
ash*depth		NoAsh	6	74.6381	3.3597	186	22.22	<.0001
canopy*ash	Canopy	Ash		78.3741	1.1381	186	68.87	<.0001
canopy*ash	Canopy	NoAsh		70.9762	1.1840	186	59.95	<.0001
canopy*ash	NoCanopy	Ash		68.6854	1.3209	186	52.00	<.0001
canopy*ash	NoCanopy	NoAsh		64.2285	0.8047	186	79.82	<.0001
canopy*ash*depth	Canopy	Ash	10	80.9985	4.3865	186	18.47	<.0001
canopy*ash*depth	Canopy	Ash	14	78.5119	4.3865	186	17.90	<.0001
canopy*ash*depth	Canopy	Ash	18	67.9652	4.3865	186	15.49	<.0001
canopy*ash*depth	Canopy	Ash	2	84.8037	4.3865	186	19.33	<.0001
canopy*ash*depth	Canopy	Ash	6	79.5914	5.2739	186	15.09	<.0001
canopy*ash*depth	Canopy	NoAsh	10	71.1317	4.3865	186	16.22	<.0001
canopy*ash*depth	Canopy	NoAsh	14	71.8727	4.6397	186	15.49	<.0001
canopy*ash*depth	Canopy	NoAsh	18	60.9168	4.6397	186	13.13	<.0001

Least Squares Means								
Effect	canopy	ash	depth	Estimate	Standard Error	DF	t Value	Pr > |t|
canopy*ash*depth	Canopy	NoAsh	2	75.7263	4.1637	186	18.19	<.0001
canopy*ash*depth	Canopy	NoAsh	6	75.2337	5.2739	186	14.27	<.0001
canopy*ash*depth	NoCanopy	Ash	10	63.5344	4.6397	186	13.69	<.0001
canopy*ash*depth	NoCanopy	Ash	14	68.7173	4.9317	186	13.93	<.0001
canopy*ash*depth	NoCanopy	Ash	18	59.4190	4.9317	186	12.05	<.0001
canopy*ash*depth	NoCanopy	Ash	2	73.4861	4.6397	186	15.84	<.0001
canopy*ash*depth	NoCanopy	Ash	6	78.2703	4.9317	186	15.87	<.0001
canopy*ash*depth	NoCanopy	NoAsh	10	63.3293	4.3865	186	14.44	<.0001
canopy*ash*depth	NoCanopy	NoAsh	14	55.7273	4.1637	186	13.38	<.0001
canopy*ash*depth	NoCanopy	NoAsh	18	56.9637	4.1637	186	13.68	<.0001
canopy*ash*depth	NoCanopy	NoAsh	2	71.0796	4.1637	186	17.07	<.0001
canopy*ash*depth	NoCanopy	NoAsh	6	74.0425	4.1637	186	17.78	<.0001

Differences of Least Squares Means											
Effect	canopy	ash	depth	_canopy	_ash	_depth	Estimate	Standard Error	DF	t Value	Pr > |t|
depth			10			14	1.0412	3.4518	186	0.30	0.7633
depth			10			18	8.4323	3.4518	186	2.44	0.0155
depth			10			2	-6.5255	3.3879	186	-1.93	0.0556
depth			10			6	-7.0360	3.5838	186	-1.96	0.0511
depth			14			18	7.3911	3.4804	186	2.12	0.0350
depth			14			2	-7.5666	3.4171	186	-2.21	0.0280
depth			14			6	-8.0772	3.6114	186	-2.24	0.0265
depth			18			2	-14.9578	3.4171	186	-4.38	<.0001
depth			18			6	-15.4683	3.6114	186	-4.28	<.0001
depth			2			6	-0.5106	3.5504	186	-0.14	0.8858
canopy	Canopy			NoCanopy			8.2182	1.1280	186	7.29	<.0001
canopy*depth	Canopy		10	Canopy		14	0.8728	4.8407	186	0.18	0.8571
canopy*depth	Canopy		10	Canopy		18	11.6241	4.8407	186	2.40	0.0173
canopy*depth	Canopy		10	Canopy		2	-4.1999	4.7312	186	-0.89	0.3759
canopy*depth	Canopy		10	Canopy		6	-1.3475	5.2103	186	-0.26	0.7962
canopy*depth	Canopy		10	NoCanopy		10	12.6332	4.4511	186	2.84	0.0050
canopy*depth	Canopy		10	NoCanopy		14	13.8428	4.4760	186	3.09	0.0023
canopy*depth	Canopy		10	NoCanopy		18	17.8737	4.4760	186	3.99	<.0001
canopy*depth	Canopy		10	NoCanopy		2	3.7822	4.3973	186	0.86	0.3908

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*depth	Canopy		10	NoCanopy		6	-0.09135	4.4760	186	-0.02	0.9837
canopy*depth	Canopy		14	Canopy		18	10.7513	4.8994	186	2.19	0.0294
canopy*depth	Canopy		14	Canopy		2	-5.0727	4.7913	186	-1.06	0.2911
canopy*depth	Canopy		14	Canopy		6	-2.2202	5.2649	186	-0.42	0.6737
canopy*depth	Canopy		14	NoCanopy		10	11.7605	4.5149	186	2.60	0.0099
canopy*depth	Canopy		14	NoCanopy		14	12.9700	4.5394	186	2.86	0.0048
canopy*depth	Canopy		14	NoCanopy		18	17.0010	4.5394	186	3.75	0.0002
canopy*depth	Canopy		14	NoCanopy		2	2.9094	4.4618	186	0.65	0.5152
canopy*depth	Canopy		14	NoCanopy		6	-0.9641	4.5394	186	-0.21	0.8320
canopy*depth	Canopy		18	Canopy		2	-15.8240	4.7913	186	-3.30	0.0011
canopy*depth	Canopy		18	Canopy		6	-12.9715	5.2649	186	-2.46	0.0147
canopy*depth	Canopy		18	NoCanopy		10	1.0092	4.5149	186	0.22	0.8234
canopy*depth	Canopy		18	NoCanopy		14	2.2187	4.5394	186	0.49	0.6256
canopy*depth	Canopy		18	NoCanopy		18	6.2497	4.5394	186	1.38	0.1702
canopy*depth	Canopy		18	NoCanopy		2	-7.8419	4.4618	186	-1.76	0.0805
canopy*depth	Canopy		18	NoCanopy		6	-11.7154	4.5394	186	-2.58	0.0106
canopy*depth	Canopy		2	Canopy		6	2.8524	5.1644	186	0.55	0.5814
canopy*depth	Canopy		2	NoCanopy		10	16.8331	4.3973	186	3.83	0.0002
canopy*depth	Canopy		2	NoCanopy		14	18.0427	4.4225	186	4.08	<.0001
canopy*depth	Canopy		2	NoCanopy		18	22.0736	4.4225	186	4.99	<.0001
canopy*depth	Canopy		2	NoCanopy		2	7.9821	4.3428	186	1.84	0.0677
canopy*depth	Canopy		2	NoCanopy		6	4.1086	4.4225	186	0.93	0.3541
canopy*depth	Canopy		6	NoCanopy		10	13.9807	4.9091	186	2.85	0.0049
canopy*depth	Canopy		6	NoCanopy		14	15.1902	4.9317	186	3.08	0.0024
canopy*depth	Canopy		6	NoCanopy		18	19.2212	4.9317	186	3.90	0.0001
canopy*depth	Canopy		6	NoCanopy		2	5.1297	4.8603	186	1.06	0.2926
canopy*depth	Canopy		6	NoCanopy		6	1.2561	4.9317	186	0.25	0.7992
canopy*depth	NoCanopy		10	NoCanopy		14	1.2095	4.9220	186	0.25	0.8062
canopy*depth	NoCanopy		10	NoCanopy		18	5.2405	4.9220	186	1.06	0.2884
canopy*depth	NoCanopy		10	NoCanopy		2	-8.8510	4.8505	186	-1.82	0.0696
canopy*depth	NoCanopy		10	NoCanopy		6	-12.7246	4.9220	186	-2.59	0.0105
canopy*depth	NoCanopy		14	NoCanopy		18	4.0310	4.9445	186	0.82	0.4160
canopy*depth	NoCanopy		14	NoCanopy		2	-10.0606	4.8734	186	-2.06	0.0404
canopy*depth	NoCanopy		14	NoCanopy		6	-13.9341	4.9445	186	-2.82	0.0054
canopy*depth	NoCanopy		18	NoCanopy		2	-14.0915	4.8734	186	-2.89	0.0043
canopy*depth	NoCanopy		18	NoCanopy		6	-17.9651	4.9445	186	-3.63	0.0004
canopy*depth	NoCanopy		2	NoCanopy		6	-3.8736	4.8734	186	-0.79	0.4277
ash		Ash			NoAsh		5.9274	1.1280	186	5.25	<.0001
ash*depth		Ash	10		Ash	14	-1.3482	4.9702	186	-0.27	0.7865

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
ash*depth		Ash	10		Ash	18	8.5743	4.9702	186	1.73	0.0862
ash*depth		Ash	10		Ash	2	-6.8785	4.8994	186	-1.40	0.1620
ash*depth		Ash	10		Ash	6	-6.6644	5.1813	186	-1.29	0.2000
ash*depth		Ash	10		NoAsh	10	5.0359	4.4511	186	1.13	0.2594
ash*depth		Ash	10		NoAsh	14	8.4664	4.4618	186	1.90	0.0593
ash*depth		Ash	10		NoAsh	18	13.3262	4.4618	186	2.99	0.0032
ash*depth		Ash	10		NoAsh	2	-1.1365	4.3428	186	-0.26	0.7938
ash*depth		Ash	10		NoAsh	6	-2.3717	4.6346	186	-0.51	0.6094
ash*depth		Ash	14		Ash	18	9.9225	5.0399	186	1.97	0.0505
ash*depth		Ash	14		Ash	2	-5.5303	4.9702	186	-1.11	0.2673
ash*depth		Ash	14		Ash	6	-5.3162	5.2483	186	-1.01	0.3124
ash*depth		Ash	14		NoAsh	10	6.3841	4.5289	186	1.41	0.1603
ash*depth		Ash	14		NoAsh	14	9.8146	4.5394	186	2.16	0.0319
ash*depth		Ash	14		NoAsh	18	14.6744	4.5394	186	3.23	0.0015
ash*depth		Ash	14		NoAsh	2	0.2117	4.4225	186	0.05	0.9619
ash*depth		Ash	14		NoAsh	6	-1.0235	4.7094	186	-0.22	0.8282
ash*depth		Ash	18		Ash	2	-15.4528	4.9702	186	-3.11	0.0022
ash*depth		Ash	18		Ash	6	-15.2387	5.2483	186	-2.90	0.0041
ash*depth		Ash	18		NoAsh	10	-3.5384	4.5289	186	-0.78	0.4356
ash*depth		Ash	18		NoAsh	14	-0.1079	4.5394	186	-0.02	0.9811
ash*depth		Ash	18		NoAsh	18	4.7519	4.5394	186	1.05	0.2966
ash*depth		Ash	18		NoAsh	2	-9.7108	4.4225	186	-2.20	0.0293
ash*depth		Ash	18		NoAsh	6	-10.9460	4.7094	186	-2.32	0.0212
ash*depth		Ash	2		Ash	6	0.2141	5.1813	186	0.04	0.9671
ash*depth		Ash	2		NoAsh	10	11.9144	4.4511	186	2.68	0.0081
ash*depth		Ash	2		NoAsh	14	15.3449	4.4618	186	3.44	0.0007
ash*depth		Ash	2		NoAsh	18	20.2047	4.4618	186	4.53	<.0001
ash*depth		Ash	2		NoAsh	2	5.7420	4.3428	186	1.32	0.1877
ash*depth		Ash	2		NoAsh	6	4.5068	4.6346	186	0.97	0.3321
ash*depth		Ash	6		NoAsh	10	11.7003	4.7597	186	2.46	0.0149
ash*depth		Ash	6		NoAsh	14	15.1308	4.7697	186	3.17	0.0018
ash*depth		Ash	6		NoAsh	18	19.9906	4.7697	186	4.19	<.0001
ash*depth		Ash	6		NoAsh	2	5.5279	4.6585	186	1.19	0.2369
ash*depth		Ash	6		NoAsh	6	4.2927	4.9317	186	0.87	0.3852
ash*depth		NoAsh	10		NoAsh	14	3.4305	4.7913	186	0.72	0.4749
ash*depth		NoAsh	10		NoAsh	18	8.2903	4.7913	186	1.73	0.0852
ash*depth		NoAsh	10		NoAsh	2	-6.1724	4.6806	186	-1.32	0.1889
ash*depth		NoAsh	10		NoAsh	6	-7.4076	4.9526	186	-1.50	0.1364
ash*depth		NoAsh	14		NoAsh	18	4.8598	4.8012	186	1.01	0.3128

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
ash*depth		NoAsh	14		NoAsh	2	-9.6029	4.6908	186	-2.05	0.0420
ash*depth		NoAsh	14		NoAsh	6	-10.8381	4.9622	186	-2.18	0.0302
ash*depth		NoAsh	18		NoAsh	2	-14.4627	4.6908	186	-3.08	0.0024
ash*depth		NoAsh	18		NoAsh	6	-15.6979	4.9622	186	-3.16	0.0018
ash*depth		NoAsh	2		NoAsh	6	-1.2352	4.8554	186	-0.25	0.7995
canopy*ash	Canopy	Ash		Canopy	NoAsh		7.3979	1.6423	186	4.50	<.0001
canopy*ash	Canopy	Ash		NoCanopy	Ash		9.6887	1.7436	186	5.56	<.0001
canopy*ash	Canopy	Ash		NoCanopy	NoAsh		14.1456	1.3938	186	10.15	<.0001
canopy*ash	Canopy	NoAsh		NoCanopy	Ash		2.2908	1.7739	186	1.29	0.1982
canopy*ash	Canopy	NoAsh		NoCanopy	NoAsh		6.7478	1.4316	186	4.71	<.0001
canopy*ash	NoCanopy	Ash		NoCanopy	NoAsh		4.4569	1.5467	186	2.88	0.0044
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	14	2.4866	6.7618	186	0.37	0.7135
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	18	13.0332	6.7618	186	1.93	0.0554
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	2	-3.8052	6.7618	186	-0.56	0.5743
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	6	1.4071	7.3685	186	0.19	0.8488
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	10	9.8668	6.2034	186	1.59	0.1134
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	14	9.1257	6.3850	186	1.43	0.1546
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	18	20.0817	6.3850	186	3.15	0.0019
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	2	5.2722	6.0479	186	0.87	0.3845
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	6	5.7647	6.8597	186	0.84	0.4018
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	10	17.4641	6.3850	186	2.74	0.0068
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	14	12.2811	6.6002	186	1.86	0.0644
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	18	21.5795	6.6002	186	3.27	0.0013
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	2	7.5123	6.3850	186	1.18	0.2409
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	6	2.7281	6.6002	186	0.41	0.6798
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	10	17.6692	6.2034	186	2.85	0.0049
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	14	25.2712	6.0479	186	4.18	<.0001
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	18	24.0348	6.0479	186	3.97	0.0001
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	2	9.9189	6.0479	186	1.64	0.1027
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	6	6.9559	6.0479	186	1.15	0.2516
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	18	10.5467	6.7618	186	1.56	0.1205
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	2	-6.2918	6.7618	186	-0.93	0.3533
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	6	-1.0795	7.3685	186	-0.15	0.8837
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	10	7.3802	6.2034	186	1.19	0.2357
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	14	6.6392	6.3850	186	1.04	0.2998
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	18	17.5951	6.3850	186	2.76	0.0064
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	2	2.7856	6.0479	186	0.46	0.6456
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	6	3.2782	6.8597	186	0.48	0.6333
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	10	14.9775	6.3850	186	2.35	0.0200

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	14	9.7946	6.6002	186	1.48	0.1395
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	18	19.0929	6.6002	186	2.89	0.0043
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	2	5.0258	6.3850	186	0.79	0.4322
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	6	0.2416	6.6002	186	0.04	0.9708
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	10	15.1826	6.2034	186	2.45	0.0153
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	14	22.7846	6.0479	186	3.77	0.0002
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	18	21.5482	6.0479	186	3.56	0.0005
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	2	7.4323	6.0479	186	1.23	0.2207
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	6	4.4694	6.0479	186	0.74	0.4608
canopy*ash*depth	Canopy	Ash	18	Canopy	Ash	2	-16.8385	6.7618	186	-2.49	0.0136
canopy*ash*depth	Canopy	Ash	18	Canopy	Ash	6	-11.6261	7.3685	186	-1.58	0.1163
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	10	-3.1665	6.2034	186	-0.51	0.6103
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	14	-3.9075	6.3850	186	-0.61	0.5413
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	18	7.0485	6.3850	186	1.10	0.2711
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	2	-7.7610	6.0479	186	-1.28	0.2010
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	6	-7.2685	6.8597	186	-1.06	0.2907
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	10	4.4309	6.3850	186	0.69	0.4886
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	14	-0.7521	6.6002	186	-0.11	0.9094
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	18	8.5463	6.6002	186	1.29	0.1970
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	2	-5.5209	6.3850	186	-0.86	0.3883
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	6	-10.3051	6.6002	186	-1.56	0.1201
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	10	4.6359	6.2034	186	0.75	0.4558
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	14	12.2380	6.0479	186	2.02	0.0445
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	18	11.0015	6.0479	186	1.82	0.0705
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	2	-3.1144	6.0479	186	-0.51	0.6072
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	6	-6.0773	6.0479	186	-1.00	0.3163
canopy*ash*depth	Canopy	Ash	2	Canopy	Ash	6	5.2123	7.3685	186	0.71	0.4802
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	10	13.6720	6.2034	186	2.20	0.0288
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	14	12.9310	6.3850	186	2.03	0.0443
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	18	23.8869	6.3850	186	3.74	0.0002
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	2	9.0774	6.0479	186	1.50	0.1351
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	6	9.5700	6.8597	186	1.40	0.1646
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	10	21.2693	6.3850	186	3.33	0.0010
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	14	16.0864	6.6002	186	2.44	0.0157
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	18	25.3847	6.6002	186	3.85	0.0002
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	2	11.3176	6.3850	186	1.77	0.0779
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	6	6.5334	6.6002	186	0.99	0.3235
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	10	21.4744	6.2034	186	3.46	0.0007
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	14	29.0764	6.0479	186	4.81	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	18	27.8400	6.0479	186	4.60	<.0001
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	2	13.7241	6.0479	186	2.27	0.0244
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	6	10.7612	6.0479	186	1.78	0.0768
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	10	8.4597	6.8597	186	1.23	0.2190
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	14	7.7186	7.0243	186	1.10	0.2733
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	18	18.6746	7.0243	186	2.66	0.0085
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	2	3.8651	6.7194	186	0.58	0.5658
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	6	4.3577	7.4584	186	0.58	0.5598
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	10	16.0570	7.0243	186	2.29	0.0234
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	14	10.8740	7.2205	186	1.51	0.1338
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	18	20.1724	7.2205	186	2.79	0.0058
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	2	6.1052	7.0243	186	0.87	0.3859
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	6	1.3210	7.2205	186	0.18	0.8550
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	10	16.2621	6.8597	186	2.37	0.0188
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	14	23.8641	6.7194	186	3.55	0.0005
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	18	22.6277	6.7194	186	3.37	0.0009
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	2	8.5118	6.7194	186	1.27	0.2068
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	6	5.5489	6.7194	186	0.83	0.4100
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	14	-0.7410	6.9288	186	-0.11	0.9149
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	18	10.2149	6.9288	186	1.47	0.1421
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	2	-4.5946	6.6194	186	-0.69	0.4885
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	6	-4.1020	7.3685	186	-0.56	0.5784
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	10	7.5973	6.3850	186	1.19	0.2356
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	14	2.4144	6.6002	186	0.37	0.7149
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	18	11.7127	6.6002	186	1.77	0.0776
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	2	-2.3544	6.3850	186	-0.37	0.7127
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	6	-7.1386	6.6002	186	-1.08	0.2808
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	10	7.8024	6.2034	186	1.26	0.2101
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	14	15.4044	6.0479	186	2.55	0.0117
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	18	14.1680	6.0479	186	2.34	0.0202
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	2	0.05209	6.0479	186	0.01	0.9931
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	6	-2.9108	6.0479	186	-0.48	0.6309
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	18	10.9560	7.0918	186	1.54	0.1241
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	2	-3.8535	6.7899	186	-0.57	0.5710
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	6	-3.3610	7.5220	186	-0.45	0.6555
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	10	8.3384	6.5616	186	1.27	0.2054
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	14	3.1554	6.7712	186	0.47	0.6418
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	18	12.4538	6.7712	186	1.84	0.0675
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	2	-1.6134	6.5616	186	-0.25	0.8060

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	6	-6.3976	6.7712	186	-0.94	0.3460
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	10	8.5434	6.3850	186	1.34	0.1825
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	14	16.1455	6.2340	186	2.59	0.0104
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	18	14.9090	6.2340	186	2.39	0.0178
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	2	0.7931	6.2340	186	0.13	0.8989
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	6	-2.1698	6.2340	186	-0.35	0.7282
canopy*ash*depth	Canopy	NoAsh	18	Canopy	NoAsh	2	-14.8095	6.7899	186	-2.18	0.0304
canopy*ash*depth	Canopy	NoAsh	18	Canopy	NoAsh	6	-14.3169	7.5220	186	-1.90	0.0585
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	10	-2.6176	6.5616	186	-0.40	0.6904
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	14	-7.8006	6.7712	186	-1.15	0.2508
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	18	1.4978	6.7712	186	0.22	0.8252
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	2	-12.5694	6.5616	186	-1.92	0.0570
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	6	-17.3536	6.7712	186	-2.56	0.0112
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	10	-2.4125	6.3850	186	-0.38	0.7060
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	14	5.1895	6.2340	186	0.83	0.4062
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	18	3.9531	6.2340	186	0.63	0.5268
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	2	-10.1628	6.2340	186	-1.63	0.1047
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	6	-13.1258	6.2340	186	-2.11	0.0366
canopy*ash*depth	Canopy	NoAsh	2	Canopy	NoAsh	6	0.4926	7.2381	186	0.07	0.9458
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	10	12.1919	6.2340	186	1.96	0.0520
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	14	7.0089	6.4542	186	1.09	0.2789
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	18	16.3073	6.4542	186	2.53	0.0124
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	2	2.2401	6.2340	186	0.36	0.7197
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	6	-2.5441	6.4542	186	-0.39	0.6939
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	10	12.3970	6.0479	186	2.05	0.0418
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	14	19.9990	5.8883	186	3.40	0.0008
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	18	18.7626	5.8883	186	3.19	0.0017
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	2	4.6467	5.8883	186	0.79	0.4310
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	6	1.6838	5.8883	186	0.29	0.7752
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	10	11.6993	7.0243	186	1.67	0.0975
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	14	6.5164	7.2205	186	0.90	0.3680
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	18	15.8147	7.2205	186	2.19	0.0297
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	2	1.7476	7.0243	186	0.25	0.8038
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	6	-3.0366	7.2205	186	-0.42	0.6746
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	10	11.9044	6.8597	186	1.74	0.0843
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	14	19.5064	6.7194	186	2.90	0.0041
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	18	18.2700	6.7194	186	2.72	0.0072
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	2	4.1541	6.7194	186	0.62	0.5372
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	6	1.1912	6.7194	186	0.18	0.8595

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	14	-5.1830	7.2862	186	-0.71	0.4778
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	18	4.1154	7.2862	186	0.56	0.5729
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	2	-9.9517	7.0918	186	-1.40	0.1622
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	6	-14.7360	7.2862	186	-2.02	0.0446
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	10	0.2051	6.3850	186	0.03	0.9744
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	14	7.8071	6.2340	186	1.25	0.2120
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	18	6.5707	6.2340	186	1.05	0.2933
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	2	-7.5452	6.2340	186	-1.21	0.2277
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	6	-10.5081	6.2340	186	-1.69	0.0935
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	18	9.2984	7.4755	186	1.24	0.2151
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	2	-4.7688	7.2862	186	-0.65	0.5136
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	6	-9.5530	7.4755	186	-1.28	0.2029
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	10	5.3880	6.6002	186	0.82	0.4153
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	14	12.9900	6.4542	186	2.01	0.0456
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	18	11.7536	6.4542	186	1.82	0.0702
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	2	-2.3623	6.4542	186	-0.37	0.7148
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	6	-5.3252	6.4542	186	-0.83	0.4104
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	Ash	2	-14.0671	7.2862	186	-1.93	0.0550
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	Ash	6	-18.8514	7.4755	186	-2.52	0.0125
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	10	-3.9103	6.6002	186	-0.59	0.5543
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	14	3.6917	6.4542	186	0.57	0.5680
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	18	2.4553	6.4542	186	0.38	0.7041
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	2	-11.6606	6.4542	186	-1.81	0.0724
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	6	-14.6235	6.4542	186	-2.27	0.0246
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	Ash	6	-4.7842	7.2862	186	-0.66	0.5122
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	10	10.1568	6.3850	186	1.59	0.1134
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	14	17.7588	6.2340	186	2.85	0.0049
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	18	16.5224	6.2340	186	2.65	0.0087
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	2	2.4065	6.2340	186	0.39	0.6999
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	6	-0.5564	6.2340	186	-0.09	0.9290
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	10	14.9410	6.6002	186	2.26	0.0247
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	14	22.5431	6.4542	186	3.49	0.0006
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	18	21.3066	6.4542	186	3.30	0.0012
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	2	7.1907	6.4542	186	1.11	0.2667
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	6	4.2278	6.4542	186	0.66	0.5132
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	14	7.6020	6.6194	186	1.15	0.2523
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	18	6.3656	6.6194	186	0.96	0.3375
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	2	-7.7503	6.6194	186	-1.17	0.2432
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	6	-10.7132	6.6194	186	-1.62	0.1073

Differences of Least Squares Means											
Effect	canopy	ash	depth	_canopy	_ash	_depth	Estimate	Standard Error	DF	t Value	Pr > |t|
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	18	-1.2364	6.4739	186	-0.19	0.8487
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	2	-15.3523	6.4739	186	-2.37	0.0187
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	6	-18.3152	6.4739	186	-2.83	0.0052
canopy*ash*depth	NoCanopy	NoAsh	18	NoCanopy	NoAsh	2	-14.1159	6.4739	186	-2.18	0.0305
canopy*ash*depth	NoCanopy	NoAsh	18	NoCanopy	NoAsh	6	-17.0788	6.4739	186	-2.64	0.0090
canopy*ash*depth	NoCanopy	NoAsh	2	NoCanopy	NoAsh	6	-2.9629	6.4739	186	-0.46	0.6477

Differences of Least Squares Means								
Effect	canopy	ash	depth	_canopy	_ash	_depth	Adjustment	Adj P
depth			10			14	Tukey-Kramer	0.9982
depth			10			18	Tukey-Kramer	0.1086
depth			10			2	Tukey-Kramer	0.3072
depth			10			6	Tukey-Kramer	0.2881
depth			14			18	Tukey-Kramer	0.2145
depth			14			2	Tukey-Kramer	0.1790
depth			14			6	Tukey-Kramer	0.1709
depth			18			2	Tukey-Kramer	0.0002
depth			18			6	Tukey-Kramer	0.0003
depth			2			6	Tukey-Kramer	0.9999
canopy	Canopy			NoCanopy			Tukey-Kramer	<.0001
canopy*depth	Canopy		10	Canopy		14	Tukey-Kramer	1.0000
canopy*depth	Canopy		10	Canopy		18	Tukey-Kramer	0.3311
canopy*depth	Canopy		10	Canopy		2	Tukey-Kramer	0.9967
canopy*depth	Canopy		10	Canopy		6	Tukey-Kramer	1.0000
canopy*depth	Canopy		10	NoCanopy		10	Tukey-Kramer	0.1315
canopy*depth	Canopy		10	NoCanopy		14	Tukey-Kramer	0.0681
canopy*depth	Canopy		10	NoCanopy		18	Tukey-Kramer	0.0036
canopy*depth	Canopy		10	NoCanopy		2	Tukey-Kramer	0.9974
canopy*depth	Canopy		10	NoCanopy		6	Tukey-Kramer	1.0000
canopy*depth	Canopy		14	Canopy		18	Tukey-Kramer	0.4644
canopy*depth	Canopy		14	Canopy		2	Tukey-Kramer	0.9879
canopy*depth	Canopy		14	Canopy		6	Tukey-Kramer	1.0000
canopy*depth	Canopy		14	NoCanopy		10	Tukey-Kramer	0.2229

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*depth	Canopy		14	NoCanopy		14	Tukey-Kramer	0.1256
canopy*depth	Canopy		14	NoCanopy		18	Tukey-Kramer	0.0089
canopy*depth	Canopy		14	NoCanopy		2	Tukey-Kramer	0.9997
canopy*depth	Canopy		14	NoCanopy		6	Tukey-Kramer	1.0000
canopy*depth	Canopy		18	Canopy		2	Tukey-Kramer	0.0373
canopy*depth	Canopy		18	Canopy		6	Tukey-Kramer	0.2952
canopy*depth	Canopy		18	NoCanopy		10	Tukey-Kramer	1.0000
canopy*depth	Canopy		18	NoCanopy		14	Tukey-Kramer	1.0000
canopy*depth	Canopy		18	NoCanopy		18	Tukey-Kramer	0.9329
canopy*depth	Canopy		18	NoCanopy		2	Tukey-Kramer	0.7606
canopy*depth	Canopy		18	NoCanopy		6	Tukey-Kramer	0.2343
canopy*depth	Canopy		2	Canopy		6	Tukey-Kramer	0.9999
canopy*depth	Canopy		2	NoCanopy		10	Tukey-Kramer	0.0066
canopy*depth	Canopy		2	NoCanopy		14	Tukey-Kramer	0.0026
canopy*depth	Canopy		2	NoCanopy		18	Tukey-Kramer	<.0001
canopy*depth	Canopy		2	NoCanopy		2	Tukey-Kramer	0.7102
canopy*depth	Canopy		2	NoCanopy		6	Tukey-Kramer	0.9953
canopy*depth	Canopy		6	NoCanopy		10	Tukey-Kramer	0.1285
canopy*depth	Canopy		6	NoCanopy		14	Tukey-Kramer	0.0705
canopy*depth	Canopy		6	NoCanopy		18	Tukey-Kramer	0.0052
canopy*depth	Canopy		6	NoCanopy		2	Tukey-Kramer	0.9882
canopy*depth	Canopy		6	NoCanopy		6	Tukey-Kramer	1.0000
canopy*depth	NoCanopy		10	NoCanopy		14	Tukey-Kramer	1.0000
canopy*depth	NoCanopy		10	NoCanopy		18	Tukey-Kramer	0.9874
canopy*depth	NoCanopy		10	NoCanopy		2	Tukey-Kramer	0.7187
canopy*depth	NoCanopy		10	NoCanopy		6	Tukey-Kramer	0.2322
canopy*depth	NoCanopy		14	NoCanopy		18	Tukey-Kramer	0.9983
canopy*depth	NoCanopy		14	NoCanopy		2	Tukey-Kramer	0.5549
canopy*depth	NoCanopy		14	NoCanopy		6	Tukey-Kramer	0.1381
canopy*depth	NoCanopy		18	NoCanopy		2	Tukey-Kramer	0.1154
canopy*depth	NoCanopy		18	NoCanopy		6	Tukey-Kramer	0.0130
canopy*depth	NoCanopy		2	NoCanopy		6	Tukey-Kramer	0.9986

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
ash		Ash			NoAsh		Tukey-Kramer	<.0001
ash*depth		Ash	10		Ash	14	Tukey-Kramer	1.0000
ash*depth		Ash	10		Ash	18	Tukey-Kramer	0.7798
ash*depth		Ash	10		Ash	2	Tukey-Kramer	0.9247
ash*depth		Ash	10		Ash	6	Tukey-Kramer	0.9556
ash*depth		Ash	10		NoAsh	10	Tukey-Kramer	0.9808
ash*depth		Ash	10		NoAsh	14	Tukey-Kramer	0.6707
ash*depth		Ash	10		NoAsh	18	Tukey-Kramer	0.0905
ash*depth		Ash	10		NoAsh	2	Tukey-Kramer	1.0000
ash*depth		Ash	10		NoAsh	6	Tukey-Kramer	1.0000
ash*depth		Ash	14		Ash	18	Tukey-Kramer	0.6219
ash*depth		Ash	14		Ash	2	Tukey-Kramer	0.9829
ash*depth		Ash	14		Ash	6	Tukey-Kramer	0.9912
ash*depth		Ash	14		NoAsh	10	Tukey-Kramer	0.9229
ash*depth		Ash	14		NoAsh	14	Tukey-Kramer	0.4866
ash*depth		Ash	14		NoAsh	18	Tukey-Kramer	0.0458
ash*depth		Ash	14		NoAsh	2	Tukey-Kramer	1.0000
ash*depth		Ash	14		NoAsh	6	Tukey-Kramer	1.0000
ash*depth		Ash	18		Ash	2	Tukey-Kramer	0.0651
ash*depth		Ash	18		Ash	6	Tukey-Kramer	0.1120
ash*depth		Ash	18		NoAsh	10	Tukey-Kramer	0.9988
ash*depth		Ash	18		NoAsh	14	Tukey-Kramer	1.0000
ash*depth		Ash	18		NoAsh	18	Tukey-Kramer	0.9888
ash*depth		Ash	18		NoAsh	2	Tukey-Kramer	0.4634
ash*depth		Ash	18		NoAsh	6	Tukey-Kramer	0.3785
ash*depth		Ash	2		Ash	6	Tukey-Kramer	1.0000
ash*depth		Ash	2		NoAsh	10	Tukey-Kramer	0.1910
ash*depth		Ash	2		NoAsh	14	Tukey-Kramer	0.0245
ash*depth		Ash	2		NoAsh	18	Tukey-Kramer	0.0004
ash*depth		Ash	2		NoAsh	2	Tukey-Kramer	0.9474
ash*depth		Ash	2		NoAsh	6	Tukey-Kramer	0.9934
ash*depth		Ash	6		NoAsh	10	Tukey-Kramer	0.2983

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
ash*depth		Ash	6		NoAsh	14	Tukey-Kramer	0.0545
ash*depth		Ash	6		NoAsh	18	Tukey-Kramer	0.0017
ash*depth		Ash	6		NoAsh	2	Tukey-Kramer	0.9736
ash*depth		Ash	6		NoAsh	6	Tukey-Kramer	0.9971
ash*depth		NoAsh	10		NoAsh	14	Tukey-Kramer	0.9994
ash*depth		NoAsh	10		NoAsh	18	Tukey-Kramer	0.7768
ash*depth		NoAsh	10		NoAsh	2	Tukey-Kramer	0.9482
ash*depth		NoAsh	10		NoAsh	6	Tukey-Kramer	0.8924
ash*depth		NoAsh	14		NoAsh	18	Tukey-Kramer	0.9912
ash*depth		NoAsh	14		NoAsh	2	Tukey-Kramer	0.5670
ash*depth		NoAsh	14		NoAsh	6	Tukey-Kramer	0.4714
ash*depth		NoAsh	18		NoAsh	2	Tukey-Kramer	0.0699
ash*depth		NoAsh	18		NoAsh	6	Tukey-Kramer	0.0559
ash*depth		NoAsh	2		NoAsh	6	Tukey-Kramer	1.0000
canopy*ash	Canopy	Ash		Canopy	NoAsh		Tukey-Kramer	<.0001
canopy*ash	Canopy	Ash		NoCanopy	Ash		Tukey-Kramer	<.0001
canopy*ash	Canopy	Ash		NoCanopy	NoAsh		Tukey-Kramer	<.0001
canopy*ash	Canopy	NoAsh		NoCanopy	Ash		Tukey-Kramer	0.5696
canopy*ash	Canopy	NoAsh		NoCanopy	NoAsh		Tukey-Kramer	<.0001
canopy*ash	NoCanopy	Ash		NoCanopy	NoAsh		Tukey-Kramer	0.0227
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	18	Tukey-Kramer	0.9253
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	10	Tukey-Kramer	0.9889
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	14	Tukey-Kramer	0.9969
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	18	Tukey-Kramer	0.1738
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	10	Tukey-Kramer	0.4096
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	14	Tukey-Kramer	0.9453
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	18	Tukey-Kramer	0.1269

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	2	Tukey-Kramer	0.9998
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	10	Tukey-Kramer	0.3327
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	14	Tukey-Kramer	0.0068
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	18	Tukey-Kramer	0.0143
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	2	Tukey-Kramer	0.9844
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	6	Tukey-Kramer	0.9998
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	18	Tukey-Kramer	0.9911
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	10	Tukey-Kramer	0.9997
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	18	Tukey-Kramer	0.3951
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	10	Tukey-Kramer	0.7000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	14	Tukey-Kramer	0.9950
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	18	Tukey-Kramer	0.3047
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	10	Tukey-Kramer	0.6253
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	14	Tukey-Kramer	0.0290
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	18	Tukey-Kramer	0.0553
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	2	Tukey-Kramer	0.9996
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	Canopy	Ash	2	Tukey-Kramer	0.5929
canopy*ash*depth	Canopy	Ash	18	Canopy	Ash	6	Tukey-Kramer	0.9898
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	18	Tukey-Kramer	0.9999
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	2	Tukey-Kramer	0.9992
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	6	Tukey-Kramer	1.0000

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	18	Tukey-Kramer	0.9991
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	6	Tukey-Kramer	0.9910
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	14	Tukey-Kramer	0.8887
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	18	Tukey-Kramer	0.9556
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	2	Canopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	10	Tukey-Kramer	0.7943
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	14	Tukey-Kramer	0.8879
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	18	Tukey-Kramer	0.0316
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	2	Tukey-Kramer	0.9943
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	6	Tukey-Kramer	0.9977
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	10	Tukey-Kramer	0.1077
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	14	Tukey-Kramer	0.6329
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	18	Tukey-Kramer	0.0223
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	2	Tukey-Kramer	0.9654
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	10	Tukey-Kramer	0.0746
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	14	Tukey-Kramer	0.0005
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	18	Tukey-Kramer	0.0013
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	2	Tukey-Kramer	0.7527
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	6	Tukey-Kramer	0.9640
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	10	Tukey-Kramer	0.9995
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	14	Tukey-Kramer	0.9999
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	18	Tukey-Kramer	0.4653
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	10	Tukey-Kramer	0.7415

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	14	Tukey-Kramer	0.9941
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	18	Tukey-Kramer	0.3688
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	10	Tukey-Kramer	0.6821
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	14	Tukey-Kramer	0.0572
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	18	Tukey-Kramer	0.0974
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	2	Tukey-Kramer	0.9993
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	18	Tukey-Kramer	0.9954
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	10	Tukey-Kramer	0.9997
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	18	Tukey-Kramer	0.9650
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	6	Tukey-Kramer	0.9999
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	10	Tukey-Kramer	0.9994
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	14	Tukey-Kramer	0.5495
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	18	Tukey-Kramer	0.7022
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	18	Tukey-Kramer	0.9920
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	10	Tukey-Kramer	0.9993
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	18	Tukey-Kramer	0.9508
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	10	Tukey-Kramer	0.9986

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	14	Tukey-Kramer	0.5169
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	18	Tukey-Kramer	0.6669
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	Canopy	NoAsh	2	Tukey-Kramer	0.8080
canopy*ash*depth	Canopy	NoAsh	18	Canopy	NoAsh	6	Tukey-Kramer	0.9330
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	14	Tukey-Kramer	0.9998
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	2	Tukey-Kramer	0.9292
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	6	Tukey-Kramer	0.5375
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	2	Tukey-Kramer	0.9854
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	6	Tukey-Kramer	0.8498
canopy*ash*depth	Canopy	NoAsh	2	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	10	Tukey-Kramer	0.9155
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	14	Tukey-Kramer	0.9999
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	18	Tukey-Kramer	0.5651
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	10	Tukey-Kramer	0.8770
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	14	Tukey-Kramer	0.0899
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	18	Tukey-Kramer	0.1570
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	10	Tukey-Kramer	0.9816
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	18	Tukey-Kramer	0.8025
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	6	Tukey-Kramer	1.0000

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	10	Tukey-Kramer	0.9719
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	14	Tukey-Kramer	0.2985
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	18	Tukey-Kramer	0.4211
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	2	Tukey-Kramer	0.9975
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	6	Tukey-Kramer	0.8891
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	14	Tukey-Kramer	0.9994
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	2	Tukey-Kramer	0.9997
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	6	Tukey-Kramer	0.9792
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	18	Tukey-Kramer	0.9995
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	6	Tukey-Kramer	0.9993
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	14	Tukey-Kramer	0.8933
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	18	Tukey-Kramer	0.9551
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	Ash	2	Tukey-Kramer	0.9242
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	Ash	6	Tukey-Kramer	0.5688
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	2	Tukey-Kramer	0.9584
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	6	Tukey-Kramer	0.7550
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	10	Tukey-Kramer	0.9889
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	14	Tukey-Kramer	0.3325

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	18	Tukey-Kramer	0.4714
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	10	Tukey-Kramer	0.7563
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	14	Tukey-Kramer	0.0682
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	18	Tukey-Kramer	0.1167
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	2	Tukey-Kramer	0.9999
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	14	Tukey-Kramer	0.9998
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	2	Tukey-Kramer	0.9998
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	6	Tukey-Kramer	0.9865
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	2	Tukey-Kramer	0.6816
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	6	Tukey-Kramer	0.3452
canopy*ash*depth	NoCanopy	NoAsh	18	NoCanopy	NoAsh	2	Tukey-Kramer	0.8084
canopy*ash*depth	NoCanopy	NoAsh	18	NoCanopy	NoAsh	6	Tukey-Kramer	0.4806
canopy*ash*depth	NoCanopy	NoAsh	2	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000

July No Burn Grass Dominated Islands CTSL 0 – 20 cm AVG (Figure 6A)

Program:

```
title '0 - 20 cm CTSL Avg July Grass';

proc mixed data=CTSL;
        class island canopy ash;
        model TotalAvgCTSL=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	13	0.37	0.5550
ash	1	13	2.69	0.1249
canopy*ash	1	13	0.15	0.7042
island	1	13	0.16	0.6967
island*canopy	1	13	0.11	0.7412
island*ash	1	13	0.10	0.7539
island*canopy*ash	1	13	0.00	0.9504

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		71.4665	4.5373	13	15.75	<.0001
canopy	NoCanopy		67.6773	4.3044	13	15.72	<.0001
ash		Ash	74.7015	4.5373	13	16.46	<.0001
ash		NoAsh	64.4423	4.3044	13	14.97	<.0001
canopy*ash	Canopy	Ash	77.8100	6.4167	13	12.13	<.0001
canopy*ash	Canopy	NoAsh	65.1231	6.4167	13	10.15	<.0001
canopy*ash	NoCanopy	Ash	71.5930	6.4167	13	11.16	<.0001
canopy*ash	NoCanopy	NoAsh	63.7616	5.7392	13	11.11	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		3.7892	6.2542	13	0.61	0.5550	Tukey-Kramer	0.5550
ash		Ash		NoAsh	10.2592	6.2542	13	1.64	0.1249	Tukey-Kramer	0.1249
canopy*ash	Canopy	Ash	Canopy	NoAsh	12.6869	9.0745	13	1.40	0.1855	Tukey-Kramer	0.5221
canopy*ash	Canopy	Ash	NoCanopy	Ash	6.2170	9.0745	13	0.69	0.5053	Tukey-Kramer	0.9009
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	14.0484	8.6089	13	1.63	0.1267	Tukey-Kramer	0.3958
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	-6.4700	9.0745	13	-0.71	0.4885	Tukey-Kramer	0.8902
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	1.3615	8.6089	13	0.16	0.8768	Tukey-Kramer	0.9985
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	7.8315	8.6089	13	0.91	0.3795	Tukey-Kramer	0.8001

July No Burn Grass Dominated Depthwise CTSL (Figure 9A)

Program:

```
title 'July No Burn Grass Dom CTSL Depthwise';


proc mixed data=CTSL;
class canopy ash island depth;
model CTSLdepthwise = canopy|ash|depth;
random island;
repeated depth/subject = canopy*ash type=cs;
lsmeans depth|canopy|ash / adjust=tukey;

RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	80	2.44	0.1219
ash	1	80	6.66	0.0117
canopy*ash	1	80	0.05	0.8158
depth	4	80	10.38	<.0001
canopy*depth	4	80	0.87	0.4887
ash*depth	4	80	0.31	0.8734
canopy*ash*depth	4	80	0.45	0.7732

Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
depth			10	72.2762	3.6334	80	19.89	<.0001
depth			14	67.3537	3.7462	80	17.98	<.0001
depth			18	51.4994	3.6334	80	14.17	<.0001
depth			2	77.5922	3.5552	80	21.82	<.0001
depth			6	82.3970	4.1341	80	19.93	<.0001
canopy	Canopy			72.8057	2.5047	80	29.07	<.0001
canopy	NoCanopy			67.6416	2.3293	80	29.04	<.0001
canopy*depth	Canopy		10	76.7653	5.2079	80	14.74	<.0001
canopy*depth	Canopy		14	74.4686	5.5187	80	13.49	<.0001

Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*depth	Canopy		18	53.7918	5.2079	80	10.33	<.0001
canopy*depth	Canopy		2	75.9855	4.9884	80	15.23	<.0001
canopy*depth	Canopy		6	83.0175	6.2735	80	13.23	<.0001
canopy*depth	NoCanopy		10	67.7870	4.9886	80	13.59	<.0001
canopy*depth	NoCanopy		14	60.2388	4.9886	80	12.08	<.0001
canopy*depth	NoCanopy		18	49.2069	4.9886	80	9.86	<.0001
canopy*depth	NoCanopy		2	79.1989	4.9886	80	15.88	<.0001
canopy*depth	NoCanopy		6	81.7765	5.3124	80	15.39	<.0001
ash		Ash		74.4910	2.4502	80	30.40	<.0001
ash		NoAsh		65.9564	2.3896	80	27.60	<.0001
ash*depth		Ash	10	77.9071	5.2066	80	14.96	<.0001
ash*depth		Ash	14	73.3595	5.2066	80	14.09	<.0001
ash*depth		Ash	18	57.0296	5.2066	80	10.95	<.0001
ash*depth		Ash	2	79.2913	5.2066	80	15.23	<.0001
ash*depth		Ash	6	84.8674	5.8146	80	14.60	<.0001
ash*depth		NoAsh	10	66.6452	4.9913	80	13.35	<.0001
ash*depth		NoAsh	14	61.3479	5.3145	80	11.54	<.0001
ash*depth		NoAsh	18	45.9692	4.9913	80	9.21	<.0001
ash*depth		NoAsh	2	75.8931	4.7608	80	15.94	<.0001
ash*depth		NoAsh	6	79.9265	5.8136	80	13.75	<.0001
canopy*ash	Canopy	Ash		77.4602	3.4112	80	22.71	<.0001
canopy*ash	Canopy	NoAsh		68.1512	3.5720	80	19.08	<.0001
canopy*ash	NoCanopy	Ash		71.5217	3.4091	80	20.98	<.0001
canopy*ash	NoCanopy	NoAsh		63.7616	3.0492	80	20.91	<.0001
canopy*ash*depth	Canopy	Ash	10	83.4488	7.3375	80	11.37	<.0001
canopy*ash*depth	Canopy	Ash	14	78.4729	7.3375	80	10.69	<.0001
canopy*ash*depth	Canopy	Ash	18	60.0411	7.3375	80	8.18	<.0001
canopy*ash*depth	Canopy	Ash	2	81.6635	7.3375	80	11.13	<.0001
canopy*ash*depth	Canopy	Ash	6	83.6748	8.2018	80	10.20	<.0001
canopy*ash*depth	Canopy	NoAsh	10	70.0818	7.3450	80	9.54	<.0001
canopy*ash*depth	Canopy	NoAsh	14	70.4642	8.2018	80	8.59	<.0001

Least Squares Means								
Effect	canopy	ash	depth	Estimate	Standard Error	DF	t Value	Pr > |t|
canopy*ash*depth	Canopy	NoAsh	18	47.5426	7.3450	80	6.47	<.0001
canopy*ash*depth	Canopy	NoAsh	2	70.3075	6.7051	80	10.49	<.0001
canopy*ash*depth	Canopy	NoAsh	6	82.3601	9.4597	80	8.71	<.0001
canopy*ash*depth	NoCanopy	Ash	10	72.3654	7.3375	80	9.86	<.0001
canopy*ash*depth	NoCanopy	Ash	14	68.2460	7.3375	80	9.30	<.0001
canopy*ash*depth	NoCanopy	Ash	18	54.0180	7.3375	80	7.36	<.0001
canopy*ash*depth	NoCanopy	Ash	2	76.9191	7.3375	80	10.48	<.0001
canopy*ash*depth	NoCanopy	Ash	6	86.0600	8.1966	80	10.50	<.0001
canopy*ash*depth	NoCanopy	NoAsh	10	63.2087	6.7022	80	9.43	<.0001
canopy*ash*depth	NoCanopy	NoAsh	14	52.2316	6.7022	80	7.79	<.0001
canopy*ash*depth	NoCanopy	NoAsh	18	44.3959	6.7022	80	6.62	<.0001
canopy*ash*depth	NoCanopy	NoAsh	2	81.4787	6.7022	80	12.16	<.0001
canopy*ash*depth	NoCanopy	NoAsh	6	77.4930	6.7022	80	11.56	<.0001

Differences of Least Squares Means											
Effect	canopy	ash	depth	_canopy	_ash	_depth	Estimate	Standard Error	DF	t Value	Pr > |t|
depth			10			14	4.9225	5.1419	80	0.96	0.3413
depth			10			18	20.7768	5.0600	80	4.11	<.0001
depth			10			2	-5.3160	5.0049	80	-1.06	0.2914
depth			10			6	-10.1208	5.4325	80	-1.86	0.0661
depth			14			18	15.8543	5.1419	80	3.08	0.0028
depth			14			2	-10.2385	5.0875	80	-2.01	0.0475
depth			14			6	-15.0433	5.5086	80	-2.73	0.0078
depth			18			2	-26.0928	5.0049	80	-5.21	<.0001
depth			18			6	-30.8976	5.4325	80	-5.69	<.0001
depth			2			6	-4.8048	5.3804	80	-0.89	0.3745
canopy	Canopy			NoCanopy			5.1641	3.3030	80	1.56	0.1219
canopy*depth	Canopy		10	Canopy		14	2.2967	7.5349	80	0.30	0.7613
canopy*depth	Canopy		10	Canopy		18	22.9735	7.3098	80	3.14	0.0023
canopy*depth	Canopy		10	Canopy		2	0.7798	7.1564	80	0.11	0.9135
canopy*depth	Canopy		10	Canopy		6	-6.2522	8.1060	80	-0.77	0.4428
canopy*depth	Canopy		10	NoCanopy		10	8.9782	7.1562	80	1.25	0.2133
canopy*depth	Canopy		10	NoCanopy		14	16.5265	7.1562	80	2.31	0.0235
canopy*depth	Canopy		10	NoCanopy		18	27.5584	7.1562	80	3.85	0.0002

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*depth	Canopy		10	NoCanopy		2	-2.4336	7.1562	80	-0.34	0.7347
canopy*depth	Canopy		10	NoCanopy		6	-5.0112	7.3865	80	-0.68	0.4995
canopy*depth	Canopy		14	Canopy		18	20.6767	7.5349	80	2.74	0.0075
canopy*depth	Canopy		14	Canopy		2	-1.5169	7.3857	80	-0.21	0.8378
canopy*depth	Canopy		14	Canopy		6	-8.5489	8.3089	80	-1.03	0.3066
canopy*depth	Canopy		14	NoCanopy		10	6.6815	7.3856	80	0.90	0.3684
canopy*depth	Canopy		14	NoCanopy		14	14.2298	7.3856	80	1.93	0.0576
canopy*depth	Canopy		14	NoCanopy		18	25.2616	7.3856	80	3.42	0.0010
canopy*depth	Canopy		14	NoCanopy		2	-4.7303	7.3856	80	-0.64	0.5237
canopy*depth	Canopy		14	NoCanopy		6	-7.3079	7.6088	80	-0.96	0.3397
canopy*depth	Canopy		18	Canopy		2	-22.1937	7.1564	80	-3.10	0.0027
canopy*depth	Canopy		18	Canopy		6	-29.2256	8.1060	80	-3.61	0.0005
canopy*depth	Canopy		18	NoCanopy		10	-13.9952	7.1562	80	-1.96	0.0540
canopy*depth	Canopy		18	NoCanopy		14	-6.4470	7.1562	80	-0.90	0.3703
canopy*depth	Canopy		18	NoCanopy		18	4.5849	7.1562	80	0.64	0.5236
canopy*depth	Canopy		18	NoCanopy		2	-25.4071	7.1562	80	-3.55	0.0006
canopy*depth	Canopy		18	NoCanopy		6	-27.9847	7.3865	80	-3.79	0.0003
canopy*depth	Canopy		2	Canopy		6	-7.0320	7.9662	80	-0.88	0.3800
canopy*depth	Canopy		2	NoCanopy		10	8.1984	6.9987	80	1.17	0.2449
canopy*depth	Canopy		2	NoCanopy		14	15.7467	6.9987	80	2.25	0.0272
canopy*depth	Canopy		2	NoCanopy		18	26.7786	6.9987	80	3.83	0.0003
canopy*depth	Canopy		2	NoCanopy		2	-3.2134	6.9987	80	-0.46	0.6474
canopy*depth	Canopy		2	NoCanopy		6	-5.7910	7.2334	80	-0.80	0.4257
canopy*depth	Canopy		6	NoCanopy		10	15.2304	7.9664	80	1.91	0.0595
canopy*depth	Canopy		6	NoCanopy		14	22.7787	7.9664	80	2.86	0.0054
canopy*depth	Canopy		6	NoCanopy		18	33.8105	7.9664	80	4.24	<.0001
canopy*depth	Canopy		6	NoCanopy		2	3.8186	7.9664	80	0.48	0.6330
canopy*depth	Canopy		6	NoCanopy		6	1.2410	8.1728	80	0.15	0.8797
canopy*depth	NoCanopy		10	NoCanopy		14	7.5483	6.9986	80	1.08	0.2840
canopy*depth	NoCanopy		10	NoCanopy		18	18.5801	6.9986	80	2.65	0.0096
canopy*depth	NoCanopy		10	NoCanopy		2	-11.4118	6.9986	80	-1.63	0.1069
canopy*depth	NoCanopy		10	NoCanopy		6	-13.9894	7.2335	80	-1.93	0.0567
canopy*depth	NoCanopy		14	NoCanopy		18	11.0319	6.9986	80	1.58	0.1189
canopy*depth	NoCanopy		14	NoCanopy		2	-18.9601	6.9986	80	-2.71	0.0082
canopy*depth	NoCanopy		14	NoCanopy		6	-21.5377	7.2335	80	-2.98	0.0038
canopy*depth	NoCanopy		18	NoCanopy		2	-29.9920	6.9986	80	-4.29	<.0001
canopy*depth	NoCanopy		18	NoCanopy		6	-32.5696	7.2335	80	-4.50	<.0001
canopy*depth	NoCanopy		2	NoCanopy		6	-2.5776	7.2335	80	-0.36	0.7225
ash		Ash			NoAsh		8.5346	3.3072	80	2.58	0.0117

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
ash*depth		Ash	10		Ash	14	4.5476	7.3098	80	0.62	0.5356
ash*depth		Ash	10		Ash	18	20.8776	7.3098	80	2.86	0.0055
ash*depth		Ash	10		Ash	2	-1.3842	7.3098	80	-0.19	0.8503
ash*depth		Ash	10		Ash	6	-6.9603	7.7546	80	-0.90	0.3721
ash*depth		Ash	10		NoAsh	10	11.2619	7.1581	80	1.57	0.1196
ash*depth		Ash	10		NoAsh	14	16.5592	7.3870	80	2.24	0.0278
ash*depth		Ash	10		NoAsh	18	31.9379	7.1581	80	4.46	<.0001
ash*depth		Ash	10		NoAsh	2	2.0140	6.9993	80	0.29	0.7743
ash*depth		Ash	10		NoAsh	6	-2.0194	7.7539	80	-0.26	0.7952
ash*depth		Ash	14		Ash	18	16.3299	7.3098	80	2.23	0.0283
ash*depth		Ash	14		Ash	2	-5.9318	7.3098	80	-0.81	0.4195
ash*depth		Ash	14		Ash	6	-11.5080	7.7546	80	-1.48	0.1417
ash*depth		Ash	14		NoAsh	10	6.7142	7.1581	80	0.94	0.3511
ash*depth		Ash	14		NoAsh	14	12.0116	7.3870	80	1.63	0.1079
ash*depth		Ash	14		NoAsh	18	27.3903	7.1581	80	3.83	0.0003
ash*depth		Ash	14		NoAsh	2	-2.5336	6.9993	80	-0.36	0.7183
ash*depth		Ash	14		NoAsh	6	-6.5671	7.7539	80	-0.85	0.3996
ash*depth		Ash	18		Ash	2	-22.2618	7.3098	80	-3.05	0.0031
ash*depth		Ash	18		Ash	6	-27.8379	7.7546	80	-3.59	0.0006
ash*depth		Ash	18		NoAsh	10	-9.6157	7.1581	80	-1.34	0.1830
ash*depth		Ash	18		NoAsh	14	-4.3183	7.3870	80	-0.58	0.5605
ash*depth		Ash	18		NoAsh	18	11.0603	7.1581	80	1.55	0.1263
ash*depth		Ash	18		NoAsh	2	-18.8635	6.9993	80	-2.70	0.0086
ash*depth		Ash	18		NoAsh	6	-22.8970	7.7539	80	-2.95	0.0041
ash*depth		Ash	2		Ash	6	-5.5761	7.7546	80	-0.72	0.4742
ash*depth		Ash	2		NoAsh	10	12.6461	7.1581	80	1.77	0.0811
ash*depth		Ash	2		NoAsh	14	17.9434	7.3870	80	2.43	0.0174
ash*depth		Ash	2		NoAsh	18	33.3221	7.1581	80	4.66	<.0001
ash*depth		Ash	2		NoAsh	2	3.3982	6.9993	80	0.49	0.6286
ash*depth		Ash	2		NoAsh	6	-0.6352	7.7539	80	-0.08	0.9349
ash*depth		Ash	6		NoAsh	10	18.2222	7.6152	80	2.39	0.0191
ash*depth		Ash	6		NoAsh	14	23.5195	7.8302	80	3.00	0.0036
ash*depth		Ash	6		NoAsh	18	38.8982	7.6152	80	5.11	<.0001
ash*depth		Ash	6		NoAsh	2	8.9743	7.4646	80	1.20	0.2328
ash*depth		Ash	6		NoAsh	6	4.9409	8.1763	80	0.60	0.5474
ash*depth		NoAsh	10		NoAsh	14	5.2973	7.2333	80	0.73	0.4661
ash*depth		NoAsh	10		NoAsh	18	20.6760	6.9986	80	2.95	0.0041
ash*depth		NoAsh	10		NoAsh	2	-9.2478	6.8382	80	-1.35	0.1801
ash*depth		NoAsh	10		NoAsh	6	-13.2813	7.6087	80	-1.75	0.0847

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
ash*depth		NoAsh	14		NoAsh	18	15.3787	7.2333	80	2.13	0.0366
ash*depth		NoAsh	14		NoAsh	2	-14.5452	7.0779	80	-2.06	0.0431
ash*depth		NoAsh	14		NoAsh	6	-18.5786	7.8249	80	-2.37	0.0200
ash*depth		NoAsh	18		NoAsh	2	-29.9239	6.8382	80	-4.38	<.0001
ash*depth		NoAsh	18		NoAsh	6	-33.9573	7.6087	80	-4.46	<.0001
ash*depth		NoAsh	2		NoAsh	6	-4.0335	7.4606	80	-0.54	0.5903
canopy*ash	Canopy	Ash		Canopy	NoAsh		9.3090	4.8679	80	1.91	0.0594
canopy*ash	Canopy	Ash		NoCanopy	Ash		5.9385	4.7437	80	1.25	0.2143
canopy*ash	Canopy	Ash		NoCanopy	NoAsh		13.6987	4.4889	80	3.05	0.0031
canopy*ash	Canopy	NoAsh		NoCanopy	Ash		-3.3705	4.8523	80	-0.69	0.4893
canopy*ash	Canopy	NoAsh		NoCanopy	NoAsh		4.3897	4.6122	80	0.95	0.3441
canopy*ash	NoCanopy	Ash		NoCanopy	NoAsh		7.7601	4.4873	80	1.73	0.0876
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	14	4.9759	10.3377	80	0.48	0.6316
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	18	23.4077	10.3377	80	2.26	0.0263
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	2	1.7853	10.3377	80	0.17	0.8633
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	6	-0.2260	10.9662	80	-0.02	0.9836
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	10	13.3671	10.3483	80	1.29	0.2002
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	14	12.9846	10.9725	80	1.18	0.2402
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	18	35.9063	10.3483	80	3.47	0.0008
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	2	13.1414	9.9025	80	1.33	0.1883
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	6	1.0887	11.9410	80	0.09	0.9276
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	10	11.0834	10.3403	80	1.07	0.2870
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	14	15.2028	10.3403	80	1.47	0.1454
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	18	29.4308	10.3403	80	2.85	0.0056
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	2	6.5297	10.3403	80	0.63	0.5295
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	6	-2.6112	10.9654	80	-0.24	0.8124
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	10	20.2401	9.8983	80	2.04	0.0442
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	14	31.2172	9.8983	80	3.15	0.0023
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	18	39.0530	9.8983	80	3.95	0.0002
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	2	1.9701	9.8983	80	0.20	0.8427
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	6	5.9559	9.8983	80	0.60	0.5491
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	18	18.4318	10.3377	80	1.78	0.0784
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	2	-3.1906	10.3377	80	-0.31	0.7584
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	6	-5.2019	10.9662	80	-0.47	0.6365
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	10	8.3912	10.3483	80	0.81	0.4198
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	14	8.0088	10.9725	80	0.73	0.4676
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	18	30.9304	10.3483	80	2.99	0.0037
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	2	8.1655	9.9025	80	0.82	0.4121
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	6	-3.8872	11.9410	80	-0.33	0.7456

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	10	6.1075	10.3403	80	0.59	0.5564
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	14	10.2270	10.3403	80	0.99	0.3256
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	18	24.4549	10.3403	80	2.37	0.0205
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	2	1.5539	10.3403	80	0.15	0.8809
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	6	-7.5871	10.9654	80	-0.69	0.4910
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	10	15.2643	9.8983	80	1.54	0.1270
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	14	26.2413	9.8983	80	2.65	0.0097
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	18	34.0771	9.8983	80	3.44	0.0009
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	2	-3.0057	9.8983	80	-0.30	0.7622
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	6	0.9800	9.8983	80	0.10	0.9214
canopy*ash*depth	Canopy	Ash	18	Canopy	Ash	2	-21.6224	10.3377	80	-2.09	0.0396
canopy*ash*depth	Canopy	Ash	18	Canopy	Ash	6	-23.6337	10.9662	80	-2.16	0.0342
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	10	-10.0407	10.3483	80	-0.97	0.3348
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	14	-10.4231	10.9725	80	-0.95	0.3450
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	18	12.4985	10.3483	80	1.21	0.2307
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	2	-10.2664	9.9025	80	-1.04	0.3030
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	6	-22.3190	11.9410	80	-1.87	0.0653
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	10	-12.3243	10.3403	80	-1.19	0.2368
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	14	-8.2049	10.3403	80	-0.79	0.4298
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	18	6.0231	10.3403	80	0.58	0.5619
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	2	-16.8780	10.3403	80	-1.63	0.1066
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	6	-26.0189	10.9654	80	-2.37	0.0201
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	10	-3.1676	9.8983	80	-0.32	0.7498
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	14	7.8095	9.8983	80	0.79	0.4325
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	18	15.6452	9.8983	80	1.58	0.1179
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	2	-21.4376	9.8983	80	-2.17	0.0333
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	6	-17.4519	9.8983	80	-1.76	0.0817
canopy*ash*depth	Canopy	Ash	2	Canopy	Ash	6	-2.0113	10.9662	80	-0.18	0.8549
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	10	11.5818	10.3483	80	1.12	0.2664
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	14	11.1993	10.9725	80	1.02	0.3105
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	18	34.1210	10.3483	80	3.30	0.0015
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	2	11.3561	9.9025	80	1.15	0.2549
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	6	-0.6966	11.9410	80	-0.06	0.9536
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	10	9.2981	10.3403	80	0.90	0.3712
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	14	13.4175	10.3403	80	1.30	0.1982
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	18	27.6455	10.3403	80	2.67	0.0091
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	2	4.7444	10.3403	80	0.46	0.6476
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	6	-4.3965	10.9654	80	-0.40	0.6895
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	10	18.4549	9.8983	80	1.86	0.0659

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > abs(t)**
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	14	29.4319	9.8983	80	2.97	0.0039
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	18	37.2677	9.8983	80	3.77	0.0003
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	2	0.1848	9.8983	80	0.02	0.9851
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	6	4.1706	9.8983	80	0.42	0.6746
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	10	13.5931	10.9838	80	1.24	0.2195
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	14	13.2106	11.5728	80	1.14	0.2571
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	18	36.1323	10.9838	80	3.29	0.0015
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	2	13.3674	10.5622	80	1.27	0.2093
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	6	1.3147	12.4935	80	0.11	0.9165
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	10	11.3094	10.9725	80	1.03	0.3058
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	14	15.4288	10.9725	80	1.41	0.1636
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	18	29.6568	10.9725	80	2.70	0.0084
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	2	6.7557	10.9725	80	0.62	0.5398
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	6	-2.3852	11.5616	80	-0.21	0.8371
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	10	20.4661	10.5549	80	1.94	0.0560
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	14	31.4432	10.5549	80	2.98	0.0038
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	18	39.2790	10.5549	80	3.72	0.0004
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	2	2.1961	10.5549	80	0.21	0.8357
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	6	6.1819	10.5549	80	0.59	0.5597
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	14	-0.3824	10.9649	80	-0.03	0.9723
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	18	22.5392	10.3377	80	2.18	0.0322
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	2	-0.2257	9.8988	80	-0.02	0.9819
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	6	-12.2784	11.9379	80	-1.03	0.3068
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	10	-2.2836	10.3403	80	-0.22	0.8258
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	14	1.8358	10.3403	80	0.18	0.8595
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	18	16.0638	10.3403	80	1.55	0.1242
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	2	-6.8373	10.3403	80	-0.66	0.5104
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	6	-15.9782	10.9704	80	-1.46	0.1492
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	10	6.8731	9.9038	80	0.69	0.4897
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	14	17.8502	9.9038	80	1.80	0.0753
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	18	25.6859	9.9038	80	2.59	0.0113
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	2	-11.3969	9.9038	80	-1.15	0.2533
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	6	-7.4112	9.9038	80	-0.75	0.4565
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	18	22.9216	10.9649	80	2.09	0.0398
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	2	0.1567	10.5513	80	0.01	0.9882
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	6	-11.8959	12.4843	80	-0.95	0.3435
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	10	-1.9012	10.9662	80	-0.17	0.8628
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	14	2.2182	10.9662	80	0.20	0.8402
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	18	16.4462	10.9662	80	1.50	0.1376

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	2	-6.4549	10.9662	80	-0.59	0.5578
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	6	-15.5958	11.5616	80	-1.35	0.1812
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	10	7.2555	10.5549	80	0.69	0.4938
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	14	18.2326	10.5549	80	1.73	0.0880
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	18	26.0683	10.5549	80	2.47	0.0156
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	2	-11.0145	10.5549	80	-1.04	0.2998
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	6	-7.0288	10.5549	80	-0.67	0.5074
canopy*ash*depth	Canopy	NoAsh	18	Canopy	NoAsh	2	-22.7649	9.8988	80	-2.30	0.0241
canopy*ash*depth	Canopy	NoAsh	18	Canopy	NoAsh	6	-34.8176	11.9379	80	-2.92	0.0046
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	10	-24.8229	10.3403	80	-2.40	0.0187
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	14	-20.7034	10.3403	80	-2.00	0.0487
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	18	-6.4754	10.3403	80	-0.63	0.5329
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	2	-29.3765	10.3403	80	-2.84	0.0057
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	6	-38.5175	10.9704	80	-3.51	0.0007
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	10	-15.6661	9.9038	80	-1.58	0.1176
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	14	-4.6890	9.9038	80	-0.47	0.6372
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	18	3.1467	9.9038	80	0.32	0.7515
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	2	-33.9361	9.9038	80	-3.43	0.0010
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	6	-29.9504	9.9038	80	-3.02	0.0034
canopy*ash*depth	Canopy	NoAsh	2	Canopy	NoAsh	6	-12.0527	11.5579	80	-1.04	0.3002
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	10	-2.0580	9.8979	80	-0.21	0.8358
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	14	2.0615	9.8979	80	0.21	0.8355
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	18	16.2894	9.8979	80	1.65	0.1037
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	2	-6.6116	9.8979	80	-0.67	0.5061
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	6	-15.7526	10.5526	80	-1.49	0.1394
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	10	7.0988	9.4390	80	0.75	0.4542
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	14	18.0758	9.4390	80	1.92	0.0591
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	18	25.9116	9.4390	80	2.75	0.0075
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	2	-11.1712	9.4390	80	-1.18	0.2401
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	6	-7.1855	9.4390	80	-0.76	0.4487
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	10	9.9947	11.9372	80	0.84	0.4049
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	14	14.1141	11.9372	80	1.18	0.2406
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	18	28.3421	11.9372	80	2.37	0.0200
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	2	5.4410	11.9372	80	0.46	0.6498
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	6	-3.6999	12.4854	80	-0.30	0.7677
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	10	19.1514	11.5595	80	1.66	0.1015
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	14	30.1285	11.5595	80	2.61	0.0109
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	18	37.9643	11.5595	80	3.28	0.0015
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	2	0.8814	11.5595	80	0.08	0.9394

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	6	4.8672	11.5595	80	0.42	0.6748
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	14	4.1194	10.3377	80	0.40	0.6913
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	18	18.3474	10.3377	80	1.77	0.0797
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	2	-4.5537	10.3377	80	-0.44	0.6608
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	6	-13.6946	10.9654	80	-1.25	0.2153
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	10	9.1567	9.8983	80	0.93	0.3577
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	14	20.1338	9.8983	80	2.03	0.0453
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	18	27.9696	9.8983	80	2.83	0.0060
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	2	-9.1133	9.8983	80	-0.92	0.3600
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	6	-5.1276	9.8983	80	-0.52	0.6059
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	18	14.2280	10.3377	80	1.38	0.1726
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	2	-8.6731	10.3377	80	-0.84	0.4040
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	6	-17.8140	10.9654	80	-1.62	0.1082
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	10	5.0373	9.8983	80	0.51	0.6122
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	14	16.0144	9.8983	80	1.62	0.1096
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	18	23.8501	9.8983	80	2.41	0.0183
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	2	-13.2327	9.8983	80	-1.34	0.1851
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	6	-9.2470	9.8983	80	-0.93	0.3530
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	Ash	2	-22.9011	10.3377	80	-2.22	0.0296
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	Ash	6	-32.0420	10.9654	80	-2.92	0.0045
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	10	-9.1907	9.8983	80	-0.93	0.3559
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	14	1.7864	9.8983	80	0.18	0.8572
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	18	9.6221	9.8983	80	0.97	0.3339
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	2	-27.4607	9.8983	80	-2.77	0.0069
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	6	-23.4750	9.8983	80	-2.37	0.0201
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	Ash	6	-9.1409	10.9654	80	-0.83	0.4070
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	10	13.7104	9.8983	80	1.39	0.1699
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	14	24.6875	9.8983	80	2.49	0.0147
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	18	32.5232	9.8983	80	3.29	0.0015
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	2	-4.5596	9.8983	80	-0.46	0.6463
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	6	-0.5739	9.8983	80	-0.06	0.9539
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	10	22.8513	10.5508	80	2.17	0.0333
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	14	33.8284	10.5508	80	3.21	0.0019
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	18	41.6642	10.5508	80	3.95	0.0002
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	2	4.5813	10.5508	80	0.43	0.6653
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	6	8.5670	10.5508	80	0.81	0.4192
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	14	10.9771	9.4370	80	1.16	0.2482
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	18	18.8128	9.4370	80	1.99	0.0496
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	2	-18.2700	9.4370	80	-1.94	0.0564

Differences of Least Squares Means											
Effect	canopy	ash	depth	_canopy	_ash	_depth	Estimate	Standard Error	DF	t Value	Pr > |t|
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	6	-14.2843	9.4370	80	-1.51	0.1341
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	18	7.8357	9.4370	80	0.83	0.4088
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	2	-29.2471	9.4370	80	-3.10	0.0027
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	6	-25.2614	9.4370	80	-2.68	0.0090
canopy*ash*depth	NoCanopy	NoAsh	18	NoCanopy	NoAsh	2	-37.0828	9.4370	80	-3.93	0.0002
canopy*ash*depth	NoCanopy	NoAsh	18	NoCanopy	NoAsh	6	-33.0971	9.4370	80	-3.51	0.0007
canopy*ash*depth	NoCanopy	NoAsh	2	NoCanopy	NoAsh	6	3.9857	9.4370	80	0.42	0.6739

Differences of Least Squares Means								
Effect	canopy	ash	depth	_canopy	_ash	_depth	Adjustment	Adj P
depth			10			14	Tukey-Kramer	0.8732
depth			10			18	Tukey-Kramer	0.0009
depth			10			2	Tukey-Kramer	0.8252
depth			10			6	Tukey-Kramer	0.3456
depth			14			18	Tukey-Kramer	0.0229
depth			14			2	Tukey-Kramer	0.2695
depth			14			6	Tukey-Kramer	0.0582
depth			18			2	Tukey-Kramer	<.0001
depth			18			6	Tukey-Kramer	<.0001
depth			2			6	Tukey-Kramer	0.8987
canopy	Canopy			NoCanopy			Tukey-Kramer	0.1219
canopy*depth	Canopy		10	Canopy		14	Tukey-Kramer	1.0000
canopy*depth	Canopy		10	Canopy		18	Tukey-Kramer	0.0673
canopy*depth	Canopy		10	Canopy		2	Tukey-Kramer	1.0000
canopy*depth	Canopy		10	Canopy		6	Tukey-Kramer	0.9988
canopy*depth	Canopy		10	NoCanopy		10	Tukey-Kramer	0.9606
canopy*depth	Canopy		10	NoCanopy		14	Tukey-Kramer	0.3946
canopy*depth	Canopy		10	NoCanopy		18	Tukey-Kramer	0.0085
canopy*depth	Canopy		10	NoCanopy		2	Tukey-Kramer	1.0000
canopy*depth	Canopy		10	NoCanopy		6	Tukey-Kramer	0.9996
canopy*depth	Canopy		14	Canopy		18	Tukey-Kramer	0.1744
canopy*depth	Canopy		14	Canopy		2	Tukey-Kramer	1.0000
canopy*depth	Canopy		14	Canopy		6	Tukey-Kramer	0.9896

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*depth	Canopy		14	NoCanopy		10	Tukey-Kramer	0.9959
canopy*depth	Canopy		14	NoCanopy		14	Tukey-Kramer	0.6512
canopy*depth	Canopy		14	NoCanopy		18	Tukey-Kramer	0.0315
canopy*depth	Canopy		14	NoCanopy		2	Tukey-Kramer	0.9997
canopy*depth	Canopy		14	NoCanopy		6	Tukey-Kramer	0.9936
canopy*depth	Canopy		18	Canopy		2	Tukey-Kramer	0.0749
canopy*depth	Canopy		18	Canopy		6	Tukey-Kramer	0.0182
canopy*depth	Canopy		18	NoCanopy		10	Tukey-Kramer	0.6317
canopy*depth	Canopy		18	NoCanopy		14	Tukey-Kramer	0.9960
canopy*depth	Canopy		18	NoCanopy		18	Tukey-Kramer	0.9997
canopy*depth	Canopy		18	NoCanopy		2	Tukey-Kramer	0.0215
canopy*depth	Canopy		18	NoCanopy		6	Tukey-Kramer	0.0103
canopy*depth	Canopy		2	Canopy		6	Tukey-Kramer	0.9966
canopy*depth	Canopy		2	NoCanopy		10	Tukey-Kramer	0.9746
canopy*depth	Canopy		2	NoCanopy		14	Tukey-Kramer	0.4326
canopy*depth	Canopy		2	NoCanopy		18	Tukey-Kramer	0.0092
canopy*depth	Canopy		2	NoCanopy		2	Tukey-Kramer	1.0000
canopy*depth	Canopy		2	NoCanopy		6	Tukey-Kramer	0.9984
canopy*depth	Canopy		6	NoCanopy		10	Tukey-Kramer	0.6611
canopy*depth	Canopy		6	NoCanopy		14	Tukey-Kramer	0.1349
canopy*depth	Canopy		6	NoCanopy		18	Tukey-Kramer	0.0023
canopy*depth	Canopy		6	NoCanopy		2	Tukey-Kramer	1.0000
canopy*depth	Canopy		6	NoCanopy		6	Tukey-Kramer	1.0000
canopy*depth	NoCanopy		10	NoCanopy		14	Tukey-Kramer	0.9855
canopy*depth	NoCanopy		10	NoCanopy		18	Tukey-Kramer	0.2104
canopy*depth	NoCanopy		10	NoCanopy		2	Tukey-Kramer	0.8291
canopy*depth	NoCanopy		10	NoCanopy		6	Tukey-Kramer	0.6463
canopy*depth	NoCanopy		14	NoCanopy		18	Tukey-Kramer	0.8555
canopy*depth	NoCanopy		14	NoCanopy		2	Tukey-Kramer	0.1879
canopy*depth	NoCanopy		14	NoCanopy		6	Tukey-Kramer	0.1021
canopy*depth	NoCanopy		18	NoCanopy		2	Tukey-Kramer	0.0020
canopy*depth	NoCanopy		18	NoCanopy		6	Tukey-Kramer	0.0009

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*depth	NoCanopy		2	NoCanopy		6	Tukey-Kramer	1.0000
ash		Ash			NoAsh		Tukey-Kramer	0.0117
ash*depth		Ash	10		Ash	14	Tukey-Kramer	0.9998
ash*depth		Ash	10		Ash	18	Tukey-Kramer	0.1359
ash*depth		Ash	10		Ash	2	Tukey-Kramer	1.0000
ash*depth		Ash	10		Ash	6	Tukey-Kramer	0.9961
ash*depth		Ash	10		NoAsh	10	Tukey-Kramer	0.8568
ash*depth		Ash	10		NoAsh	14	Tukey-Kramer	0.4380
ash*depth		Ash	10		NoAsh	18	Tukey-Kramer	0.0010
ash*depth		Ash	10		NoAsh	2	Tukey-Kramer	1.0000
ash*depth		Ash	10		NoAsh	6	Tukey-Kramer	1.0000
ash*depth		Ash	14		Ash	18	Tukey-Kramer	0.4430
ash*depth		Ash	14		Ash	2	Tukey-Kramer	0.9982
ash*depth		Ash	14		Ash	6	Tukey-Kramer	0.8945
ash*depth		Ash	14		NoAsh	10	Tukey-Kramer	0.9947
ash*depth		Ash	14		NoAsh	14	Tukey-Kramer	0.8314
ash*depth		Ash	14		NoAsh	18	Tukey-Kramer	0.0092
ash*depth		Ash	14		NoAsh	2	Tukey-Kramer	1.0000
ash*depth		Ash	14		NoAsh	6	Tukey-Kramer	0.9975
ash*depth		Ash	18		Ash	2	Tukey-Kramer	0.0863
ash*depth		Ash	18		Ash	6	Tukey-Kramer	0.0191
ash*depth		Ash	18		NoAsh	10	Tukey-Kramer	0.9401
ash*depth		Ash	18		NoAsh	14	Tukey-Kramer	0.9999
ash*depth		Ash	18		NoAsh	18	Tukey-Kramer	0.8694
ash*depth		Ash	18		NoAsh	2	Tukey-Kramer	0.1936
ash*depth		Ash	18		NoAsh	6	Tukey-Kramer	0.1083
ash*depth		Ash	2		Ash	6	Tukey-Kramer	0.9993
ash*depth		Ash	2		NoAsh	10	Tukey-Kramer	0.7535
ash*depth		Ash	2		NoAsh	14	Tukey-Kramer	0.3232
ash*depth		Ash	2		NoAsh	18	Tukey-Kramer	0.0005
ash*depth		Ash	2		NoAsh	2	Tukey-Kramer	1.0000
ash*depth		Ash	2		NoAsh	6	Tukey-Kramer	1.0000

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
ash*depth		Ash	6		NoAsh	10	Tukey-Kramer	0.3440
ash*depth		Ash	6		NoAsh	14	Tukey-Kramer	0.0957
ash*depth		Ash	6		NoAsh	18	Tukey-Kramer	<.0001
ash*depth		Ash	6		NoAsh	2	Tukey-Kramer	0.9699
ash*depth		Ash	6		NoAsh	6	Tukey-Kramer	0.9998
ash*depth		NoAsh	10		NoAsh	14	Tukey-Kramer	0.9992
ash*depth		NoAsh	10		NoAsh	18	Tukey-Kramer	0.1079
ash*depth		NoAsh	10		NoAsh	2	Tukey-Kramer	0.9377
ash*depth		NoAsh	10		NoAsh	6	Tukey-Kramer	0.7661
ash*depth		NoAsh	14		NoAsh	18	Tukey-Kramer	0.5152
ash*depth		NoAsh	14		NoAsh	2	Tukey-Kramer	0.5639
ash*depth		NoAsh	14		NoAsh	6	Tukey-Kramer	0.3550
ash*depth		NoAsh	18		NoAsh	2	Tukey-Kramer	0.0014
ash*depth		NoAsh	18		NoAsh	6	Tukey-Kramer	0.0010
ash*depth		NoAsh	2		NoAsh	6	Tukey-Kramer	0.9999
canopy*ash	Canopy	Ash		Canopy	NoAsh		Tukey-Kramer	0.2311
canopy*ash	Canopy	Ash		NoCanopy	Ash		Tukey-Kramer	0.5960
canopy*ash	Canopy	Ash		NoCanopy	NoAsh		Tukey-Kramer	0.0160
canopy*ash	Canopy	NoAsh		NoCanopy	Ash		Tukey-Kramer	0.8989
canopy*ash	Canopy	NoAsh		NoCanopy	NoAsh		Tukey-Kramer	0.7770
canopy*ash	NoCanopy	Ash		NoCanopy	NoAsh		Tukey-Kramer	0.3154
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	18	Tukey-Kramer	0.7518
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	10	Tukey-Kramer	0.9989
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	14	Tukey-Kramer	0.9997
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	18	Tukey-Kramer	0.0855
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	2	Tukey-Kramer	0.9985
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	10	Tukey-Kramer	0.9999
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	14	Tukey-Kramer	0.9947

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	18	Tukey-Kramer	0.3460
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	10	Tukey-Kramer	0.8734
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	14	Tukey-Kramer	0.1853
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	18	Tukey-Kramer	0.0217
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	18	Tukey-Kramer	0.9595
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	18	Tukey-Kramer	0.2634
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	18	Tukey-Kramer	0.6843
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	10	Tukey-Kramer	0.9908
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	14	Tukey-Kramer	0.4776
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	18	Tukey-Kramer	0.0918
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	Canopy	Ash	2	Tukey-Kramer	0.8510
canopy*ash*depth	Canopy	Ash	18	Canopy	Ash	6	Tukey-Kramer	0.8175
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	18	Tukey-Kramer	0.9996
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	2	Tukey-Kramer	1.0000

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	6	Tukey-Kramer	0.9382
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	10	Tukey-Kramer	0.9996
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	2	Tukey-Kramer	0.9830
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	6	Tukey-Kramer	0.6788
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	18	Tukey-Kramer	0.9880
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	2	Tukey-Kramer	0.8115
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	6	Tukey-Kramer	0.9635
canopy*ash*depth	Canopy	Ash	2	Canopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	10	Tukey-Kramer	0.9998
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	18	Tukey-Kramer	0.1324
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	2	Tukey-Kramer	0.9998
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	14	Tukey-Kramer	0.9989
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	18	Tukey-Kramer	0.4616
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	10	Tukey-Kramer	0.9395
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	14	Tukey-Kramer	0.2717
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	18	Tukey-Kramer	0.0374
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	10	Tukey-Kramer	0.9994
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	14	Tukey-Kramer	0.9998
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	18	Tukey-Kramer	0.1349
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	2	Tukey-Kramer	0.9992
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	6	Tukey-Kramer	1.0000

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	14	Tukey-Kramer	0.9969
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	18	Tukey-Kramer	0.4411
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	10	Tukey-Kramer	0.9160
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	14	Tukey-Kramer	0.2687
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	18	Tukey-Kramer	0.0425
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	18	Tukey-Kramer	0.8032
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	18	Tukey-Kramer	0.9900
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	6	Tukey-Kramer	0.9952
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	14	Tukey-Kramer	0.9553
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	18	Tukey-Kramer	0.5191
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	2	Tukey-Kramer	0.9998
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	18	Tukey-Kramer	0.8516
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	18	Tukey-Kramer	0.9933
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	6	Tukey-Kramer	0.9981

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	14	Tukey-Kramer	0.9700
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	18	Tukey-Kramer	0.6094
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	2	Tukey-Kramer	0.9999
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	Canopy	NoAsh	2	Tukey-Kramer	0.7287
canopy*ash*depth	Canopy	NoAsh	18	Canopy	NoAsh	6	Tukey-Kramer	0.3037
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	10	Tukey-Kramer	0.6592
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	14	Tukey-Kramer	0.8919
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	2	Tukey-Kramer	0.3493
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	6	Tukey-Kramer	0.0766
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	10	Tukey-Kramer	0.9879
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	2	Tukey-Kramer	0.0957
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	6	Tukey-Kramer	0.2451
canopy*ash*depth	Canopy	NoAsh	2	Canopy	NoAsh	6	Tukey-Kramer	0.9999
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	18	Tukey-Kramer	0.9815
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	6	Tukey-Kramer	0.9936
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	14	Tukey-Kramer	0.9242
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	18	Tukey-Kramer	0.4120
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	2	Tukey-Kramer	0.9997
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	14	Tukey-Kramer	0.9997
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	18	Tukey-Kramer	0.6778
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	2	Tukey-Kramer	1.0000

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	10	Tukey-Kramer	0.9802
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	14	Tukey-Kramer	0.5097
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	18	Tukey-Kramer	0.1367
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	18	Tukey-Kramer	0.9612
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	6	Tukey-Kramer	0.9993
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	14	Tukey-Kramer	0.8782
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	18	Tukey-Kramer	0.3590
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	18	Tukey-Kramer	0.9976
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	6	Tukey-Kramer	0.9839
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	14	Tukey-Kramer	0.9845
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	18	Tukey-Kramer	0.6528
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	2	Tukey-Kramer	0.9983
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	Ash	2	Tukey-Kramer	0.7824
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	Ash	6	Tukey-Kramer	0.3004
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	2	Tukey-Kramer	0.3924
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	6	Tukey-Kramer	0.6796
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	10	Tukey-Kramer	0.9974

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	14	Tukey-Kramer	0.5917
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	18	Tukey-Kramer	0.1362
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	10	Tukey-Kramer	0.8115
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	14	Tukey-Kramer	0.1644
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	18	Tukey-Kramer	0.0214
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	14	Tukey-Kramer	0.9997
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	18	Tukey-Kramer	0.8954
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	2	Tukey-Kramer	0.9171
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	6	Tukey-Kramer	0.9925
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	2	Tukey-Kramer	0.2090
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	6	Tukey-Kramer	0.4593
canopy*ash*depth	NoCanopy	NoAsh	18	NoCanopy	NoAsh	2	Tukey-Kramer	0.0228
canopy*ash*depth	NoCanopy	NoAsh	18	NoCanopy	NoAsh	6	Tukey-Kramer	0.0774
canopy*ash*depth	NoCanopy	NoAsh	2	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000

July No Burn Sedge Dominated Islands CTSL 0 – 20 cm AVG (Figure 6B)

Program:

```
title '0 - 20 cm CTSL Avg July Sedge';

proc mixed data=CTSL;
        class island canopy ash;
        model TotalAvgCTSL=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	15	9.70	0.0071
ash	1	15	0.40	0.5362
canopy*ash	1	15	0.44	0.5194
island	1	15	0.04	0.8539
island*canopy	1	15	5.57	0.0323
island*ash	1	15	0.07	0.7956
island*canopy*ash	1	15	2.02	0.1752

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		76.4940	2.5693	15	29.77	<.0001
canopy	NoCanopy		64.8318	2.7252	15	23.79	<.0001
ash		Ash	71.8484	2.7252	15	26.36	<.0001
ash		NoAsh	69.4774	2.5693	15	27.04	<.0001
canopy*ash	Canopy	Ash	78.9151	3.6336	15	21.72	<.0001
canopy*ash	Canopy	NoAsh	74.0729	3.6336	15	20.39	<.0001
canopy*ash	NoCanopy	Ash	64.7817	4.0624	15	15.95	<.0001
canopy*ash	NoCanopy	NoAsh	64.8819	3.6336	15	17.86	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		11.6622	3.7454	15	3.11	0.0071	Tukey-Kramer	0.0071
ash		Ash		NoAsh	2.3710	3.7454	15	0.63	0.5362	Tukey-Kramer	0.5362
canopy*ash	Canopy	Ash	Canopy	NoAsh	4.8422	5.1386	15	0.94	0.3610	Tukey-Kramer	0.7830
canopy*ash	Canopy	Ash	NoCanopy	Ash	14.1334	5.4503	15	2.59	0.0204	Tukey-Kramer	0.0851
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	14.0332	5.1386	15	2.73	0.0155	Tukey-Kramer	0.0662
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	9.2912	5.4503	15	1.70	0.1089	Tukey-Kramer	0.3554
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	9.1910	5.1386	15	1.79	0.0939	Tukey-Kramer	0.3164
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-0.1002	5.4503	15	-0.02	0.9856	Tukey-Kramer	1.0000

July No Burn Sedge Dominated Depthwise CTSL (Figure 9B)

Program:

```
title 'July No Burn Sedge Dom CTSL Depthwise';


proc mixed data=CTSL;
class canopy ash island depth;
model CTSLdepthwise = canopy|ash|depth;
random island;
repeated depth/subject = canopy*ash type=cs;
lsmeans depth|canopy|ash / adjust=tukey;

RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	87	15.62	0.0002
ash	1	87	1.44	0.2333
canopy*ash	1	87	0.30	0.5824
depth	4	87	0.85	0.4981
canopy*depth	4	87	1.30	0.2775
ash*depth	4	87	0.52	0.7193
canopy*ash*depth	4	87	0.43	0.7861

Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
depth			10	67.3140	3.0440	87	22.11	<.0001
depth			14	69.9940	3.0784	87	22.74	<.0001
depth			18	70.8969	3.1460	87	22.54	<.0001
depth			2	74.8447	2.9740	87	25.17	<.0001
depth			6	72.2579	3.2123	87	22.49	<.0001
canopy	Canopy			76.5262	1.9164	87	39.93	<.0001
canopy	NoCanopy			65.5968	1.9940	87	32.90	<.0001
canopy*depth	Canopy		10	75.5177	4.1045	87	18.40	<.0001
canopy*depth	Canopy		14	75.6961	4.1045	87	18.44	<.0001

Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*depth	Canopy		18	73.9159	4.3048	87	17.17	<.0001
canopy*depth	Canopy		2	84.3009	4.1045	87	20.54	<.0001
canopy*depth	Canopy		6	73.2004	4.7690	87	15.35	<.0001
canopy*depth	NoCanopy		10	59.1104	4.4963	87	13.15	<.0001
canopy*depth	NoCanopy		14	64.2918	4.5890	87	14.01	<.0001
canopy*depth	NoCanopy		18	67.8780	4.5890	87	14.79	<.0001
canopy*depth	NoCanopy		2	65.3885	4.3048	87	15.19	<.0001
canopy*depth	NoCanopy		6	71.3153	4.3048	87	16.57	<.0001
ash		Ash		72.7212	2.0191	87	36.02	<.0001
ash		NoAsh		69.4018	1.8899	87	36.72	<.0001
ash*depth		Ash	10	66.8335	4.3048	87	15.53	<.0001
ash*depth		Ash	14	73.9345	4.5890	87	16.11	<.0001
ash*depth		Ash	18	70.3785	4.5890	87	15.34	<.0001
ash*depth		Ash	2	78.7405	4.3048	87	18.29	<.0001
ash*depth		Ash	6	73.7191	4.7690	87	15.46	<.0001
ash*depth		NoAsh	10	67.7945	4.3048	87	15.75	<.0001
ash*depth		NoAsh	14	66.0535	4.1045	87	16.09	<.0001
ash*depth		NoAsh	18	71.4154	4.3048	87	16.59	<.0001
ash*depth		NoAsh	2	70.9489	4.1045	87	17.29	<.0001
ash*depth		NoAsh	6	70.7966	4.3048	87	16.45	<.0001
canopy*ash	Canopy	Ash		78.9490	2.7226	87	29.00	<.0001
canopy*ash	Canopy	NoAsh		74.1033	2.6978	87	27.47	<.0001
canopy*ash	NoCanopy	Ash		66.4934	2.9825	87	22.29	<.0001
canopy*ash	NoCanopy	NoAsh		64.7002	2.6473	87	24.44	<.0001
canopy*ash*depth	Canopy	Ash	10	78.9204	5.8046	87	13.60	<.0001
canopy*ash*depth	Canopy	Ash	14	78.5082	5.8046	87	13.53	<.0001
canopy*ash*depth	Canopy	Ash	18	74.5326	5.8046	87	12.84	<.0001
canopy*ash*depth	Canopy	Ash	2	87.3844	5.8046	87	15.05	<.0001
canopy*ash*depth	Canopy	Ash	6	75.3996	7.1092	87	10.61	<.0001
canopy*ash*depth	Canopy	NoAsh	10	72.1150	5.8046	87	12.42	<.0001
canopy*ash*depth	Canopy	NoAsh	14	72.8840	5.8046	87	12.56	<.0001

Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*ash*depth	Canopy	NoAsh	18	73.2992	6.3587	87	11.53	<.0001
canopy*ash*depth	Canopy	NoAsh	2	81.2173	5.8046	87	13.99	<.0001
canopy*ash*depth	Canopy	NoAsh	6	71.0012	6.3587	87	11.17	<.0001
canopy*ash*depth	NoCanopy	Ash	10	54.7467	6.3587	87	8.61	<.0001
canopy*ash*depth	NoCanopy	Ash	14	69.3607	7.1092	87	9.76	<.0001
canopy*ash*depth	NoCanopy	Ash	18	66.2244	7.1092	87	9.32	<.0001
canopy*ash*depth	NoCanopy	Ash	2	70.0965	6.3587	87	11.02	<.0001
canopy*ash*depth	NoCanopy	Ash	6	72.0386	6.3587	87	11.33	<.0001
canopy*ash*depth	NoCanopy	NoAsh	10	63.4741	6.3587	87	9.98	<.0001
canopy*ash*depth	NoCanopy	NoAsh	14	59.2230	5.8046	87	10.20	<.0001
canopy*ash*depth	NoCanopy	NoAsh	18	69.5316	5.8046	87	11.98	<.0001
canopy*ash*depth	NoCanopy	NoAsh	2	60.6805	5.8046	87	10.45	<.0001
canopy*ash*depth	NoCanopy	NoAsh	6	70.5921	5.8046	87	12.16	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
depth			10			14	-2.6799	4.3292	87	-0.62	0.5375
depth			10			18	-3.5829	4.3776	87	-0.82	0.4153
depth			10			2	-7.5307	4.2556	87	-1.77	0.0803
depth			10			6	-4.9438	4.4254	87	-1.12	0.2670
depth			14			18	-0.9029	4.4016	87	-0.21	0.8379
depth			14			2	-4.8507	4.2803	87	-1.13	0.2602
depth			14			6	-2.2639	4.4492	87	-0.51	0.6122
depth			18			2	-3.9478	4.3292	87	-0.91	0.3643
depth			18			6	-1.3610	4.4963	87	-0.30	0.7629
depth			2			6	2.5868	4.3776	87	0.59	0.5561
canopy	Canopy			NoCanopy			10.9294	2.7656	87	3.95	0.0002
canopy*depth	Canopy		10	Canopy		14	-0.1784	5.8046	87	-0.03	0.9755
canopy*depth	Canopy		10	Canopy		18	1.6018	5.9480	87	0.27	0.7883
canopy*depth	Canopy		10	Canopy		2	-8.7832	5.8046	87	-1.51	0.1339
canopy*depth	Canopy		10	Canopy		6	2.3173	6.2921	87	0.37	0.7136
canopy*depth	Canopy		10	NoCanopy		10	16.4073	6.0880	87	2.70	0.0084
canopy*depth	Canopy		10	NoCanopy		14	11.2259	6.1567	87	1.82	0.0717
canopy*depth	Canopy		10	NoCanopy		18	7.6397	6.1567	87	1.24	0.2180

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*depth	Canopy		10	NoCanopy		2	10.1292	5.9480	87	1.70	0.0921
canopy*depth	Canopy		10	NoCanopy		6	4.2024	5.9480	87	0.71	0.4818
canopy*depth	Canopy		14	Canopy		18	1.7803	5.9480	87	0.30	0.7654
canopy*depth	Canopy		14	Canopy		2	-8.6047	5.8046	87	-1.48	0.1418
canopy*depth	Canopy		14	Canopy		6	2.4957	6.2921	87	0.40	0.6926
canopy*depth	Canopy		14	NoCanopy		10	16.5857	6.0880	87	2.72	0.0078
canopy*depth	Canopy		14	NoCanopy		14	11.4043	6.1567	87	1.85	0.0674
canopy*depth	Canopy		14	NoCanopy		18	7.8182	6.1567	87	1.27	0.2075
canopy*depth	Canopy		14	NoCanopy		2	10.3076	5.9480	87	1.73	0.0866
canopy*depth	Canopy		14	NoCanopy		6	4.3808	5.9480	87	0.74	0.4634
canopy*depth	Canopy		18	Canopy		2	-10.3850	5.9480	87	-1.75	0.0843
canopy*depth	Canopy		18	Canopy		6	0.7155	6.4246	87	0.11	0.9116
canopy*depth	Canopy		18	NoCanopy		10	14.8055	6.2248	87	2.38	0.0196
canopy*depth	Canopy		18	NoCanopy		14	9.6240	6.2921	87	1.53	0.1298
canopy*depth	Canopy		18	NoCanopy		18	6.0379	6.2921	87	0.96	0.3399
canopy*depth	Canopy		18	NoCanopy		2	8.5273	6.0880	87	1.40	0.1649
canopy*depth	Canopy		18	NoCanopy		6	2.6005	6.0880	87	0.43	0.6703
canopy*depth	Canopy		2	Canopy		6	11.1005	6.2921	87	1.76	0.0812
canopy*depth	Canopy		2	NoCanopy		10	25.1905	6.0880	87	4.14	<.0001
canopy*depth	Canopy		2	NoCanopy		14	20.0090	6.1567	87	3.25	0.0016
canopy*depth	Canopy		2	NoCanopy		18	16.4229	6.1567	87	2.67	0.0091
canopy*depth	Canopy		2	NoCanopy		2	18.9123	5.9480	87	3.18	0.0020
canopy*depth	Canopy		2	NoCanopy		6	12.9855	5.9480	87	2.18	0.0317
canopy*depth	Canopy		6	NoCanopy		10	14.0900	6.5544	87	2.15	0.0344
canopy*depth	Canopy		6	NoCanopy		14	8.9086	6.6183	87	1.35	0.1818
canopy*depth	Canopy		6	NoCanopy		18	5.3224	6.6183	87	0.80	0.4235
canopy*depth	Canopy		6	NoCanopy		2	7.8119	6.4246	87	1.22	0.2273
canopy*depth	Canopy		6	NoCanopy		6	1.8851	6.4246	87	0.29	0.7699
canopy*depth	NoCanopy		10	NoCanopy		14	-5.1814	6.4246	87	-0.81	0.4222
canopy*depth	NoCanopy		10	NoCanopy		18	-8.7676	6.4246	87	-1.36	0.1759
canopy*depth	NoCanopy		10	NoCanopy		2	-6.2781	6.2248	87	-1.01	0.3160
canopy*depth	NoCanopy		10	NoCanopy		6	-12.2050	6.2248	87	-1.96	0.0531
canopy*depth	NoCanopy		14	NoCanopy		18	-3.5861	6.4898	87	-0.55	0.5820
canopy*depth	NoCanopy		14	NoCanopy		2	-1.0967	6.2921	87	-0.17	0.8620
canopy*depth	NoCanopy		14	NoCanopy		6	-7.0235	6.2921	87	-1.12	0.2674
canopy*depth	NoCanopy		18	NoCanopy		2	2.4894	6.2921	87	0.40	0.6933
canopy*depth	NoCanopy		18	NoCanopy		6	-3.4374	6.2921	87	-0.55	0.5863
canopy*depth	NoCanopy		2	NoCanopy		6	-5.9268	6.0880	87	-0.97	0.3330
ash		Ash			NoAsh		3.3194	2.7656	87	1.20	0.2333

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
ash*depth		Ash	10		Ash	14	-7.1009	6.2921	87	-1.13	0.2622
ash*depth		Ash	10		Ash	18	-3.5449	6.2921	87	-0.56	0.5746
ash*depth		Ash	10		Ash	2	-11.9069	6.0880	87	-1.96	0.0537
ash*depth		Ash	10		Ash	6	-6.8856	6.4246	87	-1.07	0.2868
ash*depth		Ash	10		NoAsh	10	-0.9610	6.0880	87	-0.16	0.8749
ash*depth		Ash	10		NoAsh	14	0.7801	5.9480	87	0.13	0.8960
ash*depth		Ash	10		NoAsh	18	-4.5818	6.0880	87	-0.75	0.4537
ash*depth		Ash	10		NoAsh	2	-4.1154	5.9480	87	-0.69	0.4908
ash*depth		Ash	10		NoAsh	6	-3.9631	6.0880	87	-0.65	0.5168
ash*depth		Ash	14		Ash	18	3.5560	6.4898	87	0.55	0.5851
ash*depth		Ash	14		Ash	2	-4.8060	6.2921	87	-0.76	0.4470
ash*depth		Ash	14		Ash	6	0.2154	6.6183	87	0.03	0.9741
ash*depth		Ash	14		NoAsh	10	6.1399	6.2921	87	0.98	0.3319
ash*depth		Ash	14		NoAsh	14	7.8810	6.1567	87	1.28	0.2039
ash*depth		Ash	14		NoAsh	18	2.5191	6.2921	87	0.40	0.6899
ash*depth		Ash	14		NoAsh	2	2.9855	6.1567	87	0.48	0.6290
ash*depth		Ash	14		NoAsh	6	3.1378	6.2921	87	0.50	0.6193
ash*depth		Ash	18		Ash	2	-8.3620	6.2921	87	-1.33	0.1873
ash*depth		Ash	18		Ash	6	-3.3406	6.6183	87	-0.50	0.6150
ash*depth		Ash	18		NoAsh	10	2.5839	6.2921	87	0.41	0.6823
ash*depth		Ash	18		NoAsh	14	4.3250	6.1567	87	0.70	0.4843
ash*depth		Ash	18		NoAsh	18	-1.0369	6.2921	87	-0.16	0.8695
ash*depth		Ash	18		NoAsh	2	-0.5705	6.1567	87	-0.09	0.9264
ash*depth		Ash	18		NoAsh	6	-0.4182	6.2921	87	-0.07	0.9472
ash*depth		Ash	2		Ash	6	5.0214	6.4246	87	0.78	0.4366
ash*depth		Ash	2		NoAsh	10	10.9459	6.0880	87	1.80	0.0757
ash*depth		Ash	2		NoAsh	14	12.6870	5.9480	87	2.13	0.0357
ash*depth		Ash	2		NoAsh	18	7.3251	6.0880	87	1.20	0.2322
ash*depth		Ash	2		NoAsh	2	7.7915	5.9480	87	1.31	0.1937
ash*depth		Ash	2		NoAsh	6	7.9438	6.0880	87	1.30	0.1954
ash*depth		Ash	6		NoAsh	10	5.9246	6.4246	87	0.92	0.3590
ash*depth		Ash	6		NoAsh	14	7.6656	6.2921	87	1.22	0.2264
ash*depth		Ash	6		NoAsh	18	2.3037	6.4246	87	0.36	0.7208
ash*depth		Ash	6		NoAsh	2	2.7702	6.2921	87	0.44	0.6608
ash*depth		Ash	6		NoAsh	6	2.9224	6.4246	87	0.45	0.6503
ash*depth		NoAsh	10		NoAsh	14	1.7411	5.9480	87	0.29	0.7704
ash*depth		NoAsh	10		NoAsh	18	-3.6208	6.0880	87	-0.59	0.5536
ash*depth		NoAsh	10		NoAsh	2	-3.1544	5.9480	87	-0.53	0.5972
ash*depth		NoAsh	10		NoAsh	6	-3.0021	6.0880	87	-0.49	0.6232

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
ash*depth		NoAsh	14		NoAsh	18	-5.3619	5.9480	87	-0.90	0.3698
ash*depth		NoAsh	14		NoAsh	2	-4.8955	5.8046	87	-0.84	0.4013
ash*depth		NoAsh	14		NoAsh	6	-4.7432	5.9480	87	-0.80	0.4274
ash*depth		NoAsh	18		NoAsh	2	0.4664	5.9480	87	0.08	0.9377
ash*depth		NoAsh	18		NoAsh	6	0.6187	6.0880	87	0.10	0.9193
ash*depth		NoAsh	2		NoAsh	6	0.1523	5.9480	87	0.03	0.9796
canopy*ash	Canopy	Ash		Canopy	NoAsh		4.8457	3.8328	87	1.26	0.2095
canopy*ash	Canopy	Ash		NoCanopy	Ash		12.4557	4.0383	87	3.08	0.0027
canopy*ash	Canopy	Ash		NoCanopy	NoAsh		14.2488	3.7975	87	3.75	0.0003
canopy*ash	Canopy	NoAsh		NoCanopy	Ash		7.6100	4.0216	87	1.89	0.0618
canopy*ash	Canopy	NoAsh		NoCanopy	NoAsh		9.4031	3.7797	87	2.49	0.0148
canopy*ash	NoCanopy	Ash		NoCanopy	NoAsh		1.7931	3.9879	87	0.45	0.6541
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	14	0.4121	8.2090	87	0.05	0.9601
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	18	4.3878	8.2090	87	0.53	0.5943
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	2	-8.4640	8.2090	87	-1.03	0.3054
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	6	3.5208	9.1779	87	0.38	0.7022
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	10	6.8054	8.2090	87	0.83	0.4094
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	14	6.0364	8.2090	87	0.74	0.4641
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	18	5.6212	8.6097	87	0.65	0.5155
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	2	-2.2969	8.2090	87	-0.28	0.7803
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	6	7.9192	8.6097	87	0.92	0.3602
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	10	24.1737	8.6097	87	2.81	0.0062
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	14	9.5597	9.1779	87	1.04	0.3005
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	18	12.6960	9.1779	87	1.38	0.1701
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	2	8.8239	8.6097	87	1.02	0.3083
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	6	6.8818	8.6097	87	0.80	0.4263
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	10	15.4463	8.6097	87	1.79	0.0763
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	14	19.6974	8.2090	87	2.40	0.0186
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	18	9.3888	8.2090	87	1.14	0.2559
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	2	18.2398	8.2090	87	2.22	0.0289
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	6	8.3283	8.2090	87	1.01	0.3131
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	18	3.9757	8.2090	87	0.48	0.6294
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	2	-8.8762	8.2090	87	-1.08	0.2826
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	6	3.1087	9.1779	87	0.34	0.7356
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	10	6.3932	8.2090	87	0.78	0.4382
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	14	5.6242	8.2090	87	0.69	0.4951
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	18	5.2091	8.6097	87	0.61	0.5467
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	2	-2.7091	8.2090	87	-0.33	0.7422
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	6	7.5070	8.6097	87	0.87	0.3856

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	10	23.7616	8.6097	87	2.76	0.0071
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	14	9.1476	9.1779	87	1.00	0.3217
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	18	12.2839	9.1779	87	1.34	0.1842
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	2	8.4117	8.6097	87	0.98	0.3313
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	6	6.4696	8.6097	87	0.75	0.4544
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	10	15.0342	8.6097	87	1.75	0.0843
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	14	19.2853	8.2090	87	2.35	0.0211
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	18	8.9767	8.2090	87	1.09	0.2772
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	2	17.8277	8.2090	87	2.17	0.0326
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	6	7.9162	8.2090	87	0.96	0.3376
canopy*ash*depth	Canopy	Ash	18	Canopy	Ash	2	-12.8518	8.2090	87	-1.57	0.1211
canopy*ash*depth	Canopy	Ash	18	Canopy	Ash	6	-0.8670	9.1779	87	-0.09	0.9250
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	10	2.4176	8.2090	87	0.29	0.7691
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	14	1.6486	8.2090	87	0.20	0.8413
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	18	1.2334	8.6097	87	0.14	0.8864
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	2	-6.6848	8.2090	87	-0.81	0.4177
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	6	3.5314	8.6097	87	0.41	0.6827
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	10	19.7859	8.6097	87	2.30	0.0240
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	14	5.1719	9.1779	87	0.56	0.5745
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	18	8.3082	9.1779	87	0.91	0.3678
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	2	4.4361	8.6097	87	0.52	0.6077
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	6	2.4940	8.6097	87	0.29	0.7728
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	10	11.0585	8.6097	87	1.28	0.2024
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	14	15.3096	8.2090	87	1.86	0.0656
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	18	5.0010	8.2090	87	0.61	0.5440
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	2	13.8520	8.2090	87	1.69	0.0951
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	6	3.9405	8.2090	87	0.48	0.6324
canopy*ash*depth	Canopy	Ash	2	Canopy	Ash	6	11.9848	9.1779	87	1.31	0.1951
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	10	15.2694	8.2090	87	1.86	0.0663
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	14	14.5004	8.2090	87	1.77	0.0808
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	18	14.0852	8.6097	87	1.64	0.1055
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	2	6.1671	8.2090	87	0.75	0.4545
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	6	16.3832	8.6097	87	1.90	0.0604
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	10	32.6377	8.6097	87	3.79	0.0003
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	14	18.0237	9.1779	87	1.96	0.0527
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	18	21.1600	9.1779	87	2.31	0.0235
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	2	17.2879	8.6097	87	2.01	0.0477
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	6	15.3458	8.6097	87	1.78	0.0782
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	10	23.9103	8.6097	87	2.78	0.0067

Differences of Least Squares Means											
Effect	canopy	ash	depth	_canopy	_ash	_depth	Estimate	Standard Error	DF	t Value	Pr > |t|
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	14	28.1614	8.2090	87	3.43	0.0009
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	18	17.8528	8.2090	87	2.17	0.0324
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	2	26.7039	8.2090	87	3.25	0.0016
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	6	16.7923	8.2090	87	2.05	0.0438
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	10	3.2846	9.1779	87	0.36	0.7213
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	14	2.5156	9.1779	87	0.27	0.7847
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	18	2.1004	9.5380	87	0.22	0.8262
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	2	-5.8178	9.1779	87	-0.63	0.5278
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	6	4.3984	9.5380	87	0.46	0.6458
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	10	20.6529	9.5380	87	2.17	0.0331
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	14	6.0389	10.0539	87	0.60	0.5496
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	18	9.1752	10.0539	87	0.91	0.3640
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	2	5.3031	9.5380	87	0.56	0.5796
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	6	3.3610	9.5380	87	0.35	0.7254
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	10	11.9255	9.5380	87	1.25	0.2145
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	14	16.1766	9.1779	87	1.76	0.0815
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	18	5.8680	9.1779	87	0.64	0.5243
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	2	14.7190	9.1779	87	1.60	0.1124
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	6	4.8075	9.1779	87	0.52	0.6017
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	14	-0.7690	8.2090	87	-0.09	0.9256
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	18	-1.1842	8.6097	87	-0.14	0.8909
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	2	-9.1023	8.2090	87	-1.11	0.2706
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	6	1.1138	8.6097	87	0.13	0.8974
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	10	17.3683	8.6097	87	2.02	0.0467
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	14	2.7543	9.1779	87	0.30	0.7648
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	18	5.8906	9.1779	87	0.64	0.5227
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	2	2.0185	8.6097	87	0.23	0.8152
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	6	0.07640	8.6097	87	0.01	0.9929
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	10	8.6409	8.6097	87	1.00	0.3183
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	14	12.8920	8.2090	87	1.57	0.1199
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	18	2.5834	8.2090	87	0.31	0.7537
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	2	11.4345	8.2090	87	1.39	0.1672
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	6	1.5229	8.2090	87	0.19	0.8533
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	18	-0.4152	8.6097	87	-0.05	0.9617
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	2	-8.3333	8.2090	87	-1.02	0.3129
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	6	1.8828	8.6097	87	0.22	0.8274
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	10	18.1373	8.6097	87	2.11	0.0380
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	14	3.5233	9.1779	87	0.38	0.7020
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	18	6.6596	9.1779	87	0.73	0.4700

Differences of Least Squares Means											
Effect	canopy	ash	depth	_canopy	_ash	_depth	Estimate	Standard Error	DF	t Value	Pr > |t|
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	2	2.7875	8.6097	87	0.32	0.7469
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	6	0.8454	8.6097	87	0.10	0.9220
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	10	9.4099	8.6097	87	1.09	0.2774
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	14	13.6610	8.2090	87	1.66	0.0997
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	18	3.3524	8.2090	87	0.41	0.6840
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	2	12.2035	8.2090	87	1.49	0.1407
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	6	2.2919	8.2090	87	0.28	0.7808
canopy*ash*depth	Canopy	NoAsh	18	Canopy	NoAsh	2	-7.9182	8.6097	87	-0.92	0.3603
canopy*ash*depth	Canopy	NoAsh	18	Canopy	NoAsh	6	2.2979	8.9925	87	0.26	0.7989
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	10	18.5525	8.9925	87	2.06	0.0421
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	14	3.9385	9.5380	87	0.41	0.6807
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	18	7.0748	9.5380	87	0.74	0.4602
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	2	3.2027	8.9925	87	0.36	0.7226
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	6	1.2606	8.9925	87	0.14	0.8888
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	10	9.8251	8.9925	87	1.09	0.2776
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	14	14.0762	8.6097	87	1.63	0.1057
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	18	3.7676	8.6097	87	0.44	0.6628
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	2	12.6186	8.6097	87	1.47	0.1464
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	6	2.7071	8.6097	87	0.31	0.7540
canopy*ash*depth	Canopy	NoAsh	2	Canopy	NoAsh	6	10.2161	8.6097	87	1.19	0.2386
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	10	26.4706	8.6097	87	3.07	0.0028
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	14	11.8567	9.1779	87	1.29	0.1998
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	18	14.9930	9.1779	87	1.63	0.1060
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	2	11.1208	8.6097	87	1.29	0.1999
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	6	9.1787	8.6097	87	1.07	0.2893
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	10	17.7433	8.6097	87	2.06	0.0423
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	14	21.9944	8.2090	87	2.68	0.0088
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	18	11.6858	8.2090	87	1.42	0.1582
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	2	20.5368	8.2090	87	2.50	0.0142
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	6	10.6253	8.2090	87	1.29	0.1990
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	10	16.2545	8.9925	87	1.81	0.0741
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	14	1.6405	9.5380	87	0.17	0.8638
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	18	4.7768	9.5380	87	0.50	0.6178
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	2	0.9047	8.9925	87	0.10	0.9201
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	6	-1.0374	8.9925	87	-0.12	0.9084
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	10	7.5271	8.9925	87	0.84	0.4049
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	14	11.7782	8.6097	87	1.37	0.1748
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	18	1.4696	8.6097	87	0.17	0.8649
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	2	10.3207	8.6097	87	1.20	0.2339

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	6	0.4091	8.6097	87	0.05	0.9622
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	14	-14.6140	9.5380	87	-1.53	0.1291
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	18	-11.4777	9.5380	87	-1.20	0.2321
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	2	-15.3498	8.9925	87	-1.71	0.0914
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	6	-17.2919	8.9925	87	-1.92	0.0578
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	10	-8.7274	8.9925	87	-0.97	0.3345
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	14	-4.4763	8.6097	87	-0.52	0.6044
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	18	-14.7849	8.6097	87	-1.72	0.0895
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	2	-5.9339	8.6097	87	-0.69	0.4925
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	6	-15.8454	8.6097	87	-1.84	0.0691
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	18	3.1363	10.0539	87	0.31	0.7558
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	2	-0.7358	9.5380	87	-0.08	0.9387
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	6	-2.6779	9.5380	87	-0.28	0.7796
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	10	5.8866	9.5380	87	0.62	0.5387
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	14	10.1377	9.1779	87	1.10	0.2724
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	18	-0.1709	9.1779	87	-0.02	0.9852
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	2	8.6801	9.1779	87	0.95	0.3469
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	6	-1.2314	9.1779	87	-0.13	0.8936
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	Ash	2	-3.8721	9.5380	87	-0.41	0.6858
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	Ash	6	-5.8142	9.5380	87	-0.61	0.5437
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	10	2.7503	9.5380	87	0.29	0.7738
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	14	7.0014	9.1779	87	0.76	0.4476
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	18	-3.3072	9.1779	87	-0.36	0.7195
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	2	5.5438	9.1779	87	0.60	0.5474
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	6	-4.3677	9.1779	87	-0.48	0.6353
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	Ash	6	-1.9421	8.9925	87	-0.22	0.8295
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	10	6.6224	8.9925	87	0.74	0.4634
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	14	10.8735	8.6097	87	1.26	0.2100
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	18	0.5649	8.6097	87	0.07	0.9478
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	2	9.4160	8.6097	87	1.09	0.2771
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	6	-0.4956	8.6097	87	-0.06	0.9542
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	10	8.5645	8.9925	87	0.95	0.3435
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	14	12.8156	8.6097	87	1.49	0.1402
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	18	2.5070	8.6097	87	0.29	0.7716
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	2	11.3581	8.6097	87	1.32	0.1906
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	6	1.4465	8.6097	87	0.17	0.8670
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	14	4.2511	8.6097	87	0.49	0.6227
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	18	-6.0575	8.6097	87	-0.70	0.4836
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	2	2.7935	8.6097	87	0.32	0.7464

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	6	-7.1180	8.6097	87	-0.83	0.4106
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	18	-10.3086	8.2090	87	-1.26	0.2126
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	2	-1.4576	8.2090	87	-0.18	0.8595
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	6	-11.3691	8.2090	87	-1.38	0.1696
canopy*ash*depth	NoCanopy	NoAsh	18	NoCanopy	NoAsh	2	8.8510	8.2090	87	1.08	0.2839
canopy*ash*depth	NoCanopy	NoAsh	18	NoCanopy	NoAsh	6	-1.0605	8.2090	87	-0.13	0.8975
canopy*ash*depth	NoCanopy	NoAsh	2	NoCanopy	NoAsh	6	-9.9115	8.2090	87	-1.21	0.2306

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
depth			10			14	Tukey-Kramer	0.9717
depth			10			18	Tukey-Kramer	0.9243
depth			10			2	Tukey-Kramer	0.3978
depth			10			6	Tukey-Kramer	0.7971
depth			14			18	Tukey-Kramer	0.9996
depth			14			2	Tukey-Kramer	0.7885
depth			14			6	Tukey-Kramer	0.9863
depth			18			2	Tukey-Kramer	0.8916
depth			18			6	Tukey-Kramer	0.9981
depth			2			6	Tukey-Kramer	0.9761
canopy	Canopy			NoCanopy			Tukey-Kramer	0.0002
canopy*depth	Canopy		10	Canopy		14	Tukey-Kramer	1.0000
canopy*depth	Canopy		10	Canopy		18	Tukey-Kramer	1.0000
canopy*depth	Canopy		10	Canopy		2	Tukey-Kramer	0.8833
canopy*depth	Canopy		10	Canopy		6	Tukey-Kramer	1.0000
canopy*depth	Canopy		10	NoCanopy		10	Tukey-Kramer	0.1922
canopy*depth	Canopy		10	NoCanopy		14	Tukey-Kramer	0.7187
canopy*depth	Canopy		10	NoCanopy		18	Tukey-Kramer	0.9634
canopy*depth	Canopy		10	NoCanopy		2	Tukey-Kramer	0.7908
canopy*depth	Canopy		10	NoCanopy		6	Tukey-Kramer	0.9994
canopy*depth	Canopy		14	Canopy		18	Tukey-Kramer	1.0000
canopy*depth	Canopy		14	Canopy		2	Tukey-Kramer	0.8955
canopy*depth	Canopy		14	Canopy		6	Tukey-Kramer	1.0000

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*depth	Canopy		14	NoCanopy		10	Tukey-Kramer	0.1805
canopy*depth	Canopy		14	NoCanopy		14	Tukey-Kramer	0.7002
canopy*depth	Canopy		14	NoCanopy		18	Tukey-Kramer	0.9577
canopy*depth	Canopy		14	NoCanopy		2	Tukey-Kramer	0.7737
canopy*depth	Canopy		14	NoCanopy		6	Tukey-Kramer	0.9992
canopy*depth	Canopy		18	Canopy		2	Tukey-Kramer	0.7661
canopy*depth	Canopy		18	Canopy		6	Tukey-Kramer	1.0000
canopy*depth	Canopy		18	NoCanopy		10	Tukey-Kramer	0.3515
canopy*depth	Canopy		18	NoCanopy		14	Tukey-Kramer	0.8765
canopy*depth	Canopy		18	NoCanopy		18	Tukey-Kramer	0.9937
canopy*depth	Canopy		18	NoCanopy		2	Tukey-Kramer	0.9238
canopy*depth	Canopy		18	NoCanopy		6	Tukey-Kramer	1.0000
canopy*depth	Canopy		2	Canopy		6	Tukey-Kramer	0.7552
canopy*depth	Canopy		2	NoCanopy		10	Tukey-Kramer	0.0031
canopy*depth	Canopy		2	NoCanopy		14	Tukey-Kramer	0.0496
canopy*depth	Canopy		2	NoCanopy		18	Tukey-Kramer	0.2036
canopy*depth	Canopy		2	NoCanopy		2	Tukey-Kramer	0.0600
canopy*depth	Canopy		2	NoCanopy		6	Tukey-Kramer	0.4760
canopy*depth	Canopy		6	NoCanopy		10	Tukey-Kramer	0.4986
canopy*depth	Canopy		6	NoCanopy		14	Tukey-Kramer	0.9396
canopy*depth	Canopy		6	NoCanopy		18	Tukey-Kramer	0.9984
canopy*depth	Canopy		6	NoCanopy		2	Tukey-Kramer	0.9679
canopy*depth	Canopy		6	NoCanopy		6	Tukey-Kramer	1.0000
canopy*depth	NoCanopy		10	NoCanopy		14	Tukey-Kramer	0.9983
canopy*depth	NoCanopy		10	NoCanopy		18	Tukey-Kramer	0.9345
canopy*depth	NoCanopy		10	NoCanopy		2	Tukey-Kramer	0.9910
canopy*depth	NoCanopy		10	NoCanopy		6	Tukey-Kramer	0.6282
canopy*depth	NoCanopy		14	NoCanopy		18	Tukey-Kramer	0.9999
canopy*depth	NoCanopy		14	NoCanopy		2	Tukey-Kramer	1.0000
canopy*depth	NoCanopy		14	NoCanopy		6	Tukey-Kramer	0.9817
canopy*depth	NoCanopy		18	NoCanopy		2	Tukey-Kramer	1.0000
canopy*depth	NoCanopy		18	NoCanopy		6	Tukey-Kramer	0.9999

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*depth	NoCanopy		2	NoCanopy		6	Tukey-Kramer	0.9930
ash		Ash			NoAsh		Tukey-Kramer	0.2333
ash*depth		Ash	10		Ash	14	Tukey-Kramer	0.9803
ash*depth		Ash	10		Ash	18	Tukey-Kramer	0.9999
ash*depth		Ash	10		Ash	2	Tukey-Kramer	0.6315
ash*depth		Ash	10		Ash	6	Tukey-Kramer	0.9862
ash*depth		Ash	10		NoAsh	10	Tukey-Kramer	1.0000
ash*depth		Ash	10		NoAsh	14	Tukey-Kramer	1.0000
ash*depth		Ash	10		NoAsh	18	Tukey-Kramer	0.9990
ash*depth		Ash	10		NoAsh	2	Tukey-Kramer	0.9995
ash*depth		Ash	10		NoAsh	6	Tukey-Kramer	0.9997
ash*depth		Ash	14		Ash	18	Tukey-Kramer	0.9999
ash*depth		Ash	14		Ash	2	Tukey-Kramer	0.9989
ash*depth		Ash	14		Ash	6	Tukey-Kramer	1.0000
ash*depth		Ash	14		NoAsh	10	Tukey-Kramer	0.9929
ash*depth		Ash	14		NoAsh	14	Tukey-Kramer	0.9555
ash*depth		Ash	14		NoAsh	18	Tukey-Kramer	1.0000
ash*depth		Ash	14		NoAsh	2	Tukey-Kramer	1.0000
ash*depth		Ash	14		NoAsh	6	Tukey-Kramer	1.0000
ash*depth		Ash	18		Ash	2	Tukey-Kramer	0.9441
ash*depth		Ash	18		Ash	6	Tukey-Kramer	1.0000
ash*depth		Ash	18		NoAsh	10	Tukey-Kramer	1.0000
ash*depth		Ash	18		NoAsh	14	Tukey-Kramer	0.9994
ash*depth		Ash	18		NoAsh	18	Tukey-Kramer	1.0000
ash*depth		Ash	18		NoAsh	2	Tukey-Kramer	1.0000
ash*depth		Ash	18		NoAsh	6	Tukey-Kramer	1.0000
ash*depth		Ash	2		Ash	6	Tukey-Kramer	0.9987
ash*depth		Ash	2		NoAsh	10	Tukey-Kramer	0.7346
ash*depth		Ash	2		NoAsh	14	Tukey-Kramer	0.5100
ash*depth		Ash	2		NoAsh	18	Tukey-Kramer	0.9700
ash*depth		Ash	2		NoAsh	2	Tukey-Kramer	0.9488
ash*depth		Ash	2		NoAsh	6	Tukey-Kramer	0.9500

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
ash*depth		Ash	6		NoAsh	10	Tukey-Kramer	0.9953
ash*depth		Ash	6		NoAsh	14	Tukey-Kramer	0.9675
ash*depth		Ash	6		NoAsh	18	Tukey-Kramer	1.0000
ash*depth		Ash	6		NoAsh	2	Tukey-Kramer	1.0000
ash*depth		Ash	6		NoAsh	6	Tukey-Kramer	1.0000
ash*depth		NoAsh	10		NoAsh	14	Tukey-Kramer	1.0000
ash*depth		NoAsh	10		NoAsh	18	Tukey-Kramer	0.9999
ash*depth		NoAsh	10		NoAsh	2	Tukey-Kramer	0.9999
ash*depth		NoAsh	10		NoAsh	6	Tukey-Kramer	1.0000
ash*depth		NoAsh	14		NoAsh	18	Tukey-Kramer	0.9961
ash*depth		NoAsh	14		NoAsh	2	Tukey-Kramer	0.9976
ash*depth		NoAsh	14		NoAsh	6	Tukey-Kramer	0.9985
ash*depth		NoAsh	18		NoAsh	2	Tukey-Kramer	1.0000
ash*depth		NoAsh	18		NoAsh	6	Tukey-Kramer	1.0000
ash*depth		NoAsh	2		NoAsh	6	Tukey-Kramer	1.0000
canopy*ash	Canopy	Ash		Canopy	NoAsh		Tukey-Kramer	0.5880
canopy*ash	Canopy	Ash		NoCanopy	Ash		Tukey-Kramer	0.0143
canopy*ash	Canopy	Ash		NoCanopy	NoAsh		Tukey-Kramer	0.0018
canopy*ash	Canopy	NoAsh		NoCanopy	Ash		Tukey-Kramer	0.2389
canopy*ash	Canopy	NoAsh		NoCanopy	NoAsh		Tukey-Kramer	0.0689
canopy*ash	NoCanopy	Ash		NoCanopy	NoAsh		Tukey-Kramer	0.9695
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	Canopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	10	Tukey-Kramer	0.3690
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	14	Tukey-Kramer	0.9999

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	18	Tukey-Kramer	0.9975
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	10	Tukey-Kramer	0.9577
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	14	Tukey-Kramer	0.6601
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	18	Tukey-Kramer	0.9998
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	2	Tukey-Kramer	0.7790
canopy*ash*depth	Canopy	Ash	10	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	2	Tukey-Kramer	0.9999
canopy*ash*depth	Canopy	Ash	14	Canopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	10	Tukey-Kramer	0.4007
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	18	Tukey-Kramer	0.9984
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	10	Tukey-Kramer	0.9672
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	14	Tukey-Kramer	0.6955
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	18	Tukey-Kramer	0.9999
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	2	Tukey-Kramer	0.8088
canopy*ash*depth	Canopy	Ash	14	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	Canopy	Ash	2	Tukey-Kramer	0.9894
canopy*ash*depth	Canopy	Ash	18	Canopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	2	Tukey-Kramer	1.0000

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	Ash	18	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	10	Tukey-Kramer	0.7303
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	10	Tukey-Kramer	0.9990
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	14	Tukey-Kramer	0.9400
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	2	Tukey-Kramer	0.9766
canopy*ash*depth	Canopy	Ash	18	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	2	Canopy	Ash	6	Tukey-Kramer	0.9988
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	10	Tukey-Kramer	0.9414
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	14	Tukey-Kramer	0.9634
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	18	Tukey-Kramer	0.9829
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	2	Canopy	NoAsh	6	Tukey-Kramer	0.9288
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	10	Tukey-Kramer	0.0335
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	14	Tukey-Kramer	0.9078
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	18	Tukey-Kramer	0.7253
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	2	Tukey-Kramer	0.8903
canopy*ash*depth	Canopy	Ash	2	NoCanopy	Ash	6	Tukey-Kramer	0.9602
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	10	Tukey-Kramer	0.3891
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	14	Tukey-Kramer	0.0929
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	18	Tukey-Kramer	0.8071
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	2	Tukey-Kramer	0.1453
canopy*ash*depth	Canopy	Ash	2	NoCanopy	NoAsh	6	Tukey-Kramer	0.8738
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	Canopy	NoAsh	6	Tukey-Kramer	1.0000

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	10	Tukey-Kramer	0.8125
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	10	Tukey-Kramer	0.9993
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	14	Tukey-Kramer	0.9641
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	2	Tukey-Kramer	0.9862
canopy*ash*depth	Canopy	Ash	6	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	2	Tukey-Kramer	0.9999
canopy*ash*depth	Canopy	NoAsh	10	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	10	Tukey-Kramer	0.8863
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	14	Tukey-Kramer	0.9890
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	2	Tukey-Kramer	0.9973
canopy*ash*depth	Canopy	NoAsh	10	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	10	Tukey-Kramer	0.8442
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	Ash	6	Tukey-Kramer	1.0000

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	10	Tukey-Kramer	0.9999
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	14	Tukey-Kramer	0.9797
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	2	Tukey-Kramer	0.9941
canopy*ash*depth	Canopy	NoAsh	14	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	Canopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	Canopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	10	Tukey-Kramer	0.8657
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	10	Tukey-Kramer	0.9999
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	14	Tukey-Kramer	0.9831
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	2	Tukey-Kramer	0.9950
canopy*ash*depth	Canopy	NoAsh	18	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	2	Canopy	NoAsh	6	Tukey-Kramer	0.9997
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	10	Tukey-Kramer	0.2184
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	14	Tukey-Kramer	0.9990
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	18	Tukey-Kramer	0.9832
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	2	Tukey-Kramer	0.9990
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	Ash	6	Tukey-Kramer	0.9999
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	10	Tukey-Kramer	0.8668
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	14	Tukey-Kramer	0.4565
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	18	Tukey-Kramer	0.9965
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	2	Tukey-Kramer	0.5858
canopy*ash*depth	Canopy	NoAsh	2	NoCanopy	NoAsh	6	Tukey-Kramer	0.9989
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	10	Tukey-Kramer	0.9546
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	14	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	2	Tukey-Kramer	1.0000

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	14	Tukey-Kramer	0.9978
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	2	Tukey-Kramer	0.9996
canopy*ash*depth	Canopy	NoAsh	6	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	14	Tukey-Kramer	0.9916
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	18	Tukey-Kramer	0.9996
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	2	Tukey-Kramer	0.9737
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	Ash	6	Tukey-Kramer	0.9223
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	18	Tukey-Kramer	0.9721
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	10	NoCanopy	NoAsh	6	Tukey-Kramer	0.9466
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	14	Tukey-Kramer	0.9999
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	14	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	Ash	2	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	18	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	Ash	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000

Differences of Least Squares Means								
Effect	**canopy**	**ash**	**depth**	**_canopy**	**_ash**	**_depth**	**Adjustment**	**Adj P**
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	14	Tukey-Kramer	0.9992
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	2	Tukey-Kramer	0.9999
canopy*ash*depth	NoCanopy	Ash	2	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	10	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	14	Tukey-Kramer	0.9940
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	2	Tukey-Kramer	0.9986
canopy*ash*depth	NoCanopy	Ash	6	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	14	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	18	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	NoAsh	10	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	18	Tukey-Kramer	0.9993
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	2	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	NoAsh	14	NoCanopy	NoAsh	6	Tukey-Kramer	0.9975
canopy*ash*depth	NoCanopy	NoAsh	18	NoCanopy	NoAsh	2	Tukey-Kramer	0.9999
canopy*ash*depth	NoCanopy	NoAsh	18	NoCanopy	NoAsh	6	Tukey-Kramer	1.0000
canopy*ash*depth	NoCanopy	NoAsh	2	NoCanopy	NoAsh	6	Tukey-Kramer	0.9996

May No Burn Study Porewater Nutrients

May No Burn Islands Porewater Ammonium (Table 2)

Program:

```
title 'Porewater Ammonium May';

proc mixed data=porewater;
        class island canopy ash;
        model pNH4=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	32	1.39	0.2463
ash	1	32	0.00	0.9548
canopy*ash	1	32	0.06	0.8123
island	3	32	4.56	0.0090
island*canopy	3	32	3.20	0.0363
island*ash	3	32	0.37	0.7734
island*canopy*ash	3	32	1.53	0.2268

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		0.5134	0.1057	32	4.86	<.0001
canopy	NoCanopy		0.3369	0.1057	32	3.19	0.0032
ash		Ash	0.4294	0.1057	32	4.06	0.0003
ash		NoAsh	0.4209	0.1057	32	3.98	0.0004
canopy*ash	Canopy	Ash	0.5356	0.1495	32	3.58	0.0011
canopy*ash	Canopy	NoAsh	0.4913	0.1495	32	3.29	0.0025
canopy*ash	NoCanopy	Ash	0.3233	0.1495	32	2.16	0.0382
canopy*ash	NoCanopy	NoAsh	0.3505	0.1495	32	2.34	0.0254

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		0.1765	0.1495	32	1.18	0.2463	Tukey	0.2463
ash		Ash		NoAsh	0.008542	0.1495	32	0.06	0.9548	Tukey	0.9548
canopy*ash	Canopy	Ash	Canopy	NoAsh	0.04433	0.2114	32	0.21	0.8352	Tukey	0.9967
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.2123	0.2114	32	1.00	0.3227	Tukey	0.7479
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	0.1851	0.2114	32	0.88	0.3878	Tukey	0.8174
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0.1680	0.2114	32	0.79	0.4326	Tukey	0.8563
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	0.1407	0.2114	32	0.67	0.5103	Tukey	0.9091
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-0.02725	0.2114	32	-0.13	0.8982	Tukey	0.9992

May No Burn Islands Porewater Phosphate (Table 2)

Program:

```
title 'Porewater Phosphate May';

proc mixed data=porewater;
        class island canopy ash;
        model pPO4=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	32	0.93	0.3432
ash	1	32	0.20	0.6538
canopy*ash	1	32	0.00	0.9557
island	3	32	2.26	0.1006
island*canopy	3	32	1.05	0.3838
island*ash	3	32	0.60	0.6168
island*canopy*ash	3	32	1.00	0.4072

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		0.05183	0.009151	32	5.66	<.0001
canopy	NoCanopy		0.03938	0.009151	32	4.30	0.0001
ash		Ash	0.04268	0.009151	32	4.66	<.0001
ash		NoAsh	0.04854	0.009151	32	5.30	<.0001
canopy*ash	Canopy	Ash	0.04854	0.01294	32	3.75	0.0007
canopy*ash	Canopy	NoAsh	0.05512	0.01294	32	4.26	0.0002
canopy*ash	NoCanopy	Ash	0.03682	0.01294	32	2.84	0.0077
canopy*ash	NoCanopy	NoAsh	0.04195	0.01294	32	3.24	0.0028

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		0.01245	0.01294	32	0.96	0.3432	Tukey	0.3432
ash		Ash		NoAsh	-0.00586	0.01294	32	-0.45	0.6538	Tukey	0.6538
canopy*ash	Canopy	Ash	Canopy	NoAsh	-0.00658	0.01830	32	-0.36	0.7214	Tukey	0.9838
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.01172	0.01830	32	0.64	0.5263	Tukey	0.9180
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	0.006592	0.01830	32	0.36	0.7211	Tukey	0.9837
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0.01831	0.01830	32	1.00	0.3246	Tukey	0.7502
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	0.01318	0.01830	32	0.72	0.4768	Tukey	0.8884
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-0.00513	0.01830	32	-0.28	0.7809	Tukey	0.9921

May No Burn Islands Porewater Sulfide (Table 2)

Program:

```
title 'Porewater Sulfide May';

proc mixed data=porewater;
        class island canopy ash;
        model pS=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	32	0.17	0.6849
ash	1	32	1.29	0.2637
canopy*ash	1	32	0.56	0.4612
island	3	32	7.41	0.0007
island*canopy	3	32	2.97	0.0465
island*ash	3	32	0.29	0.8348
island*canopy*ash	3	32	0.26	0.8505

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		6.7669	2.1329	32	3.17	0.0033
canopy	NoCanopy		8.0020	2.1329	32	3.75	0.0007
ash		Ash	9.1003	2.1329	32	4.27	0.0002
ash		NoAsh	5.6686	2.1329	32	2.66	0.0122
canopy*ash	Canopy	Ash	9.6076	3.0164	32	3.19	0.0032
canopy*ash	Canopy	NoAsh	3.9263	3.0164	32	1.30	0.2023
canopy*ash	NoCanopy	Ash	8.5930	3.0164	32	2.85	0.0076
canopy*ash	NoCanopy	NoAsh	7.4109	3.0164	32	2.46	0.0196

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		-1.2350	3.0164	32	-0.41	0.6849	Tukey	0.6849
ash		Ash		NoAsh	3.4317	3.0164	32	1.14	0.2637	Tukey	0.2637
canopy*ash	Canopy	Ash	Canopy	NoAsh	5.6813	4.2659	32	1.33	0.1923	Tukey	0.5501
canopy*ash	Canopy	Ash	NoCanopy	Ash	1.0146	4.2659	32	0.24	0.8135	Tukey	0.9952
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	2.1967	4.2659	32	0.51	0.6101	Tukey	0.9549
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	-4.6667	4.2659	32	-1.09	0.2821	Tukey	0.6957
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	-3.4847	4.2659	32	-0.82	0.4200	Tukey	0.8460
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	1.1821	4.2659	32	0.28	0.7835	Tukey	0.9924

May No Burn Grass Dominated Islands Porewater Ammonium (Table 3)

Program:

```
title 'May Porewater Ammonium Grass Dom';

proc mixed data=resin;
        class island canopy ash;
        model pNH4=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	4.03	0.0619
ash	1	16	0.12	0.7345
canopy*ash	1	16	0.09	0.7722
island	1	16	4.20	0.0571
island*canopy	1	16	3.62	0.0752
island*ash	1	16	0.15	0.7004
island*canopy*ash	1	16	2.19	0.1586

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		0.6729	0.1719	16	3.91	0.0012
canopy	NoCanopy		0.1848	0.1719	16	1.08	0.2983
ash		Ash	0.3869	0.1719	16	2.25	0.0388
ash		NoAsh	0.4708	0.1719	16	2.74	0.0146
canopy*ash	Canopy	Ash	0.5952	0.2431	16	2.45	0.0263
canopy*ash	Canopy	NoAsh	0.7507	0.2431	16	3.09	0.0071
canopy*ash	NoCanopy	Ash	0.1787	0.2431	16	0.73	0.4731
canopy*ash	NoCanopy	NoAsh	0.1910	0.2431	16	0.79	0.4436

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > abs(t)**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		0.4881	0.2431	16	2.01	0.0619	Tukey	0.0619
ash		Ash		NoAsh	-0.08392	0.2431	16	-0.35	0.7345	Tukey	0.7345
canopy*ash	Canopy	Ash	Canopy	NoAsh	-0.1555	0.3438	16	-0.45	0.6572	Tukey	0.9682
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.4165	0.3438	16	1.21	0.2434	Tukey	0.6289
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	0.4042	0.3438	16	1.18	0.2570	Tukey	0.6502
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0.5720	0.3438	16	1.66	0.1157	Tukey	0.3737
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	0.5597	0.3438	16	1.63	0.1231	Tukey	0.3919
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-0.01233	0.3438	16	-0.04	0.9718	Tukey	1.0000

May No Burn Grass Dominated Islands Porewater Phosphate (Table 3)

Program:

```
title 'May Porewater Phosphate Grass Dom';

proc mixed data=resin;
        class island canopy ash;
        model pPO4=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	1.54	0.2320
ash	1	16	0.10	0.7542
canopy*ash	1	16	0.01	0.9435
island	1	16	1.77	0.2016
island*canopy	1	16	1.31	0.2687
island*ash	1	16	0.02	0.8913
island*canopy*ash	1	16	0.28	0.6025

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		0.05578	0.01358	16	4.11	0.0008
canopy	NoCanopy		0.03193	0.01358	16	2.35	0.0318
ash		Ash	0.04080	0.01358	16	3.01	0.0084
ash		NoAsh	0.04692	0.01358	16	3.46	0.0033
canopy*ash	Canopy	Ash	0.05342	0.01920	16	2.78	0.0133
canopy*ash	Canopy	NoAsh	0.05815	0.01920	16	3.03	0.0080
canopy*ash	NoCanopy	Ash	0.02818	0.01920	16	1.47	0.1615
canopy*ash	NoCanopy	NoAsh	0.03568	0.01920	16	1.86	0.0816

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		0.02385	0.01920	16	1.24	0.2320	Tukey	0.2320
ash		Ash		NoAsh	-0.00612	0.01920	16	-0.32	0.7542	Tukey	0.7542
canopy*ash	Canopy	Ash	Canopy	NoAsh	-0.00473	0.02715	16	-0.17	0.8638	Tukey	0.9980
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.02523	0.02715	16	0.93	0.3665	Tukey	0.7898
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	0.01773	0.02715	16	0.65	0.5229	Tukey	0.9129
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0.02997	0.02715	16	1.10	0.2860	Tukey	0.6924
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	0.02247	0.02715	16	0.83	0.4201	Tukey	0.8407
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-0.00750	0.02715	16	-0.28	0.7859	Tukey	0.9923

May No Burn Grass Dominated Islands Porewater Sulfide (Table 3)

Program:

```
title 'May Porewater Sulfide Grass Dom';

proc mixed data=resin;
        class island canopy ash;
        model pSulfide=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	1.57	0.2285
ash	1	16	0.59	0.4549
canopy*ash	1	16	0.78	0.3913
island	1	16	1.34	0.2638
island*canopy	1	16	0.62	0.4421
island*ash	1	16	0.18	0.6732
island*canopy*ash	1	16	0.23	0.6347

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		7.0299	3.2748	16	2.15	0.0475
canopy	NoCanopy		1.2302	3.2748	16	0.38	0.7121
ash		Ash	5.9034	3.2748	16	1.80	0.0903
ash		NoAsh	2.3567	3.2748	16	0.72	0.4821
canopy*ash	Canopy	Ash	10.8435	4.6313	16	2.34	0.0325
canopy*ash	Canopy	NoAsh	3.2163	4.6313	16	0.69	0.4973
canopy*ash	NoCanopy	Ash	0.9633	4.6313	16	0.21	0.8378
canopy*ash	NoCanopy	NoAsh	1.4970	4.6313	16	0.32	0.7507

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		5.7998	4.6313	16	1.25	0.2285	Tukey	0.2285
ash		Ash		NoAsh	3.5468	4.6313	16	0.77	0.4549	Tukey	0.4549
canopy*ash	Canopy	Ash	Canopy	NoAsh	7.6272	6.5496	16	1.16	0.2613	Tukey	0.6567
canopy*ash	Canopy	Ash	NoCanopy	Ash	9.8802	6.5496	16	1.51	0.1509	Tukey	0.4556
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	9.3465	6.5496	16	1.43	0.1728	Tukey	0.5016
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	2.2530	6.5496	16	0.34	0.7353	Tukey	0.9855
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	1.7193	6.5496	16	0.26	0.7963	Tukey	0.9934
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-0.5337	6.5496	16	-0.08	0.9361	Tukey	0.9998

May No Burn Sedge Dominated Islands Porewater Ammonium (Table 3)

Program:

```
title 'May Porewater Ammonium Sedge Dom';

proc mixed data=resin;
        class island canopy ash;
        model pNH4=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	0.60	0.4490
ash	1	16	0.34	0.5696
canopy*ash	1	16	0.68	0.4226
island	1	16	12.00	0.0032
island*canopy	1	16	0.70	0.4162
island*ash	1	16	0.79	0.3886
island*canopy*ash	1	16	1.72	0.2078

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		0.3539	0.1230	16	2.88	0.0109
canopy	NoCanopy		0.4889	0.1230	16	3.98	0.0011
ash		Ash	0.4719	0.1230	16	3.84	0.0015
ash		NoAsh	0.3709	0.1230	16	3.02	0.0082
canopy*ash	Canopy	Ash	0.4760	0.1739	16	2.74	0.0146
canopy*ash	Canopy	NoAsh	0.2318	0.1739	16	1.33	0.2013
canopy*ash	NoCanopy	Ash	0.4678	0.1739	16	2.69	0.0161
canopy*ash	NoCanopy	NoAsh	0.5100	0.1739	16	2.93	0.0098

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		-0.1350	0.1739	16	-0.78	0.4490	Tukey	0.4490
ash		Ash		NoAsh	0.1010	0.1739	16	0.58	0.5696	Tukey	0.5696
canopy*ash	Canopy	Ash	Canopy	NoAsh	0.2442	0.2460	16	0.99	0.3357	Tukey	0.7557
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.008167	0.2460	16	0.03	0.9739	Tukey	1.0000
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	-0.03400	0.2460	16	-0.14	0.8918	Tukey	0.9990
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	-0.2360	0.2460	16	-0.96	0.3516	Tukey	0.7738
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	-0.2782	0.2460	16	-1.13	0.2748	Tukey	0.6766
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-0.04217	0.2460	16	-0.17	0.8660	Tukey	0.9981

May No Burn Sedge Dominated Islands Porewater Phosphate (Table 3)

Program:

```
title 'May Porewater Phosphate Sedge Dom';

proc mixed data=resin;
        class island canopy ash;
        model pPO4=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
canopy	1	16	0.00	0.9525
ash	1	16	0.10	0.7512
canopy*ash	1	16	0.03	0.8724
island	1	16	5.28	0.0354
island*canopy	1	16	1.03	0.3244
island*ash	1	16	1.99	0.1772
island*canopy*ash	1	16	2.95	0.1053

Least Squares Means							
Effect	canopy	ash	Estimate	Standard Error	DF	t Value	Pr > |t|
canopy	Canopy		0.04788	0.01227	16	3.90	0.0013
canopy	NoCanopy		0.04683	0.01227	16	3.82	0.0015
ash		Ash	0.04456	0.01227	16	3.63	0.0022
ash		NoAsh	0.05016	0.01227	16	4.09	0.0009
canopy*ash	Canopy	Ash	0.04367	0.01736	16	2.52	0.0229
canopy*ash	Canopy	NoAsh	0.05210	0.01736	16	3.00	0.0085
canopy*ash	NoCanopy	Ash	0.04545	0.01736	16	2.62	0.0186
canopy*ash	NoCanopy	NoAsh	0.04822	0.01736	16	2.78	0.0134

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		0.001050	0.01736	16	0.06	0.9525	Tukey	0.9525
ash		Ash		NoAsh	-0.00560	0.01736	16	-0.32	0.7512	Tukey	0.7512
canopy*ash	Canopy	Ash	Canopy	NoAsh	-0.00843	0.02455	16	-0.34	0.7357	Tukey	0.9855
canopy*ash	Canopy	Ash	NoCanopy	Ash	-0.00178	0.02455	16	-0.07	0.9430	Tukey	0.9999
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	-0.00455	0.02455	16	-0.19	0.8553	Tukey	0.9976
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0.006650	0.02455	16	0.27	0.7899	Tukey	0.9928
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	0.003883	0.02455	16	0.16	0.8763	Tukey	0.9985
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-0.00277	0.02455	16	-0.11	0.9117	Tukey	0.9995

May No Burn Sedge Dominated Islands Porewater Sulfide (Table 3)

Program:

```
title 'May Porewater Sulfide Sedge Dom';

proc mixed data=resin;
        class island canopy ash;
        model pSulfide=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	4.58	0.0482
ash	1	16	0.74	0.4036
canopy*ash	1	16	0.01	0.9151
island	1	16	19.46	0.0004
island*canopy	1	16	3.33	0.0868
island*ash	1	16	0.78	0.3903
island*canopy*ash	1	16	0.18	0.6763

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		6.5039	2.7337	16	2.38	0.0301
canopy	NoCanopy		14.7738	2.7337	16	5.40	<.0001
ash		Ash	12.2972	2.7337	16	4.50	0.0004
ash		NoAsh	8.9805	2.7337	16	3.29	0.0047
canopy*ash	Canopy	Ash	8.3717	3.8660	16	2.17	0.0458
canopy*ash	Canopy	NoAsh	4.6362	3.8660	16	1.20	0.2479
canopy*ash	NoCanopy	Ash	16.2227	3.8660	16	4.20	0.0007
canopy*ash	NoCanopy	NoAsh	13.3248	3.8660	16	3.45	0.0033

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		-8.2698	3.8660	16	-2.14	0.0482	Tukey	0.0482
ash		Ash		NoAsh	3.3167	3.8660	16	0.86	0.4036	Tukey	0.4036
canopy*ash	Canopy	Ash	Canopy	NoAsh	3.7355	5.4674	16	0.68	0.5042	Tukey	0.9020
canopy*ash	Canopy	Ash	NoCanopy	Ash	-7.8510	5.4674	16	-1.44	0.1703	Tukey	0.4964
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	-4.9532	5.4674	16	-0.91	0.3784	Tukey	0.8019
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	-11.5865	5.4674	16	-2.12	0.0501	Tukey	0.1891
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	-8.6887	5.4674	16	-1.59	0.1316	Tukey	0.4119
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	2.8978	5.4674	16	0.53	0.6034	Tukey	0.9505

July No Burn Study Porewater Nutrients

July No Burn Islands Porewater Ammonium (Table 2)

Program:

```
title 'Porewater Ammonium July';

proc mixed data=porewater;
        class island canopy ash;
        model pNH4=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	30	9.55	0.0043
ash	1	30	0.09	0.7699
canopy*ash	1	30	0.55	0.4652
island	3	30	3.04	0.0440
island*canopy	3	30	3.19	0.0379
island*ash	3	30	0.95	0.4269
island*canopy*ash	3	30	1.21	0.3242

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		0.4749	0.07775	30	6.11	<.0001
canopy	NoCanopy		0.1447	0.07330	30	1.97	0.0577
ash		Ash	0.3255	0.07556	30	4.31	0.0002
ash		NoAsh	0.2940	0.07556	30	3.89	0.0005
canopy*ash	Canopy	Ash	0.5302	0.1100	30	4.82	<.0001
canopy*ash	Canopy	NoAsh	0.4196	0.1100	30	3.82	0.0006
canopy*ash	NoCanopy	Ash	0.1209	0.1037	30	1.17	0.2526
canopy*ash	NoCanopy	NoAsh	0.1684	0.1037	30	1.62	0.1147

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		0.3302	0.1069	30	3.09	0.0043	Tukey-Kramer	0.0043
ash		Ash		NoAsh	0.03154	0.1069	30	0.30	0.7699	Tukey	0.7699
canopy*ash	Canopy	Ash	Canopy	NoAsh	0.1106	0.1555	30	0.71	0.4825	Tukey-Kramer	0.8919
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.4093	0.1511	30	2.71	0.0111	Tukey-Kramer	0.0512
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	0.3617	0.1511	30	2.39	0.0231	Tukey-Kramer	0.1000
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0.2987	0.1511	30	1.98	0.0574	Tukey-Kramer	0.2193
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	0.2512	0.1511	30	1.66	0.1069	Tukey-Kramer	0.3608
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-0.04750	0.1466	30	-0.32	0.7482	Tukey-Kramer	0.9880

July No Burn Islands Porewater Phosphate (Table 2)

Program:

```
title 'Porewater Phosphate July';

proc mixed data=porewater;
        class island canopy ash;
        model pPO4=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	32	6.13	0.0188
ash	1	32	0.08	0.7741
canopy*ash	1	32	2.02	0.1646
island	3	32	1.08	0.3728
island*canopy	3	32	0.65	0.5899
island*ash	3	32	0.06	0.9785
island*canopy*ash	3	32	0.33	0.8002

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		0.07316	0.01007	32	7.27	<.0001
canopy	NoCanopy		0.03791	0.01007	32	3.77	0.0007
ash		Ash	0.05760	0.01007	32	5.72	<.0001
ash		NoAsh	0.05348	0.01007	32	5.31	<.0001
canopy*ash	Canopy	Ash	0.06509	0.01424	32	4.57	<.0001
canopy*ash	Canopy	NoAsh	0.08122	0.01424	32	5.70	<.0001
canopy*ash	NoCanopy	Ash	0.05010	0.01424	32	3.52	0.0013
canopy*ash	NoCanopy	NoAsh	0.02573	0.01424	32	1.81	0.0802

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		0.03525	0.01424	32	2.48	0.0188	Tukey	0.0188
ash		Ash		NoAsh	0.004121	0.01424	32	0.29	0.7741	Tukey	0.7741
canopy*ash	Canopy	Ash	Canopy	NoAsh	-0.01613	0.02014	32	-0.80	0.4289	Tukey	0.8533
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.01499	0.02014	32	0.74	0.4620	Tukey	0.8783
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	0.03937	0.02014	32	1.95	0.0594	Tukey	0.2262
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0.03112	0.02014	32	1.55	0.1320	Tukey	0.4232
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	0.05550	0.02014	32	2.76	0.0096	Tukey	0.0450
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	0.02437	0.02014	32	1.21	0.2350	Tukey	0.6249

July No Burn Islands Porewater Sulfide (Table 2)

Program:

```
title 'Porewater Sulfide July';

proc mixed data=porewater;
        class island canopy ash;
        model pS=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	32	0.13	0.7239
ash	1	32	0.26	0.6114
canopy*ash	1	32	0.10	0.7493
island	3	32	6.12	0.0021
island*canopy	3	32	1.81	0.1656
island*ash	3	32	0.24	0.8670
island*canopy*ash	3	32	0.47	0.7057

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		6.8830	0.8559	32	8.04	<.0001
canopy	NoCanopy		7.3143	0.8559	32	8.55	<.0001
ash		Ash	6.7880	0.8559	32	7.93	<.0001
ash		NoAsh	7.4092	0.8559	32	8.66	<.0001
canopy*ash	Canopy	Ash	6.7675	1.2104	32	5.59	<.0001
canopy*ash	Canopy	NoAsh	6.9984	1.2104	32	5.78	<.0001
canopy*ash	NoCanopy	Ash	6.8086	1.2104	32	5.63	<.0001
canopy*ash	NoCanopy	NoAsh	7.8199	1.2104	32	6.46	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		-0.4313	1.2104	32	-0.36	0.7239	Tukey	0.7239
ash		Ash		NoAsh	-0.6211	1.2104	32	-0.51	0.6114	Tukey	0.6114
canopy*ash	Canopy	Ash	Canopy	NoAsh	-0.2309	1.7118	32	-0.13	0.8935	Tukey	0.9991
canopy*ash	Canopy	Ash	NoCanopy	Ash	-0.04108	1.7118	32	-0.02	0.9810	Tukey	1.0000
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	-1.0524	1.7118	32	-0.61	0.5430	Tukey	0.9266
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0.1898	1.7118	32	0.11	0.9124	Tukey	0.9995
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	-0.8215	1.7118	32	-0.48	0.6346	Tukey	0.9630
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-1.0113	1.7118	32	-0.59	0.5588	Tukey	0.9341

July No Burn Grass Dominated Islands Porewater Ammonium (Table 4)

Program:

```
title 'July Porewater Ammonium Grass Dom';

proc mixed data=resin;
        class island canopy ash;
        model pNH4=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	2.57	0.1286
ash	1	16	0.01	0.9047
canopy*ash	1	16	0.00	0.9864
island	1	16	2.65	0.1232
island*canopy	1	16	2.41	0.1401
island*ash	1	16	0.22	0.6428
island*canopy*ash	1	16	0.00	0.9720

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		0.7457	0.2562	16	2.91	0.0102
canopy	NoCanopy		0.1651	0.2562	16	0.64	0.5284
ash		Ash	0.4774	0.2562	16	1.86	0.0808
ash		NoAsh	0.4333	0.2562	16	1.69	0.1101
canopy*ash	Canopy	Ash	0.7708	0.3623	16	2.13	0.0493
canopy*ash	Canopy	NoAsh	0.7205	0.3623	16	1.99	0.0641
canopy*ash	NoCanopy	Ash	0.1840	0.3623	16	0.51	0.6185
canopy*ash	NoCanopy	NoAsh	0.1462	0.3623	16	0.40	0.6920

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		0.5806	0.3623	16	1.60	0.1286	Tukey	0.1286
ash		Ash		NoAsh	0.04408	0.3623	16	0.12	0.9047	Tukey	0.9047
canopy*ash	Canopy	Ash	Canopy	NoAsh	0.05033	0.5124	16	0.10	0.9230	Tukey	0.9996
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.5868	0.5124	16	1.15	0.2689	Tukey	0.6680
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	0.6247	0.5124	16	1.22	0.2404	Tukey	0.6241
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0.5365	0.5124	16	1.05	0.3106	Tukey	0.7251
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	0.5743	0.5124	16	1.12	0.2788	Tukey	0.6823
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	0.03783	0.5124	16	0.07	0.9421	Tukey	0.9998

July No Burn Grass Dominated Islands Porewater Phosphate (Table 4)

Program:

```
title 'July Porewater Phosphate Grass Dom';

proc mixed data=resin;
        class island canopy ash;
        model pPO4=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	2.88	0.1089
ash	1	16	0.03	0.8577
canopy*ash	1	16	1.67	0.2147
island	1	16	1.54	0.2331
island*canopy	1	16	0.82	0.3789
island*ash	1	16	0.02	0.8961
island*canopy*ash	1	16	0.09	0.7655

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		0.08078	0.01759	16	4.59	0.0003
canopy	NoCanopy		0.03852	0.01759	16	2.19	0.0437
ash		Ash	0.06192	0.01759	16	3.52	0.0028
ash		NoAsh	0.05738	0.01759	16	3.26	0.0049
canopy*ash	Canopy	Ash	0.06697	0.02488	16	2.69	0.0160
canopy*ash	Canopy	NoAsh	0.09458	0.02488	16	3.80	0.0016
canopy*ash	NoCanopy	Ash	0.05687	0.02488	16	2.29	0.0363
canopy*ash	NoCanopy	NoAsh	0.02018	0.02488	16	0.81	0.4292

Differences of Least Squares Means												
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		0.04225	0.02488	16	1.70	0.1089	Tukey	0.1089
ash		Ash		NoAsh	0.004533	0.02488	16	0.18	0.8577	Tukey	0.8577
canopy*ash	Canopy	Ash	Canopy	NoAsh	-0.02762	0.03519	16	-0.78	0.4440	Tukey	0.8602
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.01010	0.03519	16	0.29	0.7778	Tukey	0.9914
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	0.04678	0.03519	16	1.33	0.2023	Tukey	0.5585
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0.03772	0.03519	16	1.07	0.2997	Tukey	0.7109
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	0.07440	0.03519	16	2.11	0.0505	Tukey	0.1906
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	0.03668	0.03519	16	1.04	0.3127	Tukey	0.7277

July No Burn Grass Dominated Islands Porewater Sulfide (Table 4)

Program:

```
title 'July Porewater Sulfide Grass Dom';

proc mixed data=resin;
        class island canopy ash;
        model pSulfide=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	0.20	0.6619
ash	1	16	0.66	0.4296
canopy*ash	1	16	0.00	0.9513
island	1	16	8.71	0.0094
island*canopy	1	16	1.37	0.2591
island*ash	1	16	0.00	0.9708
island*canopy*ash	1	16	0.63	0.4399

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		5.4055	1.3421	16	4.03	0.0010
canopy	NoCanopy		6.2512	1.3421	16	4.66	0.0003
ash		Ash	5.0592	1.3421	16	3.77	0.0017
ash		NoAsh	6.5975	1.3421	16	4.92	0.0002
canopy*ash	Canopy	Ash	4.5775	1.8981	16	2.41	0.0283
canopy*ash	Canopy	NoAsh	6.2335	1.8981	16	3.28	0.0047
canopy*ash	NoCanopy	Ash	5.5408	1.8981	16	2.92	0.0100
canopy*ash	NoCanopy	NoAsh	6.9615	1.8981	16	3.67	0.0021

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		-0.8457	1.8981	16	-0.45	0.6619	Tukey	0.6619
ash		Ash		NoAsh	-1.5383	1.8981	16	-0.81	0.4296	Tukey	0.4296
canopy*ash	Canopy	Ash	Canopy	NoAsh	-1.6560	2.6843	16	-0.62	0.5460	Tukey	0.9252
canopy*ash	Canopy	Ash	NoCanopy	Ash	-0.9633	2.6843	16	-0.36	0.7244	Tukey	0.9836
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	-2.3840	2.6843	16	-0.89	0.3876	Tukey	0.8110
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0.6927	2.6843	16	0.26	0.7997	Tukey	0.9937
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	-0.7280	2.6843	16	-0.27	0.7897	Tukey	0.9927
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-1.4207	2.6843	16	-0.53	0.6039	Tukey	0.9507

July No Burn Sedge Dominated Islands Porewater Ammonium (Table 4)

Program:

```
title 'July Porewater Ammonium Sedge Dom';

proc mixed data=resin;
        class island canopy ash;
        model pNH4=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	10.26	0.0055
ash	1	16	0.11	0.7447
canopy*ash	1	16	1.15	0.2997
island	1	16	3.29	0.0886
island*canopy	1	16	2.64	0.1238
island*ash	1	16	1.37	0.2594
island*canopy*ash	1	16	1.62	0.2207

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		0.6987	0.1268	16	5.51	<.0001
canopy	NoCanopy		0.1242	0.1268	16	0.98	0.3418
ash		Ash	0.4412	0.1268	16	3.48	0.0031
ash		NoAsh	0.3818	0.1268	16	3.01	0.0083
canopy*ash	Canopy	Ash	0.8245	0.1794	16	4.60	0.0003
canopy*ash	Canopy	NoAsh	0.5728	0.1794	16	3.19	0.0057
canopy*ash	NoCanopy	Ash	0.05783	0.1794	16	0.32	0.7513
canopy*ash	NoCanopy	NoAsh	0.1907	0.1794	16	1.06	0.3036

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		0.5744	0.1794	16	3.20	0.0055	Tukey	0.0055
ash		Ash		NoAsh	0.05942	0.1794	16	0.33	0.7447	Tukey	0.7447
canopy*ash	Canopy	Ash	Canopy	NoAsh	0.2517	0.2537	16	0.99	0.3359	Tukey	0.7559
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.7667	0.2537	16	3.02	0.0081	Tukey	0.0366
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	0.6338	0.2537	16	2.50	0.0237	Tukey	0.0983
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0.5150	0.2537	16	2.03	0.0593	Tukey	0.2182
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	0.3822	0.2537	16	1.51	0.1514	Tukey	0.4566
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-0.1328	0.2537	16	-0.52	0.6077	Tukey	0.9521

July No Burn Sedge Dominated Islands Porewater Phosphate (Table 4)

Program:

```
title 'July Porewater Phosphate Sedge Dom';

proc mixed data=resin;
        class island canopy ash;
        model pPO4=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	4.16	0.0584
ash	1	16	0.07	0.7924
canopy*ash	1	16	0.36	0.5548
island	1	16	1.17	0.2963
island*canopy	1	16	0.96	0.3429
island*ash	1	16	0.35	0.5642
island*canopy*ash	1	16	0.35	0.5618

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		0.06554	0.009797	16	6.69	<.0001
canopy	NoCanopy		0.03730	0.009797	16	3.81	0.0015
ash		Ash	0.05328	0.009797	16	5.44	<.0001
ash		NoAsh	0.04957	0.009797	16	5.06	0.0001
canopy*ash	Canopy	Ash	0.06322	0.01385	16	4.56	0.0003
canopy*ash	Canopy	NoAsh	0.06787	0.01385	16	4.90	0.0002
canopy*ash	NoCanopy	Ash	0.04333	0.01385	16	3.13	0.0065
canopy*ash	NoCanopy	NoAsh	0.03127	0.01385	16	2.26	0.0384

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		0.02824	0.01385	16	2.04	0.0584	Tukey	0.0584
ash		Ash		NoAsh	0.003708	0.01385	16	0.27	0.7924	Tukey	0.7924
canopy*ash	Canopy	Ash	Canopy	NoAsh	-0.00465	0.01959	16	-0.24	0.8154	Tukey	0.9951
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.01988	0.01959	16	1.01	0.3253	Tukey	0.7433
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	0.03195	0.01959	16	1.63	0.1225	Tukey	0.3903
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0.02453	0.01959	16	1.25	0.2285	Tukey	0.6045
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	0.03660	0.01959	16	1.87	0.0802	Tukey	0.2799
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	0.01207	0.01959	16	0.62	0.5467	Tukey	0.9255

July No Burn Sedge Dominated Islands Porewater Sulfide (Table 4)

Program:

```
title 'July Porewater Sulfide Sedge Dom';

proc mixed data=resin;
        class island canopy ash;
        model pSulfide=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	0.00	0.9912
ash	1	16	0.04	0.8463
canopy*ash	1	16	0.36	0.5584
island	1	16	4.21	0.0570
island*canopy	1	16	4.70	0.0455
island*ash	1	16	0.19	0.6674
island*canopy*ash	1	16	0.60	0.4506

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		8.3604	1.0625	16	7.87	<.0001
canopy	NoCanopy		8.3773	1.0625	16	7.88	<.0001
ash		Ash	8.5169	1.0625	16	8.02	<.0001
ash		NoAsh	8.2208	1.0625	16	7.74	<.0001
canopy*ash	Canopy	Ash	8.9575	1.5026	16	5.96	<.0001
canopy*ash	Canopy	NoAsh	7.7633	1.5026	16	5.17	<.0001
canopy*ash	NoCanopy	Ash	8.0763	1.5026	16	5.37	<.0001
canopy*ash	NoCanopy	NoAsh	8.6783	1.5026	16	5.78	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		-0.01692	1.5026	16	-0.01	0.9912	Tukey	0.9912
ash		Ash		NoAsh	0.2961	1.5026	16	0.20	0.8463	Tukey	0.8463
canopy*ash	Canopy	Ash	Canopy	NoAsh	1.1942	2.1250	16	0.56	0.5819	Tukey	0.9419
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.8812	2.1250	16	0.41	0.6839	Tukey	0.9752
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	0.2792	2.1250	16	0.13	0.8971	Tukey	0.9992
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	-0.3130	2.1250	16	-0.15	0.8847	Tukey	0.9988
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	-0.9150	2.1250	16	-0.43	0.6725	Tukey	0.9723
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-0.6020	2.1250	16	-0.28	0.7806	Tukey	0.9918

May Annual Burn Study Cotton Strip Analyses

May Burn Islands CTSL 0-20 cm Average (Figure 10A)

Program:

```
title 'Total Avg CTSL May';

proc mixed data=CTSL;
        class island treatment;
        model TotalAvgCTSL=t
reatment|island;
        lsmeans treatment / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
treatment	1	12	0.76	0.4014
island	2	12	1.34	0.2984
island*treatment	2	12	0.44	0.6569

Least Squares Means						
Effect	treatment	Estimate	Standard Error	DF	t Value	Pr > |t|
treatment	CanopyRe	36.2915	4.0822	12	8.89	<.0001
treatment	Control	41.3134	4.0822	12	10.12	<.0001

Differences of Least Squares Means									
Effect	treatment	_treatment	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
treatment	CanopyRe	Control	-5.0219	5.7731	12	-0.87	0.4014	Tukey	0.4014

May Burn Islands Depthwise CTSL (Figure 11A)

Program:

```
title 'May Annual Burn CTSL Depthwise';


proc mixed data=CTSL;
class treatment island depth;
model CTSLdepthwise = treatment|depth;
random island;
repeated depth/subject = treatment type=cs;
lsmeans depth|treatment / adjust=tukey;

RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
treatment	1	62	0.13	0.7222
depth	4	62	22.50	<.0001
treatment*depth	4	62	0.34	0.8467

Least Squares Means							
Effect	treatment	depth	Estimate	Standard Error	DF	t Value	Pr > |t|
depth		10	19.7064	5.9622	62	3.31	0.0016
depth		14	24.8951	6.6361	62	3.75	0.0004
depth		18	23.6817	6.7931	62	3.49	0.0009
depth		2	68.2156	5.8677	62	11.63	<.0001
depth		6	50.1372	6.0533	62	8.28	<.0001
treatment	CanopyRe		35.9831	5.9643	62	6.03	<.0001
treatment	Control		38.6713	5.9645	62	6.48	<.0001
treatment*depth	CanopyRe	10	17.0950	8.1305	62	2.10	0.0396
treatment*depth	CanopyRe	14	23.1897	8.4925	62	2.73	0.0082
treatment*depth	CanopyRe	18	26.0804	9.4826	62	2.75	0.0078
treatment*depth	CanopyRe	2	68.4216	7.8505	62	8.72	<.0001
treatment*depth	CanopyRe	6	45.1289	8.1305	62	5.55	<.0001
treatment*depth	Control	10	22.3179	7.8505	62	2.84	0.0060
treatment*depth	Control	14	26.6006	9.4816	62	2.81	0.0067

Least Squares Means							
Effect	**treatment**	**depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
treatment*depth	Control	18	21.2829	8.9238	62	2.38	0.0202
treatment*depth	Control	2	68.0096	7.8505	62	8.66	<.0001
treatment*depth	Control	6	55.1455	8.1301	62	6.78	<.0001

Differences of Least Squares Means										
Effect	**treatment**	**depth**	**_treatment**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**
depth		10		14	-5.1887	6.7625	62	-0.77	0.4458	Tukey-Kramer
depth		10		18	-3.9752	6.9098	62	-0.58	0.5672	Tukey-Kramer
depth		10		2	-48.5092	6.0158	62	-8.06	<.0001	Tukey-Kramer
depth		10		6	-30.4308	6.1952	62	-4.91	<.0001	Tukey-Kramer
depth		14		18	1.2135	7.4980	62	0.16	0.8720	Tukey-Kramer
depth		14		2	-43.3205	6.6843	62	-6.48	<.0001	Tukey-Kramer
depth		14		6	-25.2421	6.8489	62	-3.69	0.0005	Tukey-Kramer
depth		18		2	-44.5339	6.8402	62	-6.51	<.0001	Tukey-Kramer
depth		18		6	-26.4556	6.9915	62	-3.78	0.0004	Tukey-Kramer
depth		2		6	18.0784	6.1061	62	2.96	0.0043	Tukey-Kramer
treatment	CanopyRe		Control		-2.6882	7.5275	62	-0.36	0.7222	Tukey-Kramer
treatment*depth	CanopyRe	10	CanopyRe	14	-6.0947	9.2031	62	-0.66	0.5103	Tukey-Kramer
treatment*depth	CanopyRe	10	CanopyRe	18	-8.9855	10.1300	62	-0.89	0.3785	Tukey-Kramer
treatment*depth	CanopyRe	10	CanopyRe	2	-51.3267	8.6382	62	-5.94	<.0001	Tukey-Kramer
treatment*depth	CanopyRe	10	CanopyRe	6	-28.0339	8.8832	62	-3.16	0.0025	Tukey-Kramer
treatment*depth	CanopyRe	10	Control	10	-5.2229	10.6433	62	-0.49	0.6254	Tukey-Kramer
treatment*depth	CanopyRe	10	Control	14	-9.5056	11.9035	62	-0.80	0.4276	Tukey-Kramer
treatment*depth	CanopyRe	10	Control	18	-4.1879	11.4421	62	-0.37	0.7156	Tukey-Kramer
treatment*depth	CanopyRe	10	Control	2	-50.9146	10.6433	62	-4.78	<.0001	Tukey-Kramer
treatment*depth	CanopyRe	10	Control	6	-38.0506	10.8553	62	-3.51	0.0009	Tukey-Kramer
treatment*depth	CanopyRe	14	CanopyRe	18	-2.8908	10.4050	62	-0.28	0.7821	Tukey-Kramer
treatment*depth	CanopyRe	14	CanopyRe	2	-45.2320	8.9797	62	-5.04	<.0001	Tukey-Kramer
treatment*depth	CanopyRe	14	CanopyRe	6	-21.9393	9.2031	62	-2.38	0.0202	Tukey-Kramer
treatment*depth	CanopyRe	14	Control	10	0.8718	10.9224	62	0.08	0.9366	Tukey-Kramer
treatment*depth	CanopyRe	14	Control	14	-3.4109	12.1613	62	-0.28	0.7800	Tukey-Kramer
treatment*depth	CanopyRe	14	Control	18	1.9068	11.6823	62	0.16	0.8709	Tukey-Kramer
treatment*depth	CanopyRe	14	Control	2	-44.8199	10.9224	62	-4.10	0.0001	Tukey-Kramer
treatment*depth	CanopyRe	14	Control	6	-31.9559	11.1343	62	-2.87	0.0056	Tukey-Kramer
treatment*depth	CanopyRe	18	CanopyRe	2	-42.3412	9.9213	62	-4.27	<.0001	Tukey-Kramer
treatment*depth	CanopyRe	18	CanopyRe	6	-19.0485	10.1300	62	-1.88	0.0648	Tukey-Kramer

Differences of Least Squares Means										
Effect	treatment	depth	_treatment	_depth	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment
treatment*depth	CanopyRe	18	Control	10	3.7626	11.7087	62	0.32	0.7490	Tukey-Kramer
treatment*depth	CanopyRe	18	Control	14	-0.5202	12.8683	62	-0.04	0.9679	Tukey-Kramer
treatment*depth	CanopyRe	18	Control	18	4.7976	12.4306	62	0.39	0.7009	Tukey-Kramer
treatment*depth	CanopyRe	18	Control	2	-41.9291	11.7087	62	-3.58	0.0007	Tukey-Kramer
treatment*depth	CanopyRe	18	Control	6	-29.0651	11.9041	62	-2.44	0.0175	Tukey-Kramer
treatment*depth	CanopyRe	2	CanopyRe	6	23.2927	8.6382	62	2.70	0.0090	Tukey-Kramer
treatment*depth	CanopyRe	2	Control	10	46.1038	10.4310	62	4.42	<.0001	Tukey-Kramer
treatment*depth	CanopyRe	2	Control	14	41.8210	11.7079	62	3.57	0.0007	Tukey-Kramer
treatment*depth	CanopyRe	2	Control	18	47.1388	11.2610	62	4.19	<.0001	Tukey-Kramer
treatment*depth	CanopyRe	2	Control	2	0.4121	10.4310	62	0.04	0.9686	Tukey-Kramer
treatment*depth	CanopyRe	2	Control	6	13.2761	10.6430	62	1.25	0.2169	Tukey-Kramer
treatment*depth	CanopyRe	6	Control	10	22.8110	10.6433	62	2.14	0.0360	Tukey-Kramer
treatment*depth	CanopyRe	6	Control	14	18.5283	11.9035	62	1.56	0.1247	Tukey-Kramer
treatment*depth	CanopyRe	6	Control	18	23.8461	11.4421	62	2.08	0.0413	Tukey-Kramer
treatment*depth	CanopyRe	6	Control	2	-22.8806	10.6433	62	-2.15	0.0355	Tukey-Kramer
treatment*depth	CanopyRe	6	Control	6	-10.0166	10.8553	62	-0.92	0.3597	Tukey-Kramer
treatment*depth	Control	10	Control	14	-4.2827	9.9203	62	-0.43	0.6674	Tukey-Kramer
treatment*depth	Control	10	Control	18	1.0350	9.3886	62	0.11	0.9126	Tukey-Kramer
treatment*depth	Control	10	Control	2	-45.6917	8.3752	62	-5.46	<.0001	Tukey-Kramer
treatment*depth	Control	10	Control	6	-32.8277	8.6377	62	-3.80	0.0003	Tukey-Kramer
treatment*depth	Control	14	Control	18	5.3177	10.8148	62	0.49	0.6247	Tukey-Kramer
treatment*depth	Control	14	Control	2	-41.4090	9.9203	62	-4.17	<.0001	Tukey-Kramer
treatment*depth	Control	14	Control	6	-28.5449	10.1489	62	-2.81	0.0066	Tukey-Kramer
treatment*depth	Control	18	Control	2	-46.7267	9.3886	62	-4.98	<.0001	Tukey-Kramer
treatment*depth	Control	18	Control	6	-33.8627	9.6247	62	-3.52	0.0008	Tukey-Kramer
treatment*depth	Control	2	Control	6	12.8640	8.6377	62	1.49	0.1415	Tukey-Kramer

Differences of Least Squares Means					
Effect	treatment	depth	_treatment	_depth	Adj P
depth		10		14	0.9390
depth		10		18	0.9782
depth		10		2	<.0001
depth		10		6	<.0001
depth		14		18	0.9998
depth		14		2	<.0001
depth		14		6	0.0042
depth		18		2	<.0001

Differences of Least Squares Means					
Effect	**treatment**	**depth**	**_treatment**	**_depth**	**Adj P**
depth		18		6	0.0031
depth		2		6	0.0340
treatment	CanopyRe		Control		0.7222
treatment*depth	CanopyRe	10	CanopyRe	14	0.9996
treatment*depth	CanopyRe	10	CanopyRe	18	0.9964
treatment*depth	CanopyRe	10	CanopyRe	2	<.0001
treatment*depth	CanopyRe	10	CanopyRe	6	0.0691
treatment*depth	CanopyRe	10	Control	10	1.0000
treatment*depth	CanopyRe	10	Control	14	0.9984
treatment*depth	CanopyRe	10	Control	18	1.0000
treatment*depth	CanopyRe	10	Control	2	0.0004
treatment*depth	CanopyRe	10	Control	6	0.0271
treatment*depth	CanopyRe	14	CanopyRe	18	1.0000
treatment*depth	CanopyRe	14	CanopyRe	2	0.0002
treatment*depth	CanopyRe	14	CanopyRe	6	0.3531
treatment*depth	CanopyRe	14	Control	10	1.0000
treatment*depth	CanopyRe	14	Control	14	1.0000
treatment*depth	CanopyRe	14	Control	18	1.0000
treatment*depth	CanopyRe	14	Control	2	0.0044
treatment*depth	CanopyRe	14	Control	6	0.1366
treatment*depth	CanopyRe	18	CanopyRe	2	0.0026
treatment*depth	CanopyRe	18	CanopyRe	6	0.6818
treatment*depth	CanopyRe	18	Control	10	1.0000
treatment*depth	CanopyRe	18	Control	14	1.0000
treatment*depth	CanopyRe	18	Control	18	1.0000
treatment*depth	CanopyRe	18	Control	2	0.0219
treatment*depth	CanopyRe	18	Control	6	0.3203
treatment*depth	CanopyRe	2	CanopyRe	6	0.1980
treatment*depth	CanopyRe	2	Control	10	0.0016
treatment*depth	CanopyRe	2	Control	14	0.0224
treatment*depth	CanopyRe	2	Control	18	0.0034
treatment*depth	CanopyRe	2	Control	2	1.0000

Differences of Least Squares Means					
Effect	**treatment**	**depth**	**_treatment**	**_depth**	**Adj P**
treatment*depth	CanopyRe	2	Control	6	0.9612
treatment*depth	CanopyRe	6	Control	10	0.5055
treatment*depth	CanopyRe	6	Control	14	0.8632
treatment*depth	CanopyRe	6	Control	18	0.5453
treatment*depth	CanopyRe	6	Control	2	0.5011
treatment*depth	CanopyRe	6	Control	6	0.9951
treatment*depth	Control	10	Control	14	1.0000
treatment*depth	Control	10	Control	18	1.0000
treatment*depth	Control	10	Control	2	<.0001
treatment*depth	Control	10	Control	6	0.0114
treatment*depth	Control	14	Control	18	1.0000
treatment*depth	Control	14	Control	2	0.0035
treatment*depth	Control	14	Control	6	0.1550
treatment*depth	Control	18	Control	2	0.0002
treatment*depth	Control	18	Control	6	0.0262
treatment*depth	Control	2	Control	6	0.8913

July Annual Burn Study Cotton Strip Analyses

July Burn Islands CTSL 0-20 cm Average (Figure 10B)

Program:

```
title 'July Annual Burn CTSL Depthwise';


proc mixed data=CTSL;
class treatment island depth;
model CTSLdepthwise = treatment|depth;
random island;
repeated depth/subject = treatment type=cs;
lsmeans depth|treatment / adjust=tukey;

RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
treatment	1	12	0.82	0.3823
island	2	12	1.10	0.3638
island*treatment	2	12	2.07	0.1691

Least Squares Means						
Effect	treatment	Estimate	Standard Error	DF	t Value	Pr > |t|
treatment	CanopyRe	65.8585	2.5063	12	26.28	<.0001
treatment	Control	69.0732	2.5063	12	27.56	<.0001

Differences of Least Squares Means									
Effect	treatment	_treatment	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
treatment	CanopyRe	Control	-3.2147	3.5445	12	-0.91	0.3823	Tukey	0.3823

July Burn Islands Depthwise CTSL (Figure 11B)

Program:

```
title 'July Annual Burn CTSL Depthwise';


proc mixed data=CTSL;
class treatment island depth;
model CTSLdepthwise = treatment|depth;
random island;
repeated depth/subject = treatment type=cs;
lsmeans depth|treatment / adjust=tukey;

RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
treatment	1	78	0.57	0.4531
depth	4	78	3.06	0.0213
treatment*depth	4	78	0.21	0.9309

Least Squares Means							
Effect	**treatment**	**depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
depth		10	67.9567	3.6971	78	18.38	<.0001
depth		14	64.4233	3.6971	78	17.43	<.0001
depth		18	60.4745	3.6971	78	16.36	<.0001
depth		2	69.8197	3.6971	78	18.88	<.0001
depth		6	74.6549	3.6971	78	20.19	<.0001
treatment	CanopyRe		65.8585	3.2648	78	20.17	<.0001
treatment	Control		69.0732	3.2648	78	21.16	<.0001
treatment*depth	CanopyRe	10	66.0635	5.0761	78	13.01	<.0001
treatment*depth	CanopyRe	14	61.7310	5.0761	78	12.16	<.0001
treatment*depth	CanopyRe	18	57.3884	5.0761	78	11.31	<.0001
treatment*depth	CanopyRe	2	69.1328	5.0761	78	13.62	<.0001
treatment*depth	CanopyRe	6	74.9765	5.0761	78	14.77	<.0001
treatment*depth	Control	10	69.8499	5.0761	78	13.76	<.0001
treatment*depth	Control	14	67.1157	5.0761	78	13.22	<.0001

Least Squares Means							
Effect	**treatment**	**depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
treatment*depth	Control	18	63.5605	5.0761	78	12.52	<.0001
treatment*depth	Control	2	70.5066	5.0761	78	13.89	<.0001
treatment*depth	Control	6	74.3332	5.0761	78	14.64	<.0001

Differences of Least Squares Means											
Effect	**treatment**	**depth**	**_treatment**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
depth		10		14	3.5334	4.3457	78	0.81	0.4187	Tukey-Kramer	0.9259
depth		10		18	7.4822	4.3457	78	1.72	0.0891	Tukey-Kramer	0.4268
depth		10		2	-1.8630	4.3457	78	-0.43	0.6693	Tukey-Kramer	0.9928
depth		10		6	-6.6982	4.3457	78	-1.54	0.1273	Tukey-Kramer	0.5392
depth		14		18	3.9489	4.3457	78	0.91	0.3663	Tukey-Kramer	0.8928
depth		14		2	-5.3964	4.3457	78	-1.24	0.2180	Tukey-Kramer	0.7270
depth		14		6	-10.2315	4.3457	78	-2.35	0.0211	Tukey-Kramer	0.1391
depth		18		2	-9.3453	4.3457	78	-2.15	0.0346	Tukey-Kramer	0.2097
depth		18		6	-14.1804	4.3457	78	-3.26	0.0016	Tukey-Kramer	0.0138
depth		2		6	-4.8351	4.3457	78	-1.11	0.2693	Tukey-Kramer	0.7994
treatment	CanopyRe		Control		-3.2147	4.2634	78	-0.75	0.4531	Tukey-Kramer	0.4531
treatment*depth	CanopyRe	10	CanopyRe	14	4.3325	6.1458	78	0.70	0.4829	Tukey-Kramer	0.9994
treatment*depth	CanopyRe	10	CanopyRe	18	8.6751	6.1458	78	1.41	0.1621	Tukey-Kramer	0.9200
treatment*depth	CanopyRe	10	CanopyRe	2	-3.0693	6.1458	78	-0.50	0.6189	Tukey-Kramer	1.0000
treatment*depth	CanopyRe	10	CanopyRe	6	-8.9130	6.1458	78	-1.45	0.1510	Tukey-Kramer	0.9069
treatment*depth	CanopyRe	10	Control	10	-3.7864	6.9565	78	-0.54	0.5878	Tukey-Kramer	0.9999
treatment*depth	CanopyRe	10	Control	14	-1.0521	6.9565	78	-0.15	0.8802	Tukey-Kramer	1.0000
treatment*depth	CanopyRe	10	Control	18	2.5030	6.9565	78	0.36	0.7200	Tukey-Kramer	1.0000
treatment*depth	CanopyRe	10	Control	2	-4.4431	6.9565	78	-0.64	0.5249	Tukey-Kramer	0.9997
treatment*depth	CanopyRe	10	Control	6	-8.2697	6.9565	78	-1.19	0.2381	Tukey-Kramer	0.9720
treatment*depth	CanopyRe	14	CanopyRe	18	4.3426	6.1458	78	0.71	0.4819	Tukey-Kramer	0.9994
treatment*depth	CanopyRe	14	CanopyRe	2	-7.4018	6.1458	78	-1.20	0.2321	Tukey-Kramer	0.9695
treatment*depth	CanopyRe	14	CanopyRe	6	-13.2455	6.1458	78	-2.16	0.0342	Tukey-Kramer	0.4956
treatment*depth	CanopyRe	14	Control	10	-8.1189	6.9565	78	-1.17	0.2467	Tukey-Kramer	0.9752
treatment*depth	CanopyRe	14	Control	14	-5.3847	6.9565	78	-0.77	0.4412	Tukey-Kramer	0.9988
treatment*depth	CanopyRe	14	Control	18	-1.8295	6.9565	78	-0.26	0.7932	Tukey-Kramer	1.0000
treatment*depth	CanopyRe	14	Control	2	-8.7756	6.9565	78	-1.26	0.2109	Tukey-Kramer	0.9591
treatment*depth	CanopyRe	14	Control	6	-12.6022	6.9565	78	-1.81	0.0739	Tukey-Kramer	0.7260
treatment*depth	CanopyRe	18	CanopyRe	2	-11.7444	6.1458	78	-1.91	0.0597	Tukey-Kramer	0.6617
treatment*depth	CanopyRe	18	CanopyRe	6	-17.5881	6.1458	78	-2.86	0.0054	Tukey-Kramer	0.1346

Differences of Least Squares Means											
Effect	**treatment**	**depth**	**_treatment**	**_depth**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
treatment*depth	CanopyRe	18	Control	10	-12.4615	6.9565	78	-1.79	0.0771	Tukey-Kramer	0.7385
treatment*depth	CanopyRe	18	Control	14	-9.7272	6.9565	78	-1.40	0.1660	Tukey-Kramer	0.9242
treatment*depth	CanopyRe	18	Control	18	-6.1721	6.9565	78	-0.89	0.3777	Tukey-Kramer	0.9965
treatment*depth	CanopyRe	18	Control	2	-13.1182	6.9565	78	-1.89	0.0631	Tukey-Kramer	0.6784
treatment*depth	CanopyRe	18	Control	6	-16.9448	6.9565	78	-2.44	0.0171	Tukey-Kramer	0.3198
treatment*depth	CanopyRe	2	CanopyRe	6	-5.8437	6.1458	78	-0.95	0.3446	Tukey-Kramer	0.9941
treatment*depth	CanopyRe	2	Control	10	-0.7171	6.9565	78	-0.10	0.9182	Tukey-Kramer	1.0000
treatment*depth	CanopyRe	2	Control	14	2.0172	6.9565	78	0.29	0.7726	Tukey-Kramer	1.0000
treatment*depth	CanopyRe	2	Control	18	5.5723	6.9565	78	0.80	0.4256	Tukey-Kramer	0.9984
treatment*depth	CanopyRe	2	Control	2	-1.3738	6.9565	78	-0.20	0.8440	Tukey-Kramer	1.0000
treatment*depth	CanopyRe	2	Control	6	-5.2004	6.9565	78	-0.75	0.4570	Tukey-Kramer	0.9991
treatment*depth	CanopyRe	6	Control	10	5.1267	6.9565	78	0.74	0.4634	Tukey-Kramer	0.9992
treatment*depth	CanopyRe	6	Control	14	7.8609	6.9565	78	1.13	0.2619	Tukey-Kramer	0.9800
treatment*depth	CanopyRe	6	Control	18	11.4160	6.9565	78	1.64	0.1048	Tukey-Kramer	0.8237
treatment*depth	CanopyRe	6	Control	2	4.4699	6.9565	78	0.64	0.5224	Tukey-Kramer	0.9997
treatment*depth	CanopyRe	6	Control	6	0.6433	6.9565	78	0.09	0.9266	Tukey-Kramer	1.0000
treatment*depth	Control	10	Control	14	2.7342	6.1458	78	0.44	0.6576	Tukey-Kramer	1.0000
treatment*depth	Control	10	Control	18	6.2894	6.1458	78	1.02	0.3093	Tukey-Kramer	0.9899
treatment*depth	Control	10	Control	2	-0.6567	6.1458	78	-0.11	0.9152	Tukey-Kramer	1.0000
treatment*depth	Control	10	Control	6	-4.4833	6.1458	78	-0.73	0.4679	Tukey-Kramer	0.9992
treatment*depth	Control	14	Control	18	3.5552	6.1458	78	0.58	0.5646	Tukey-Kramer	0.9999
treatment*depth	Control	14	Control	2	-3.3910	6.1458	78	-0.55	0.5827	Tukey-Kramer	0.9999
treatment*depth	Control	14	Control	6	-7.2175	6.1458	78	-1.17	0.2438	Tukey-Kramer	0.9742
treatment*depth	Control	18	Control	2	-6.9461	6.1458	78	-1.13	0.2618	Tukey-Kramer	0.9800
treatment*depth	Control	18	Control	6	-10.7727	6.1458	78	-1.75	0.0836	Tukey-Kramer	0.7617
treatment*depth	Control	2	Control	6	-3.8266	6.1458	78	-0.62	0.5353	Tukey-Kramer	0.9998

May Annual Burn Study Porewater Nutrients

May Burn Islands Porewater Ammonium (Table 5)

Program:

```
title 'Porewater Ammonium May';

proc mixed data=porewater;
        class island treatment;
        model pNH4=treatment|island;
        lsmeans treatment / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
treatment	1	12	1.11	0.3124
island	2	12	4.29	0.0392
island*treatment	2	12	3.07	0.0840

Least Squares Means						
Effect	treatment	Estimate	Standard Error	DF	t Value	Pr > |t|
treatment	CanopyRe	0.4317	0.1117	12	3.87	0.0022
treatment	Control	0.2651	0.1117	12	2.37	0.0351

Differences of Least Squares Means									
Effect	treatment	_treatment	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
treatment	CanopyRe	Control	0.1666	0.1579	12	1.05	0.3124	Tukey	0.3124

May Burn Islands Porewater Phosphate (Table 5)

Program:

```
title 'Porewater Phosphate May';

proc mixed data=porewater;
        class island treatment;
        model pPO4=treatment|island;
        lsmeans treatment / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
treatment	1	12	0.00	0.9463
island	2	12	1.68	0.2269
island*treatment	2	12	0.35	0.7114

Least Squares Means						
Effect	**treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
treatment	CanopyRe	0.05060	0.01678	12	3.02	0.0108
treatment	Control	0.04897	0.01678	12	2.92	0.0129

Differences of Least Squares Means									
Effect	**treatment**	**_treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
treatment	CanopyRe	Control	0.001633	0.02373	12	0.07	0.9463	Tukey	0.9463

May Burn Islands Porewater Sulfide (Table 5)

Program:

```
title 'Porewater Sulfide May';

proc mixed data=porewater;
        class island treatment;
        model pS=treatment|island;
        lsmeans treatment / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
treatment	1	12	1.39	0.2607
island	2	12	2.00	0.1774
island*treatment	2	12	1.30	0.3074

Least Squares Means						
Effect	**treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
treatment	CanopyRe	6.3759	2.1275	12	3.00	0.0111
treatment	Control	2.8243	2.1275	12	1.33	0.2090

Differences of Least Squares Means									
Effect	**treatment**	**_treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
treatment	CanopyRe	Control	3.5516	3.0088	12	1.18	0.2607	Tukey	0.2607

July Annual Burn Study Porewater Nutrients

July Burn Islands Porewater Ammonium (Table 5)

Program:

```
title 'Porewater Ammonium July';

proc mixed data=porewater;
        class island treatment;
        model pNH4=treatment|island;
        lsmeans treatment / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
treatment	1	12	10.65	0.0049
island	2	12	5.84	0.0169
island*treatment	2	12	6.21	0.0141

Least Squares Means						
Effect	treatment	Estimate	Standard Error	DF	t Value	Pr > |t|
treatment	CanopyRe	0.7870	0.09482	12	5.53	<.0001
treatment	Control	0.1296	0.09482	12	0.91	0.3765

Differences of Least Squares Means									
Effect	treatment	_treatment	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
treatment	CanopyRe	Control	0.6574	0.1341	12	4.90	0.0049	Tukey	0.0049

July Burn Islands Porewater Phosphate (Table 5)

Program:

```
title 'Porewater Phosphate July';

proc mixed data=porewater;
        class island treatment;
        model pPO4=treatment|island;
        lsmeans treatment / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
treatment	1	12	1.86	0.1972
island	2	12	0.53	0.6011
island*treatment	2	12	1.69	0.2261

Least Squares Means						
Effect	**treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
treatment	CanopyRe	0.08000	0.01991	12	4.02	0.0017
treatment	Control	0.04156	0.01991	12	2.09	0.0589

Differences of Least Squares Means									
Effect	**treatment**	**_treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
treatment	CanopyRe	Control	0.03844	0.02816	12	1.37	0.1972	Tukey	0.1972

July Burn Islands Porewater Sulfide (Table 5)

Program:

```
title 'Porewater Sulfide July';

proc mixed data=porewater;
        class island treatment;
        model pS=treatment|island;
        lsmeans treatment / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
treatment	1	12	0.14	0.7160
island	2	12	3.63	0.0584
island*treatment	2	12	0.06	0.9466

Least Squares Means						
Effect	**treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
treatment	CanopyRe	5.4389	1.6735	12	3.25	0.0070
treatment	Control	6.3207	1.6735	12	3.78	0.0026

Differences of Least Squares Means									
Effect	**treatment**	**_treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
treatment	CanopyRe	Control	-0.8818	2.3667	12	-0.37	0.7160	Tukey	0.7160

No Burn Study Total Plant Biomass Nutrients

No Burn Islands Plant Tissue Carbon (Table 6)

Program:

```
title 'No Burn Plant C';

proc mixed data=noburnplantnutrients;
	class island canopy ash;
	model totalC= canopy|ash|island;
	lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	33	8.36	0.0067
ash	1	33	0.01	0.9274
canopy*ash	1	33	0.17	0.6804
island	3	33	2.20	0.1071
island*canopy	2	33	3.11	0.0578
island*ash	3	33	0.63	0.6018
island*canopy*ash	2	33	0.22	0.8058

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	canopy		112.02	16.6779	33	6.72	<.0001
canopy	nocanopy		Non-est	.	.	.	.
ash		ash	Non-est	.	.	.	.
ash		noash	Non-est	.	.	.	.
canopy*ash	canopy	ash	116.10	17.9868	33	6.45	<.0001
canopy*ash	canopy	noash	107.93	28.0907	33	3.84	0.0005
canopy*ash	nocanopy	ash	Non-est	.	.	.	.
canopy*ash	nocanopy	noash	Non-est	.	.	.	.

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	canopy		nocanopy		Non-est	.	.	.	.	Tukey-Kramer	.
ash		ash		noash	Non-est	.	.	.	.	Tukey	.
canopy*ash	canopy	ash	canopy	noash	8.1685	33.3559	33	0.24	0.8081	Tukey-Kramer	0.8081
canopy*ash	canopy	ash	nocanopy	ash	Non-est	.	.	.	.	Tukey-Kramer	.
canopy*ash	canopy	ash	nocanopy	noash	Non-est	.	.	.	.	Tukey-Kramer	.
canopy*ash	canopy	noash	nocanopy	ash	Non-est	.	.	.	.	Tukey-Kramer	.
canopy*ash	canopy	noash	nocanopy	noash	Non-est	.	.	.	.	Tukey-Kramer	.
canopy*ash	nocanopy	ash	nocanopy	noash	Non-est	.	.	.	.	Tukey-Kramer	.

No Burn Islands Plant Tissue Nitrogen (Table 6)

Program:

```
title 'No Burn Plant N';

proc mixed data=noburnplantnutrients;
      class island canopy ash;
      model totalN= canopy|ash|island;
      lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	33	13.49	0.0008
ash	1	33	0.18	0.6736
canopy*ash	1	33	0.31	0.5807
island	3	33	0.03	0.9921
island*canopy	2	33	4.80	0.0148
island*ash	3	33	0.90	0.4492
island*canopy*ash	2	33	0.95	0.3966

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	canopy		2.7005	0.3445	33	7.84	<.0001
canopy	nocanopy		Non-est	.	.	.	.
ash		ash	Non-est	.	.	.	.
ash		noash	Non-est	.	.	.	.
canopy*ash	canopy	ash	2.7253	0.3716	33	7.33	<.0001
canopy*ash	canopy	noash	2.6757	0.5803	33	4.61	<.0001
canopy*ash	nocanopy	ash	Non-est	.	.	.	.
canopy*ash	nocanopy	noash	Non-est	.	.	.	.

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	canopy		nocanopy		Non-est	.	.	.	.	Tukey-Kramer	.
ash		ash		noash	Non-est	.	.	.	.	Tukey	.
canopy*ash	canopy	ash	canopy	noash	0.04959	0.6891	33	0.07	0.9431	Tukey-Kramer	0.9431
canopy*ash	canopy	ash	nocanopy	ash	Non-est	.	.	.	.	Tukey-Kramer	.
canopy*ash	canopy	ash	nocanopy	noash	Non-est	.	.	.	.	Tukey-Kramer	.
canopy*ash	canopy	noash	nocanopy	ash	Non-est	.	.	.	.	Tukey-Kramer	.
canopy*ash	canopy	noash	nocanopy	noash	Non-est	.	.	.	.	Tukey-Kramer	.
canopy*ash	nocanopy	ash	nocanopy	noash	Non-est	.	.	.	.	Tukey-Kramer	.

No Burn Islands Plant Tissue Phosphorus (Table 6)

Program:

```
title 'No Burn Plant P';

proc mixed data=noburnplantnutrients;
	class island canopy ash;
	model totalP= canopy|ash|island;
	lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	31	18.58	0.0002
ash	1	31	0.19	0.6633
canopy*ash	1	31	0.09	0.7696
island	3	31	1.01	0.4013
island*canopy	2	31	2.44	0.1035
island*ash	3	31	2.12	0.1172
island*canopy*ash	2	31	1.93	0.1621

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	canopy		0.2553	0.03205	31	7.96	<.0001
canopy	nocanopy		Non-est	.	.	.	.
ash		ash	Non-est	.	.	.	.
ash		noash	Non-est	.	.	.	.
canopy*ash	canopy	ash	0.2563	0.03501	31	7.32	<.0001
canopy*ash	canopy	noash	0.2543	0.05370	31	4.73	<.0001
canopy*ash	nocanopy	ash	Non-est	.	.	.	.
canopy*ash	nocanopy	noash	Non-est	.	.	.	.

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	canopy		nocanopy		Non-est	.	.	.	.	Tukey-Kramer	.
ash		ash		noash	Non-est	.	.	.	.	Tukey	.
canopy*ash	canopy	ash	canopy	noash	0.002045	0.06411	31	0.03	0.9748	Tukey-Kramer	0.9748
canopy*ash	canopy	ash	nocanopy	ash	Non-est	.	.	.	.	Tukey-Kramer	.
canopy*ash	canopy	ash	nocanopy	noash	Non-est	.	.	.	.	Tukey-Kramer	.
canopy*ash	canopy	noash	nocanopy	ash	Non-est	.	.	.	.	Tukey-Kramer	.
canopy*ash	canopy	noash	nocanopy	noash	Non-est	.	.	.	.	Tukey-Kramer	.
canopy*ash	nocanopy	ash	nocanopy	noash	Non-est	.	.	.	.	Tukey-Kramer	.

No Burn Islands Plant Tissue Potassium (Table 6)

Program:

```
title 'No Burn Plant K';

proc mixed data=noburnplantnutrients;
    class island canopy ash;
    model totalK= canopy|ash|island;
    lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	31	17.94	0.0002
ash	1	31	0.49	0.4899
canopy*ash	1	31	0.00	0.9926
island	3	31	2.09	0.1220
island*canopy	2	31	5.48	0.0092
island*ash	3	31	0.11	0.9549
island*canopy*ash	2	31	1.11	0.3412

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	canopy		2.6815	0.4091	31	6.55	<.0001
canopy	nocanopy		Non-est	.	.	.	.
ash		ash	Non-est	.	.	.	.
ash		noash	Non-est	.	.	.	.
canopy*ash	canopy	ash	2.5036	0.4468	31	5.60	<.0001
canopy*ash	canopy	noash	2.8595	0.6854	31	4.17	0.0002
canopy*ash	nocanopy	ash	Non-est	.	.	.	.
canopy*ash	nocanopy	noash	Non-est	.	.	.	.

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	canopy		nocanopy		Non-est	.	.	.	.	Tukey-Kramer	.
ash		ash		noash	Non-est	.	.	.	.	Tukey	.
canopy*ash	canopy	ash	canopy	noash	-0.3559	0.8182	31	-0.44	0.6666	Tukey-Kramer	0.6666
canopy*ash	canopy	ash	nocanopy	ash	Non-est	.	.	.	.	Tukey-Kramer	.
canopy*ash	canopy	ash	nocanopy	noash	Non-est	.	.	.	.	Tukey-Kramer	.
canopy*ash	canopy	noash	nocanopy	ash	Non-est	.	.	.	.	Tukey-Kramer	.
canopy*ash	canopy	noash	nocanopy	noash	Non-est	.	.	.	.	Tukey-Kramer	.
canopy*ash	nocanopy	ash	nocanopy	noash	Non-est	.	.	.	.	Tukey-Kramer	.

No Burn Islands Plant Tissue Calcium (Table 6)

Program:

```
title 'No Burn Plant Ca';

proc mixed data=noburnplantnutrients;
    class island canopy ash;
    model totalCa= canopy|ash|island;
    lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	31	9.73	0.0039
ash	1	31	0.01	0.9398
canopy*ash	1	31	0.23	0.6357
island	3	31	0.51	0.6794
island*canopy	2	31	3.72	0.0356
island*ash	3	31	1.32	0.2859
island*canopy*ash	2	31	0.98	0.3870

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	canopy		0.5732	0.07615	31	7.53	<.0001
canopy	nocanopy		Non-est	.	.	.	.
ash		ash	Non-est	.	.	.	.
ash		noash	Non-est	.	.	.	.
canopy*ash	canopy	ash	0.5899	0.08317	31	7.09	<.0001
canopy*ash	canopy	noash	0.5565	0.1276	31	4.36	0.0001
canopy*ash	nocanopy	ash	Non-est	.	.	.	.
canopy*ash	nocanopy	noash	Non-est	.	.	.	.

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	canopy		nocanopy		Non-est	.	.	.	.	Tukey-Kramer	.
ash		ash		noash	Non-est	.	.	.	.	Tukey	.
canopy*ash	canopy	ash	canopy	noash	0.03341	0.1523	31	0.22	0.8278	Tukey-Kramer	0.8278
canopy*ash	canopy	ash	nocanopy	ash	Non-est	.	.	.	.	Tukey-Kramer	.
canopy*ash	canopy	ash	nocanopy	noash	Non-est	.	.	.	.	Tukey-Kramer	.
canopy*ash	canopy	noash	nocanopy	ash	Non-est	.	.	.	.	Tukey-Kramer	.
canopy*ash	canopy	noash	nocanopy	noash	Non-est	.	.	.	.	Tukey-Kramer	.
canopy*ash	nocanopy	ash	nocanopy	noash	Non-est	.	.	.	.	Tukey-Kramer	.

No Burn Islands Plant Tissue Magnesium (Table 6)

Program:

```
title ‘No Burn Plant Mg';

proc mixed data=noburnplantnutrients;
    class island canopy ash;
    model totalMg= canopy|ash|island;
    lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	31	17.47	0.0002
ash	1	31	0.06	0.8110
canopy*ash	1	31	0.09	0.7720
island	3	31	0.23	0.8752
island*canopy	2	31	3.93	0.0300
island*ash	3	31	1.59	0.2117
island*canopy*ash	2	31	0.84	0.4425

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	canopy		0.8138	0.1171	31	6.95	<.0001
canopy	nocanopy		Non-est	.	.	.	.
ash		ash	Non-est	.	.	.	.
ash		noash	Non-est	.	.	.	.
canopy*ash	canopy	ash	0.8174	0.1279	31	6.39	<.0001
canopy*ash	canopy	noash	0.8102	0.1963	31	4.13	0.0003
canopy*ash	nocanopy	ash	Non-est	.	.	.	.
canopy*ash	nocanopy	noash	Non-est	.	.	.	.

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	canopy		nocanopy		Non-est	.	.	.	.	Tukey-Kramer	.
ash		ash		noash	Non-est	.	.	.	.	Tukey	.
canopy*ash	canopy	ash	canopy	noash	0.007231	0.2343	31	0.03	0.9756	Tukey-Kramer	0.9756
canopy*ash	canopy	ash	nocanopy	ash	Non-est	.	.	.	.	Tukey-Kramer	.
canopy*ash	canopy	ash	nocanopy	noash	Non-est	.	.	.	.	Tukey-Kramer	.
canopy*ash	canopy	noash	nocanopy	ash	Non-est	.	.	.	.	Tukey-Kramer	.
canopy*ash	canopy	noash	nocanopy	noash	Non-est	.	.	.	.	Tukey-Kramer	.
canopy*ash	nocanopy	ash	nocanopy	noash	Non-est	.	.	.	.	Tukey-Kramer	.

No Burn Islands Plant Tissue Sulfur (Table 6)

Program:

```
title 'No Burn Plant S';

proc mixed data=noburnplantnutrients;
    class island canopy ash;
    model totalS= canopy|ash|island;
    lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	31	19.71	0.0001
ash	1	31	0.39	0.5355
canopy*ash	1	31	0.05	0.8167
island	3	31	5.98	0.0024
island*canopy	2	31	6.91	0.0033
island*ash	3	31	0.24	0.8670
island*canopy*ash	2	31	1.11	0.3408

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	canopy		2.0008	0.3658	31	5.47	<.0001
canopy	nocanopy		Non-est	.	.	.	.
ash		ash	Non-est	.	.	.	.
ash		noash	Non-est	.	.	.	.
canopy*ash	canopy	ash	1.8340	0.3995	31	4.59	<.0001
canopy*ash	canopy	noash	2.1676	0.6128	31	3.54	0.0013
canopy*ash	nocanopy	ash	Non-est	.	.	.	.
canopy*ash	nocanopy	noash	Non-est	.	.	.	.

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	canopy		nocanopy		Non-est	.	.	.	.	Tukey-Kramer	.
ash		ash		noash	Non-est	.	.	.	.	Tukey	.
canopy*ash	canopy	ash	canopy	noash	-0.3335	0.7315	31	-0.46	0.6516	Tukey-Kramer	0.6516
canopy*ash	canopy	ash	nocanopy	ash	Non-est	.	.	.	.	Tukey-Kramer	.
canopy*ash	canopy	ash	nocanopy	noash	Non-est	.	.	.	.	Tukey-Kramer	.
canopy*ash	canopy	noash	nocanopy	ash	Non-est	.	.	.	.	Tukey-Kramer	.
canopy*ash	canopy	noash	nocanopy	noash	Non-est	.	.	.	.	Tukey-Kramer	.
canopy*ash	nocanopy	ash	nocanopy	noash	Non-est	.	.	.	.	Tukey-Kramer	.

Annual Burn Study Total Plant Biomass Nutrients

Burn Islands Plant Tissue Carbon (Table 7)

Program:

```
title 'Burn Plant C';

proc mixed data=burnplantnutrients;
	class island canopy ash;
	model totalC= canopy|ash|island;
	lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
treatment	1	14	6.55	0.0227
island	2	14	0.03	0.9702
island*treatment	2	14	4.97	0.0234

Least Squares Means						
Effect	**treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
treatment	canopy	3.2813	0.4030	14	8.14	<.0001
treatment	control	4.5626	0.2971	14	15.36	<.0001

Differences of Least Squares Means									
Effect	**treatment**	**_treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
treatment	canopy	control	-1.2813	0.5007	14	-2.56	0.0227	Tukey-Kramer	0.0227

Burn Islands Plant Tissue Nitrogen (Table 7)

Program:

```
title ‘Burn Plant N';

proc mixed data=burnplantnutrients;
    class island canopy ash;
    model totalN= canopy|ash|island;
    lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
treatment	1	14	6.55	0.0227
island	2	14	0.03	0.9702
island*treatment	2	14	4.97	0.0234

Least Squares Means						
Effect	**treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
treatment	canopy	3.2813	0.4030	14	8.14	<.0001
treatment	control	4.5626	0.2971	14	15.36	<.0001

Differences of Least Squares Means									
Effect	**treatment**	**_treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
treatment	canopy	control	-1.2813	0.5007	14	-2.56	0.0227	Tukey-Kramer	0.0227

Burn Islands Plant Tissue Phosphorus (Table 7)

Program:

```
title 'Burn Plant P';

proc mixed data=burnplantnutrients;
	class island canopy ash;
	model totalP= canopy|ash|island;
	lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
treatment	1	14	1.76	0.2059
island	2	14	1.02	0.3867
island*treatment	2	14	0.89	0.4325

Least Squares Means						
Effect	**treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
treatment	canopy	0.3281	0.07141	14	4.59	0.0004
treatment	control	0.4458	0.05264	14	8.47	<.0001

Differences of Least Squares Means									
Effect	**treatment**	**_treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
treatment	canopy	control	-0.1177	0.08872	14	-1.33	0.2059	Tukey-Kramer	0.2059

Burn Islands Plant Tissue Calcium (Table 7)

Program:

```
title 'Burn Plant Ca';

proc mixed data=burnplantnutrients;
    class island canopy ash;
    model totalCa= canopy|ash|island;
    lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
treatment	1	14	4.51	0.0519
island	2	14	0.74	0.4948
island*treatment	2	14	2.70	0.1020

Least Squares Means						
Effect	**treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
treatment	canopy	0.5690	0.09663	14	5.89	<.0001
treatment	control	0.8240	0.07124	14	11.57	<.0001

Differences of Least Squares Means									
Effect	**treatment**	**_treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
treatment	canopy	control	-0.2550	0.1201	14	-2.12	0.0519	Tukey-Kramer	0.0519

Burn Islands Plant Tissue Magnesium (Table 7)

Program:

```
title 'Burn Plant Mg';

proc mixed data=burnplantnutrients;
    class island canopy ash;
    model totalMg= canopy|ash|island;
    lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
treatment	1	14	3.89	0.0685
island	2	14	1.53	0.2505
island*treatment	2	14	1.51	0.2551

Least Squares Means						
Effect	**treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
treatment	canopy	0.9302	0.1789	14	5.20	0.0001
treatment	control	1.3688	0.1319	14	10.38	<.0001

Differences of Least Squares Means									
Effect	**treatment**	**_treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
treatment	canopy	control	-0.4386	0.2223	14	-1.97	0.0685	Tukey-Kramer	0.0685

Burn Islands Plant Tissue Sulfur (Table 7)

Program:

```
title 'Burn Plant S';

proc mixed data=burnplantnutrients;
     class island canopy ash;
     model totalS= canopy|ash|island;
     lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
treatment	1	14	2.09	0.1706
island	2	14	1.23	0.3215
island*treatment	2	14	3.15	0.0742

Least Squares Means						
Effect	**treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
treatment	canopy	3.4548	0.6537	14	5.28	0.0001
treatment	control	4.6280	0.4819	14	9.60	<.0001

Differences of Least Squares Means									
Effect	**treatment**	**_treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
treatment	canopy	control	-1.1732	0.8122	14	-1.44	0.1706	Tukey-Kramer	0.1706

Appendix B: Statistical Models and Analysis for Chapter 3

This appendix provides statistical model inputs and outputs from SAS for resin capsule data used in Chapter 3. Each program code is preceded by a title indicating the data it is intended to analyze and the corresponding table or figure.

May No Burn Study Resin Capsule Nutrients

May No Burn Islands Resin Capsule Ammonium (Table 1)

Program:

```
title 'Resin Capsule Ammonium May';

proc mixed data=resin;
        class island canopy ash;
        model rNH4=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	30	0.02	0.9027
ash	1	30	0.32	0.5784
canopy*ash	1	30	0.18	0.6744
island	3	30	0.81	0.4963
island*canopy	3	30	0.03	0.9912
island*ash	3	30	1.12	0.3565
island*canopy*ash	3	30	0.50	0.6853

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		1.2300	0.09972	30	12.33	<.0001
canopy	NoCanopy		1.2121	0.1058	30	11.46	<.0001
ash		Ash	1.1802	0.1028	30	11.48	<.0001
ash		NoAsh	1.2619	0.1028	30	12.28	<.0001
canopy*ash	Canopy	Ash	1.1583	0.1410	30	8.21	<.0001
canopy*ash	Canopy	NoAsh	1.3017	0.1410	30	9.23	<.0001
canopy*ash	NoCanopy	Ash	1.2021	0.1496	30	8.04	<.0001
canopy*ash	NoCanopy	NoAsh	1.2221	0.1496	30	8.17	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		0.01792	0.1454	30	0.12	0.9027	Tukey-Kramer	0.9027
ash		Ash		NoAsh	-0.08167	0.1454	30	-0.56	0.5784	Tukey	0.5784
canopy*ash	Canopy	Ash	Canopy	NoAsh	-0.1433	0.1994	30	-0.72	0.4779	Tukey-Kramer	0.8889
canopy*ash	Canopy	Ash	NoCanopy	Ash	-0.04375	0.2056	30	-0.21	0.8329	Tukey-Kramer	0.9965
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	-0.06375	0.2056	30	-0.31	0.7586	Tukey-Kramer	0.9894
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0.09958	0.2056	30	0.48	0.6316	Tukey-Kramer	0.9620
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	0.07958	0.2056	30	0.39	0.7014	Tukey-Kramer	0.9799
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-0.02000	0.2115	30	-0.09	0.9253	Tukey-Kramer	0.9997

May No Burn Islands Resin Capsule Nitrate (Table 1)

Program:

```
title 'Resin Capsule Nitrate May';

proc mixed data=resin;
        class island canopy ash;
        model rNO3=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	30	0.02	0.8805
ash	1	30	0.00	0.9664
canopy*ash	1	30	0.30	0.5852
island	3	30	8.37	0.0003
island*canopy	3	30	0.13	0.9444
island*ash	3	30	0.72	0.5466
island*canopy*ash	3	30	0.49	0.6917

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		0.2837	0.02357	30	12.04	<.0001
canopy	NoCanopy		0.2785	0.02500	30	11.14	<.0001
ash		Ash	0.2804	0.02430	30	11.54	<.0001
ash		NoAsh	0.2819	0.02430	30	11.60	<.0001
canopy*ash	Canopy	Ash	0.2925	0.03334	30	8.77	<.0001
canopy*ash	Canopy	NoAsh	0.2750	0.03334	30	8.25	<.0001
canopy*ash	NoCanopy	Ash	0.2683	0.03536	30	7.59	<.0001
canopy*ash	NoCanopy	NoAsh	0.2888	0.03536	30	8.17	<.0001

Differences of Least Squares Means											
Effect	canopy	ash	_canopy	_ash	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
canopy	Canopy		NoCanopy		0.005208	0.03436	30	0.15	0.8805	Tukey-Kramer	0.8805
ash		Ash		NoAsh	-0.00146	0.03436	30	-0.04	0.9664	Tukey	0.9664
canopy*ash	Canopy	Ash	Canopy	NoAsh	0.01750	0.04714	30	0.37	0.7131	Tukey-Kramer	0.9822
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.02417	0.04859	30	0.50	0.6226	Tukey-Kramer	0.9591
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	0.003750	0.04859	30	0.08	0.9390	Tukey-Kramer	0.9998
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0.006667	0.04859	30	0.14	0.8918	Tukey-Kramer	0.9991
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	-0.01375	0.04859	30	-0.28	0.7792	Tukey-Kramer	0.9919
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-0.02042	0.05000	30	-0.41	0.6859	Tukey-Kramer	0.9766

May No Burn Islands Resin Capsule Phosphorus (Table 1)

Program:

```
title 'Resin Capsule Phosphorus May';

proc mixed data=resin;
        class island canopy ash;
        model rP=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	30	0.15	0.7034
ash	1	30	1.05	0.3136
canopy*ash	1	30	0.02	0.8989
island	3	30	4.45	0.0106
island*canopy	3	30	0.86	0.4705
island*ash	3	30	0.58	0.6317
island*canopy*ash	3	30	0.14	0.9355

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		0.07667	0.008924	30	8.59	<.0001
canopy	NoCanopy		0.07167	0.009465	30	7.57	<.0001
ash		Ash	0.06750	0.009198	30	7.34	<.0001
ash		NoAsh	0.08083	0.009198	30	8.79	<.0001
canopy*ash	Canopy	Ash	0.06917	0.01262	30	5.48	<.0001
canopy*ash	Canopy	NoAsh	0.08417	0.01262	30	6.67	<.0001
canopy*ash	NoCanopy	Ash	0.06583	0.01339	30	4.92	<.0001
canopy*ash	NoCanopy	NoAsh	0.07750	0.01339	30	5.79	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		0.005000	0.01301	30	0.38	0.7034	Tukey-Kramer	0.7034
ash		Ash		NoAsh	-0.01333	0.01301	30	-1.02	0.3136	Tukey	0.3136
canopy*ash	Canopy	Ash	Canopy	NoAsh	-0.01500	0.01785	30	-0.84	0.4073	Tukey-Kramer	0.8348
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.003333	0.01840	30	0.18	0.8574	Tukey-Kramer	0.9978
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	-0.00833	0.01840	30	-0.45	0.6538	Tukey-Kramer	0.9685
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0.01833	0.01840	30	1.00	0.3269	Tukey-Kramer	0.7525
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	0.006667	0.01840	30	0.36	0.7196	Tukey-Kramer	0.9834
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-0.01167	0.01893	30	-0.62	0.5423	Tukey-Kramer	0.9261

May No Burn Islands Resin Capsule Calcium (Table 1)

Program:

```
title 'Resin Capsule Calcium May';

proc mixed data=resin;
        class island canopy ash;
        model rCa=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	30	0.73	0.3992
ash	1	30	0.19	0.6667
canopy*ash	1	30	0.58	0.4542
island	3	30	7.94	0.0005
island*canopy	3	30	0.45	0.7178
island*ash	3	30	1.97	0.1400
island*canopy*ash	3	30	0.35	0.7924

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		49.4500	5.2880	30	9.35	<.0001
canopy	NoCanopy		42.8575	5.6088	30	7.64	<.0001
ash		Ash	44.4773	5.4508	30	8.16	<.0001
ash		NoAsh	47.8302	5.4508	30	8.77	<.0001
canopy*ash	Canopy	Ash	44.8508	7.4784	30	6.00	<.0001
canopy*ash	Canopy	NoAsh	54.0492	7.4784	30	7.23	<.0001
canopy*ash	NoCanopy	Ash	44.1038	7.9320	30	5.56	<.0001
canopy*ash	NoCanopy	NoAsh	41.6112	7.9320	30	5.25	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		6.5925	7.7085	30	0.86	0.3992	Tukey-Kramer	0.3992
ash		Ash		NoAsh	-3.3529	7.7085	30	-0.43	0.6667	Tukey	0.6667
canopy*ash	Canopy	Ash	Canopy	NoAsh	-9.1983	10.5760	30	-0.87	0.3914	Tukey-Kramer	0.8203
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.7471	10.9015	30	0.07	0.9458	Tukey-Kramer	0.9999
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	3.2396	10.9015	30	0.30	0.7684	Tukey-Kramer	0.9907
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	9.9454	10.9015	30	0.91	0.3689	Tukey-Kramer	0.7985
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	12.4379	10.9015	30	1.14	0.2629	Tukey-Kramer	0.6676
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	2.4925	11.2176	30	0.22	0.8257	Tukey-Kramer	0.9960

May No Burn Islands Resin Capsule Magnesium (Table 1)

Program:

```
title 'Resin Capsule Magnesium May';

proc mixed data=resin;
        class island canopy ash;
        model rMg=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	30	0.43	0.5155
ash	1	30	0.10	0.7588
canopy*ash	1	30	0.28	0.6021
island	3	30	8.29	0.0004
island*canopy	3	30	0.28	0.8421
island*ash	3	30	1.04	0.3911
island*canopy*ash	3	30	0.44	0.7259

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		104.83	9.7363	30	10.77	<.0001
canopy	NoCanopy		95.4885	10.3269	30	9.25	<.0001
ash		Ash	102.36	10.0360	30	10.20	<.0001
ash		NoAsh	97.9596	10.0360	30	9.76	<.0001
canopy*ash	Canopy	Ash	103.29	13.7692	30	7.50	<.0001
canopy*ash	Canopy	NoAsh	106.37	13.7692	30	7.73	<.0001
canopy*ash	NoCanopy	Ash	101.43	14.6045	30	6.94	<.0001
canopy*ash	NoCanopy	NoAsh	89.5500	14.6045	30	6.13	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		9.3410	14.1930	30	0.66	0.5155	Tukey-Kramer	0.5155
ash		Ash		NoAsh	4.3990	14.1930	30	0.31	0.7588	Tukey	0.7588
canopy*ash	Canopy	Ash	Canopy	NoAsh	-3.0792	19.4726	30	-0.16	0.8754	Tukey-Kramer	0.9986
canopy*ash	Canopy	Ash	NoCanopy	Ash	1.8629	20.0719	30	0.09	0.9267	Tukey-Kramer	0.9997
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	13.7400	20.0719	30	0.68	0.4989	Tukey-Kramer	0.9022
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	4.9421	20.0719	30	0.25	0.8072	Tukey-Kramer	0.9946
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	16.8192	20.0719	30	0.84	0.4087	Tukey-Kramer	0.8360
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	11.8771	20.6538	30	0.58	0.5695	Tukey-Kramer	0.9388

May No Burn Islands Resin Capsule Potassium (Table 1)

Program:

```
title 'Resin Capsule Potassium May';

proc mixed data=resin;
        class island canopy ash;
        model rK=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
canopy	1	30	0.23	0.6348
ash	1	30	2.06	0.1615
canopy*ash	1	30	0.09	0.7661
island	3	30	4.10	0.0150
island*canopy	3	30	0.14	0.9345
island*ash	3	30	0.15	0.9301
island*canopy*ash	3	30	1.10	0.3626

Least Squares Means							
Effect	canopy	ash	Estimate	Standard Error	DF	t Value	Pr > |t|
canopy	Canopy		12.7112	0.7146	30	17.79	<.0001
canopy	NoCanopy		12.2115	0.7579	30	16.11	<.0001
ash		Ash	13.2090	0.7366	30	17.93	<.0001
ash		NoAsh	11.7138	0.7366	30	15.90	<.0001
canopy*ash	Canopy	Ash	13.3025	1.0105	30	13.16	<.0001
canopy*ash	Canopy	NoAsh	12.1200	1.0105	30	11.99	<.0001
canopy*ash	NoCanopy	Ash	13.1154	1.0718	30	12.24	<.0001
canopy*ash	NoCanopy	NoAsh	11.3075	1.0718	30	10.55	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		0.4998	1.0416	30	0.48	0.6348	Tukey-Kramer	0.6348
ash		Ash		NoAsh	1.4952	1.0416	30	1.44	0.1615	Tukey	0.1615
canopy*ash	Canopy	Ash	Canopy	NoAsh	1.1825	1.4291	30	0.83	0.4145	Tukey-Kramer	0.8410
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.1871	1.4731	30	0.13	0.8998	Tukey-Kramer	0.9993
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	1.9950	1.4731	30	1.35	0.1858	Tukey-Kramer	0.5368
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	-0.9954	1.4731	30	-0.68	0.5044	Tukey-Kramer	0.9055
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	0.8125	1.4731	30	0.55	0.5853	Tukey-Kramer	0.9454
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	1.8079	1.5158	30	1.19	0.2423	Tukey-Kramer	0.6361

May No Burn Islands Resin Capsule Sulfur (Table 1)

Program:

```
title 'Resin Capsule Sulfur May';

proc mixed data=resin;
        class island canopy ash;
        model rS=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	30	0.07	0.8002
ash	1	30	1.04	0.3159
canopy*ash	1	30	0.01	0.9384
island	3	30	5.34	0.0046
island*canopy	3	30	0.10	0.9606
island*ash	3	30	0.78	0.5140
island*canopy*ash	3	30	1.03	0.3953

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		88.6567	6.0749	30	14.59	<.0001
canopy	NoCanopy		86.3956	6.4434	30	13.41	<.0001
ash		Ash	92.0423	6.2619	30	14.70	<.0001
ash		NoAsh	83.0100	6.2619	30	13.26	<.0001
canopy*ash	Canopy	Ash	92.8275	8.5912	30	10.80	<.0001
canopy*ash	Canopy	NoAsh	84.4858	8.5912	30	9.83	<.0001
canopy*ash	NoCanopy	Ash	91.2571	9.1124	30	10.01	<.0001
canopy*ash	NoCanopy	NoAsh	81.5342	9.1124	30	8.95	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		2.2610	8.8557	30	0.26	0.8002	Tukey-Kramer	0.8002
ash		Ash		NoAsh	9.0323	8.8557	30	1.02	0.3159	Tukey	0.3159
canopy*ash	Canopy	Ash	Canopy	NoAsh	8.3417	12.1499	30	0.69	0.4976	Tukey-Kramer	0.9014
canopy*ash	Canopy	Ash	NoCanopy	Ash	1.5704	12.5238	30	0.13	0.9010	Tukey-Kramer	0.9993
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	11.2933	12.5238	30	0.90	0.3744	Tukey-Kramer	0.8040
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	-6.7712	12.5238	30	-0.54	0.5927	Tukey-Kramer	0.9483
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	2.9517	12.5238	30	0.24	0.8153	Tukey-Kramer	0.9953
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	9.7229	12.8869	30	0.75	0.4564	Tukey-Kramer	0.8740

May No Burn Grass Dominated Islands Resin Capsule Nitrate (Table 2)

Program:

```
title 'May Resin Capsule Nitrate Grass Dom';

proc mixed data=resin;
        class island canopy ash;
        model rNO3=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	0.27	0.6093
ash	1	16	0.09	0.7639
canopy*ash	1	16	0.09	0.7639
island	1	16	3.98	0.0633
island*canopy	1	16	0.02	0.9014
island*ash	1	16	0.44	0.5155
island*canopy*ash	1	16	0.17	0.6848

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		0.2217	0.03278	16	6.76	<.0001
canopy	NoCanopy		0.1975	0.03278	16	6.02	<.0001
ash		Ash	0.2025	0.03278	16	6.18	<.0001
ash		NoAsh	0.2167	0.03278	16	6.61	<.0001
canopy*ash	Canopy	Ash	0.2217	0.04636	16	4.78	0.0002
canopy*ash	Canopy	NoAsh	0.2217	0.04636	16	4.78	0.0002
canopy*ash	NoCanopy	Ash	0.1833	0.04636	16	3.95	0.0011
canopy*ash	NoCanopy	NoAsh	0.2117	0.04636	16	4.57	0.0003

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		0.02417	0.04636	16	0.52	0.6093	Tukey	0.6093
ash		Ash		NoAsh	-0.01417	0.04636	16	-0.31	0.7639	Tukey	0.7639
canopy*ash	Canopy	Ash	Canopy	NoAsh	3.47E-18	0.06556	16	0.00	1.0000	Tukey	1.0000
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.03833	0.06556	16	0.58	0.5669	Tukey	0.9353
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	0.01000	0.06556	16	0.15	0.8807	Tukey	0.9987
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0.03833	0.06556	16	0.58	0.5669	Tukey	0.9353
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	0.01000	0.06556	16	0.15	0.8807	Tukey	0.9987
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-0.02833	0.06556	16	-0.43	0.6714	Tukey	0.9721

May No Burn Grass Dominated Islands Resin Capsule Ammonium (Table 2)

Program:

```
title 'May Resin Capsule Ammonium Grass Dom';

proc mixed data=resin;
        class island canopy ash;
        model rNH4=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	0.08	0.7769
ash	1	16	0.08	0.7769
canopy*ash	1	16	0.04	0.8513
island	1	16	0.00	0.9578
island*canopy	1	16	0.00	0.9578
island*ash	1	16	3.04	0.1004
island*canopy*ash	1	16	0.26	0.6151

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		1.1500	0.1207	16	9.53	<.0001
canopy	NoCanopy		1.1008	0.1207	16	9.12	<.0001
ash		Ash	1.1008	0.1207	16	9.12	<.0001
ash		NoAsh	1.1500	0.1207	16	9.53	<.0001
canopy*ash	Canopy	Ash	1.1417	0.1706	16	6.69	<.0001
canopy*ash	Canopy	NoAsh	1.1583	0.1706	16	6.79	<.0001
canopy*ash	NoCanopy	Ash	1.0600	0.1706	16	6.21	<.0001
canopy*ash	NoCanopy	NoAsh	1.1417	0.1706	16	6.69	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		0.04917	0.1706	16	0.29	0.7769	Tukey	0.7769
ash		Ash		NoAsh	-0.04917	0.1706	16	-0.29	0.7769	Tukey	0.7769
canopy*ash	Canopy	Ash	Canopy	NoAsh	-0.01667	0.2413	16	-0.07	0.9458	Tukey	0.9999
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.08167	0.2413	16	0.34	0.7394	Tukey	0.9862
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	-278E-18	0.2413	16	-0.00	1.0000	Tukey	1.0000
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0.09833	0.2413	16	0.41	0.6890	Tukey	0.9764
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	0.01667	0.2413	16	0.07	0.9458	Tukey	0.9999
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-0.08167	0.2413	16	-0.34	0.7394	Tukey	0.9862

May No Burn Grass Dominated Islands Resin Capsule Phopshorus (Table 2)

Program:

```
title 'May Resin Capsule Phosphorus Grass Dom';

proc mixed data=resin;
        class island canopy ash;
        model rP=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	2.79	0.1141
ash	1	16	1.05	0.3209
canopy*ash	1	16	0.35	0.5614
island	1	16	0.07	0.7909
island*canopy	1	16	0.03	0.8735
island*ash	1	16	0.14	0.7108
island*canopy*ash	1	16	0.07	0.7909

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		0.06750	0.01093	16	6.18	<.0001
canopy	NoCanopy		0.04167	0.01093	16	3.81	0.0015
ash		Ash	0.04667	0.01093	16	4.27	0.0006
ash		NoAsh	0.06250	0.01093	16	5.72	<.0001
canopy*ash	Canopy	Ash	0.05500	0.01546	16	3.56	0.0026
canopy*ash	Canopy	NoAsh	0.08000	0.01546	16	5.18	<.0001
canopy*ash	NoCanopy	Ash	0.03833	0.01546	16	2.48	0.0246
canopy*ash	NoCanopy	NoAsh	0.04500	0.01546	16	2.91	0.0102

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		0.02583	0.01546	16	1.67	0.1141	Tukey	0.1141
ash		Ash		NoAsh	-0.01583	0.01546	16	-1.02	0.3209	Tukey	0.3209
canopy*ash	Canopy	Ash	Canopy	NoAsh	-0.02500	0.02186	16	-1.14	0.2696	Tukey	0.6689
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.01667	0.02186	16	0.76	0.4569	Tukey	0.8700
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	0.01000	0.02186	16	0.46	0.6535	Tukey	0.9672
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0.04167	0.02186	16	1.91	0.0747	Tukey	0.2643
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	0.03500	0.02186	16	1.60	0.1289	Tukey	0.4056
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-0.00667	0.02186	16	-0.30	0.7643	Tukey	0.9898

May No Burn Grass Dominated Islands Resin Capsule Potassium (Table 2)

Program:

```
title 'May Resin Capsule Potassium Grass Dom';

proc mixed data=resin;
       class island canopy ash;
       model rK=canopy|ash|island;
       lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	0.17	0.6865
ash	1	16	2.50	0.1335
canopy*ash	1	16	0.58	0.4575
island	1	16	0.54	0.4711
island*canopy	1	16	0.21	0.6497
island*ash	1	16	0.11	0.7493
island*canopy*ash	1	16	0.36	0.5575

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		13.9350	0.8645	16	16.12	<.0001
canopy	NoCanopy		13.4325	0.8645	16	15.54	<.0001
ash		Ash	14.6500	0.8645	16	16.95	<.0001
ash		NoAsh	12.7175	0.8645	16	14.71	<.0001
canopy*ash	Canopy	Ash	15.3667	1.2226	16	12.57	<.0001
canopy*ash	Canopy	NoAsh	12.5033	1.2226	16	10.23	<.0001
canopy*ash	NoCanopy	Ash	13.9333	1.2226	16	11.40	<.0001
canopy*ash	NoCanopy	NoAsh	12.9317	1.2226	16	10.58	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		0.5025	1.2226	16	0.41	0.6865	Tukey	0.6865
ash		Ash		NoAsh	1.9325	1.2226	16	1.58	0.1335	Tukey	0.1335
canopy*ash	Canopy	Ash	Canopy	NoAsh	2.8633	1.7291	16	1.66	0.1172	Tukey	0.3775
canopy*ash	Canopy	Ash	NoCanopy	Ash	1.4333	1.7291	16	0.83	0.4193	Tukey	0.8400
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	2.4350	1.7291	16	1.41	0.1782	Tukey	0.5124
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	-1.4300	1.7291	16	-0.83	0.4204	Tukey	0.8409
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	-0.4283	1.7291	16	-0.25	0.8075	Tukey	0.9944
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	1.0017	1.7291	16	0.58	0.5705	Tukey	0.9369

May No Burn Grass Dominated Islands Resin Capsule Calcium (Table 2)

Program:

```
title 'May Resin Capsule Calcium Grass Dom';

proc mixed data=resin;
        class island canopy ash;
        model rCa=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	0.13	0.7235
ash	1	16	0.15	0.7005
canopy*ash	1	16	0.50	0.4893
island	1	16	1.37	0.2595
island*canopy	1	16	0.74	0.4022
island*ash	1	16	4.15	0.0585
island*canopy*ash	1	16	0.18	0.6738

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		65.1783	8.8808	16	7.34	<.0001
canopy	NoCanopy		60.6567	8.8808	16	6.83	<.0001
ash		Ash	60.4583	8.8808	16	6.81	<.0001
ash		NoAsh	65.3767	8.8808	16	7.36	<.0001
canopy*ash	Canopy	Ash	58.2750	12.5594	16	4.64	0.0003
canopy*ash	Canopy	NoAsh	72.0817	12.5594	16	5.74	<.0001
canopy*ash	NoCanopy	Ash	62.6417	12.5594	16	4.99	0.0001
canopy*ash	NoCanopy	NoAsh	58.6717	12.5594	16	4.67	0.0003

Differences of Least Squares Means											
Effect	canopy	ash	_canopy	_ash	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
canopy	Canopy		NoCanopy		4.5217	12.5594	16	0.36	0.7235	Tukey	0.7235
ash		Ash		NoAsh	-4.9183	12.5594	16	-0.39	0.7005	Tukey	0.7005
canopy*ash	Canopy	Ash	Canopy	NoAsh	-13.8067	17.7617	16	-0.78	0.4483	Tukey	0.8636
canopy*ash	Canopy	Ash	NoCanopy	Ash	-4.3667	17.7617	16	-0.25	0.8089	Tukey	0.9946
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	-0.3967	17.7617	16	-0.02	0.9825	Tukey	1.0000
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	9.4400	17.7617	16	0.53	0.6024	Tukey	0.9501
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	13.4100	17.7617	16	0.75	0.4612	Tukey	0.8732
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	3.9700	17.7617	16	0.22	0.8260	Tukey	0.9959

May No Burn Grass Dominated Islands Resin Capsule Magnesium (Table 2)

Program:

```
title 'May Resin Capsule Magnesium Grass Dom';

proc mixed data=resin;
        class island canopy ash;
        model rMg=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	0.02	0.8847
ash	1	16	0.48	0.5003
canopy*ash	1	16	0.16	0.6961
island	1	16	0.06	0.8116
island*canopy	1	16	0.39	0.5387
island*ash	1	16	2.22	0.1560
island*canopy*ash	1	16	0.32	0.5774

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		133.51	14.8969	16	8.96	<.0001
canopy	NoCanopy		130.40	14.8969	16	8.75	<.0001
ash		Ash	139.22	14.8969	16	9.35	<.0001
ash		NoAsh	124.69	14.8969	16	8.37	<.0001
canopy*ash	Canopy	Ash	136.58	21.0673	16	6.48	<.0001
canopy*ash	Canopy	NoAsh	130.43	21.0673	16	6.19	<.0001
canopy*ash	NoCanopy	Ash	141.85	21.0673	16	6.73	<.0001
canopy*ash	NoCanopy	NoAsh	118.95	21.0673	16	5.65	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		3.1042	21.0673	16	0.15	0.8847	Tukey	0.8847
ash		Ash		NoAsh	14.5275	21.0673	16	0.69	0.5003	Tukey	0.5003
canopy*ash	Canopy	Ash	Canopy	NoAsh	6.1483	29.7937	16	0.21	0.8391	Tukey	0.9968
canopy*ash	Canopy	Ash	NoCanopy	Ash	-5.2750	29.7937	16	-0.18	0.8617	Tukey	0.9979
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	17.6317	29.7937	16	0.59	0.5623	Tukey	0.9331
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	-11.4233	29.7937	16	-0.38	0.7065	Tukey	0.9802
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	11.4833	29.7937	16	0.39	0.7050	Tukey	0.9799
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	22.9067	29.7937	16	0.77	0.4532	Tukey	0.8673

May No Burn Grass Dominated Islands Resin Capsule Sulfur (Table 2)

Program:

```
title 'May Resin Capsule Sulfur Grass Dom';

proc mixed data=resin;
        class island canopy ash;
        model rS=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	0.20	0.6590
ash	1	16	2.62	0.1253
canopy*ash	1	16	0.36	0.5561
island	1	16	6.01	0.0261
island*canopy	1	16	0.14	0.7172
island*ash	1	16	0.75	0.4000
island*canopy*ash	1	16	0.00	0.9801

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		98.4283	8.7480	16	11.25	<.0001
canopy	NoCanopy		92.8658	8.7480	16	10.62	<.0001
ash		Ash	105.65	8.7480	16	12.08	<.0001
ash		NoAsh	85.6400	8.7480	16	9.79	<.0001
canopy*ash	Canopy	Ash	112.16	12.3715	16	9.07	<.0001
canopy*ash	Canopy	NoAsh	84.7017	12.3715	16	6.85	<.0001
canopy*ash	NoCanopy	Ash	99.1533	12.3715	16	8.01	<.0001
canopy*ash	NoCanopy	NoAsh	86.5783	12.3715	16	7.00	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		5.5625	12.3715	16	0.45	0.6590	Tukey	0.6590
ash		Ash		NoAsh	20.0142	12.3715	16	1.62	0.1253	Tukey	0.1253
canopy*ash	Canopy	Ash	Canopy	NoAsh	27.4533	17.4960	16	1.57	0.1362	Tukey	0.4226
canopy*ash	Canopy	Ash	NoCanopy	Ash	13.0017	17.4960	16	0.74	0.4682	Tukey	0.8782
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	25.5767	17.4960	16	1.46	0.1631	Tukey	0.4817
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	-14.4517	17.4960	16	-0.83	0.4210	Tukey	0.8414
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	-1.8767	17.4960	16	-0.11	0.9159	Tukey	0.9995
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	12.5750	17.4960	16	0.72	0.4827	Tukey	0.8882

May No Burn Sedge Dominated Islands Resin Capsule Nitrate (Table 2)

Program:

```
title 'May Resin Capsule Nitrate Sedge Dom';

proc mixed data=resin;
        class island canopy ash;
        model rNO3=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	15	0.13	0.7204
ash	1	15	0.02	0.8779
canopy*ash	1	15	0.33	0.5751
island	1	15	6.17	0.0253
island*canopy	1	15	0.01	0.9049
island*ash	1	15	1.61	0.2242
island*canopy*ash	1	15	1.61	0.2242

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		0.3458	0.03292	15	10.51	<.0001
canopy	NoCanopy		0.3633	0.03492	15	10.41	<.0001
ash		Ash	0.3583	0.03492	15	10.26	<.0001
ash		NoAsh	0.3508	0.03292	15	10.66	<.0001
canopy*ash	Canopy	Ash	0.3633	0.04656	15	7.80	<.0001
canopy*ash	Canopy	NoAsh	0.3283	0.04656	15	7.05	<.0001
canopy*ash	NoCanopy	Ash	0.3533	0.05205	15	6.79	<.0001
canopy*ash	NoCanopy	NoAsh	0.3733	0.04656	15	8.02	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		-0.01750	0.04799	15	-0.36	0.7204	Tukey-Kramer	0.7204
ash		Ash		NoAsh	0.007500	0.04799	15	0.16	0.8779	Tukey-Kramer	0.8779
canopy*ash	Canopy	Ash	Canopy	NoAsh	0.03500	0.06584	15	0.53	0.6028	Tukey-Kramer	0.9500
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.01000	0.06983	15	0.14	0.8880	Tukey-Kramer	0.9989
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	-0.01000	0.06584	15	-0.15	0.8813	Tukey-Kramer	0.9987
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	-0.02500	0.06983	15	-0.36	0.7253	Tukey-Kramer	0.9837
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	-0.04500	0.06584	15	-0.68	0.5047	Tukey-Kramer	0.9018
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-0.02000	0.06983	15	-0.29	0.7785	Tukey-Kramer	0.9915

May No Burn Sedge Dominated Islands Resin Capsule Ammonium (Table 2)

Program:

```
title 'May Resin Capsule Ammonium Sedge Dom';

proc mixed data=resin;
        class island canopy ash;
        model rNH4=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	15	0.04	0.8512
ash	1	15	0.40	0.5378
canopy*ash	1	15	0.30	0.5924
island	1	15	1.01	0.3309
island*canopy	1	15	0.13	0.7200
island*ash	1	15	0.65	0.4314
island*canopy*ash	1	15	0.90	0.3570

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		1.3100	0.1573	15	8.33	<.0001
canopy	NoCanopy		1.3537	0.1668	15	8.11	<.0001
ash		Ash	1.2596	0.1668	15	7.55	<.0001
ash		NoAsh	1.4042	0.1573	15	8.93	<.0001
canopy*ash	Canopy	Ash	1.1750	0.2224	15	5.28	<.0001
canopy*ash	Canopy	NoAsh	1.4450	0.2224	15	6.50	<.0001
canopy*ash	NoCanopy	Ash	1.3442	0.2487	15	5.40	<.0001
canopy*ash	NoCanopy	NoAsh	1.3633	0.2224	15	6.13	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		-0.04375	0.2293	15	-0.19	0.8512	Tukey-Kramer	0.8512
ash		Ash		NoAsh	-0.1446	0.2293	15	-0.63	0.5378	Tukey-Kramer	0.5378
canopy*ash	Canopy	Ash	Canopy	NoAsh	-0.2700	0.3146	15	-0.86	0.4043	Tukey-Kramer	0.8259
canopy*ash	Canopy	Ash	NoCanopy	Ash	-0.1692	0.3337	15	-0.51	0.6195	Tukey-Kramer	0.9562
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	-0.1883	0.3146	15	-0.60	0.5583	Tukey-Kramer	0.9309
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0.1008	0.3337	15	0.30	0.7667	Tukey-Kramer	0.9900
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	0.08167	0.3146	15	0.26	0.7987	Tukey-Kramer	0.9936
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-0.01917	0.3337	15	-0.06	0.9550	Tukey-Kramer	0.9999

May No Burn Sedge Dominated Islands Resin Capsule Phopshorus (Table 2)

Program:

```
title 'May Resin Capsule Phosphorus Sedge Dom';

proc mixed data=resin;
        class island canopy ash;
        model rP=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	15	0.62	0.4443
ash	1	15	0.29	0.5988
canopy*ash	1	15	0.08	0.7762
island	1	15	2.87	0.1106
island*canopy	1	15	0.00	0.9676
island*ash	1	15	1.44	0.2490
island*canopy*ash	1	15	0.02	0.9029

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		0.08583	0.01382	15	6.21	<.0001
canopy	NoCanopy		0.1017	0.01466	15	6.93	<.0001
ash		Ash	0.08833	0.01466	15	6.02	<.0001
ash		NoAsh	0.09917	0.01382	15	7.17	<.0001
canopy*ash	Canopy	Ash	0.08333	0.01955	15	4.26	0.0007
canopy*ash	Canopy	NoAsh	0.08833	0.01955	15	4.52	0.0004
canopy*ash	NoCanopy	Ash	0.09333	0.02186	15	4.27	0.0007
canopy*ash	NoCanopy	NoAsh	0.1100	0.01955	15	5.63	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		-0.01583	0.02015	15	-0.79	0.4443	Tukey-Kramer	0.4443
ash		Ash		NoAsh	-0.01083	0.02015	15	-0.54	0.5988	Tukey-Kramer	0.5988
canopy*ash	Canopy	Ash	Canopy	NoAsh	-0.00500	0.02765	15	-0.18	0.8589	Tukey-Kramer	0.9978
canopy*ash	Canopy	Ash	NoCanopy	Ash	-0.01000	0.02933	15	-0.34	0.7378	Tukey-Kramer	0.9858
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	-0.02667	0.02765	15	-0.96	0.3501	Tukey-Kramer	0.7711
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	-0.00500	0.02933	15	-0.17	0.8669	Tukey-Kramer	0.9982
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	-0.02167	0.02765	15	-0.78	0.4454	Tukey-Kramer	0.8607
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-0.01667	0.02933	15	-0.57	0.5782	Tukey-Kramer	0.9400

May No Burn Sedge Dominated Islands Resin Capsule Potassium (Table 2)

Program:

```
title 'May Resin Capsule Potassium Sedge Dom';

proc mixed data=resin;
        class island canopy ash;
        model rK=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	15	0.05	0.8307
ash	1	15	0.31	0.5832
canopy*ash	1	15	0.75	0.4002
island	1	15	5.89	0.0283
island*canopy	1	15	0.15	0.7013
island*ash	1	15	0.08	0.7792
island*canopy*ash	1	15	1.40	0.2555

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		11.4875	1.1206	15	10.25	<.0001
canopy	NoCanopy		11.1321	1.1886	15	9.37	<.0001
ash		Ash	11.7679	1.1886	15	9.90	<.0001
ash		NoAsh	10.8517	1.1206	15	9.68	<.0001
canopy*ash	Canopy	Ash	11.2383	1.5848	15	7.09	<.0001
canopy*ash	Canopy	NoAsh	11.7367	1.5848	15	7.41	<.0001
canopy*ash	NoCanopy	Ash	12.2975	1.7719	15	6.94	<.0001
canopy*ash	NoCanopy	NoAsh	9.9667	1.5848	15	6.29	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		0.3554	1.6336	15	0.22	0.8307	Tukey-Kramer	0.8307
ash		Ash		NoAsh	0.9163	1.6336	15	0.56	0.5832	Tukey-Kramer	0.5832
canopy*ash	Canopy	Ash	Canopy	NoAsh	-0.4983	2.2413	15	-0.22	0.8270	Tukey-Kramer	0.9959
canopy*ash	Canopy	Ash	NoCanopy	Ash	-1.0592	2.3772	15	-0.45	0.6623	Tukey-Kramer	0.9695
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	1.2717	2.2413	15	0.57	0.5788	Tukey-Kramer	0.9402
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	-0.5608	2.3772	15	-0.24	0.8167	Tukey-Kramer	0.9952
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	1.7700	2.2413	15	0.79	0.4420	Tukey-Kramer	0.8580
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	2.3308	2.3772	15	0.98	0.3424	Tukey-Kramer	0.7624

May No Burn Sedge Dominated Islands Resin Capsule Calcium (Table 2)

Program:

```
title 'May Resin Capsule Calcium Sedge Dom';

proc mixed data=resin;
        class island canopy ash;
        model rCa=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	15	1.32	0.2694
ash	1	15	0.05	0.8330
canopy*ash	1	15	0.15	0.7068
island	1	15	9.28	0.0082
island*canopy	1	15	0.44	0.5178
island*ash	1	15	0.01	0.9331
island*canopy*ash	1	15	1.26	0.2802

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		33.7217	5.2665	15	6.40	<.0001
canopy	NoCanopy		24.9179	5.5859	15	4.46	0.0005
ash		Ash	28.4963	5.5859	15	5.10	0.0001
ash		NoAsh	30.1433	5.2665	15	5.72	<.0001
canopy*ash	Canopy	Ash	31.4267	7.4479	15	4.22	0.0007
canopy*ash	Canopy	NoAsh	36.0167	7.4479	15	4.84	0.0002
canopy*ash	NoCanopy	Ash	25.5658	8.3270	15	3.07	0.0078
canopy*ash	NoCanopy	NoAsh	24.2700	7.4479	15	3.26	0.0053

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		8.8037	7.6771	15	1.15	0.2694	Tukey-Kramer	0.2694
ash		Ash		NoAsh	-1.6471	7.6771	15	-0.21	0.8330	Tukey-Kramer	0.8330
canopy*ash	Canopy	Ash	Canopy	NoAsh	-4.5900	10.5330	15	-0.44	0.6692	Tukey-Kramer	0.9713
canopy*ash	Canopy	Ash	NoCanopy	Ash	5.8608	11.1719	15	0.52	0.6075	Tukey-Kramer	0.9518
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	7.1567	10.5330	15	0.68	0.5072	Tukey-Kramer	0.9033
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	10.4508	11.1719	15	0.94	0.3644	Tukey-Kramer	0.7866
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	11.7467	10.5330	15	1.12	0.2823	Tukey-Kramer	0.6861
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	1.2958	11.1719	15	0.12	0.9092	Tukey-Kramer	0.9994

May No Burn Sedge Dominated Islands Resin Capsule Magnesium (Table 2)

Program:

```
title 'May Resin Capsule Magnesium Sedge Dom';

proc mixed data=resin;
        class island canopy ash;
        model rMg=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	15	0.84	0.3726
ash	1	15	0.09	0.7644
canopy*ash	1	15	0.16	0.6935
island	1	15	9.17	0.0085
island*canopy	1	15	0.18	0.6758
island*ash	1	15	0.01	0.9200
island*canopy*ash	1	15	1.35	0.2628

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		76.1533	11.9401	15	6.38	<.0001
canopy	NoCanopy		60.1579	12.6644	15	4.75	0.0003
ash		Ash	65.4996	12.6644	15	5.17	0.0001
ash		NoAsh	70.8117	11.9401	15	5.93	<.0001
canopy*ash	Canopy	Ash	70.0000	16.8858	15	4.15	0.0009
canopy*ash	Canopy	NoAsh	82.3067	16.8858	15	4.87	0.0002
canopy*ash	NoCanopy	Ash	60.9992	18.8789	15	3.23	0.0056
canopy*ash	NoCanopy	NoAsh	59.3167	16.8858	15	3.51	0.0031

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		15.9954	17.4055	15	0.92	0.3726	Tukey-Kramer	0.3726
ash		Ash		NoAsh	-5.3121	17.4055	15	-0.31	0.7644	Tukey-Kramer	0.7644
canopy*ash	Canopy	Ash	Canopy	NoAsh	-12.3067	23.8802	15	-0.52	0.6138	Tukey-Kramer	0.9541
canopy*ash	Canopy	Ash	NoCanopy	Ash	9.0008	25.3287	15	0.36	0.7273	Tukey-Kramer	0.9840
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	10.6833	23.8802	15	0.45	0.6610	Tukey-Kramer	0.9691
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	21.3075	25.3287	15	0.84	0.4134	Tukey-Kramer	0.8341
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	22.9900	23.8802	15	0.96	0.3510	Tukey-Kramer	0.7721
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	1.6825	25.3287	15	0.07	0.9479	Tukey-Kramer	0.9999

May No Burn Sedge Dominated Islands Resin Capsule Sulfur (Table 2)

Program:

```
title 'May Resin Capsule Sulfur Sedge Dom';

proc mixed data=resin;
        class island canopy ash;
        model rS=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	0.20	0.6590
ash	1	16	2.62	0.1253
canopy*ash	1	16	0.36	0.5561
island	1	16	6.01	0.0261
island*canopy	1	16	0.14	0.7172
island*ash	1	16	0.75	0.4000
island*canopy*ash	1	16	0.00	0.9801

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		98.4283	8.7480	16	11.25	<.0001
canopy	NoCanopy		92.8658	8.7480	16	10.62	<.0001
ash		Ash	105.65	8.7480	16	12.08	<.0001
ash		NoAsh	85.6400	8.7480	16	9.79	<.0001
canopy*ash	Canopy	Ash	112.16	12.3715	16	9.07	<.0001
canopy*ash	Canopy	NoAsh	84.7017	12.3715	16	6.85	<.0001
canopy*ash	NoCanopy	Ash	99.1533	12.3715	16	8.01	<.0001
canopy*ash	NoCanopy	NoAsh	86.5783	12.3715	16	7.00	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		5.5625	12.3715	16	0.45	0.6590	Tukey	0.6590
ash		Ash		NoAsh	20.0142	12.3715	16	1.62	0.1253	Tukey	0.1253
canopy*ash	Canopy	Ash	Canopy	NoAsh	27.4533	17.4960	16	1.57	0.1362	Tukey	0.4226
canopy*ash	Canopy	Ash	NoCanopy	Ash	13.0017	17.4960	16	0.74	0.4682	Tukey	0.8782
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	25.5767	17.4960	16	1.46	0.1631	Tukey	0.4817
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	-14.4517	17.4960	16	-0.83	0.4210	Tukey	0.8414
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	-1.8767	17.4960	16	-0.11	0.9159	Tukey	0.9995
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	12.5750	17.4960	16	0.72	0.4827	Tukey	0.8882

July No Burn Study Resin Capsule Nutrients

July No Burn Islands Resin Capsule Ammonium (Table 1)

Program:

```
title 'Resin Capsule Ammonium July';

proc mixed data=resin;
        class island canopy ash;
        model rNH4=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
canopy	1	32	0.52	0.4765
ash	1	32	0.01	0.9052
canopy*ash	1	32	0.10	0.7496
island	3	32	5.20	0.0049
island*canopy	3	32	1.65	0.1972
island*ash	3	32	0.73	0.5435
island*canopy*ash	3	32	1.07	0.3751

Least Squares Means							
Effect	canopy	ash	Estimate	Standard Error	DF	t Value	Pr > |t|
canopy	Canopy		1.0363	0.1080	32	9.60	<.0001
canopy	NoCanopy		0.9263	0.1080	32	8.58	<.0001
ash		Ash	0.9904	0.1080	32	9.17	<.0001
ash		NoAsh	0.9721	0.1080	32	9.00	<.0001
canopy*ash	Canopy	Ash	1.0700	0.1527	32	7.01	<.0001
canopy*ash	Canopy	NoAsh	1.0025	0.1527	32	6.56	<.0001
canopy*ash	NoCanopy	Ash	0.9108	0.1527	32	5.96	<.0001
canopy*ash	NoCanopy	NoAsh	0.9417	0.1527	32	6.17	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		0.1100	0.1527	32	0.72	0.4765	Tukey	0.4765
ash		Ash		NoAsh	0.01833	0.1527	32	0.12	0.9052	Tukey	0.9052
canopy*ash	Canopy	Ash	Canopy	NoAsh	0.06750	0.2160	32	0.31	0.7566	Tukey	0.9892
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.1592	0.2160	32	0.74	0.4665	Tukey	0.8814
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	0.1283	0.2160	32	0.59	0.5565	Tukey	0.9331
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0.09167	0.2160	32	0.42	0.6741	Tukey	0.9739
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	0.06083	0.2160	32	0.28	0.7800	Tukey	0.9920
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-0.03083	0.2160	32	-0.14	0.8874	Tukey	0.9989

July No Burn Islands Resin Capsule Nitrate (Table 1)

Program:

```
title 'Resin Capsule Nitrate July';

proc mixed data=resin;
        class island canopy ash;
        model rNO3=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	32	0.05	0.8323
ash	1	32	0.05	0.8323
canopy*ash	1	32	0.92	0.3439
island	3	32	1.30	0.2929
island*canopy	3	32	1.38	0.2681
island*ash	3	32	0.89	0.4574
island*canopy*ash	3	32	1.20	0.3240

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		0.09375	0.005520	32	16.98	<.0001
canopy	NoCanopy		0.09208	0.005520	32	16.68	<.0001
ash		Ash	0.09375	0.005520	32	16.98	<.0001
ash		NoAsh	0.09208	0.005520	32	16.68	<.0001
canopy*ash	Canopy	Ash	0.09833	0.007806	32	12.60	<.0001
canopy*ash	Canopy	NoAsh	0.08917	0.007806	32	11.42	<.0001
canopy*ash	NoCanopy	Ash	0.08917	0.007806	32	11.42	<.0001
canopy*ash	NoCanopy	NoAsh	0.09500	0.007806	32	12.17	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		0.001667	0.007806	32	0.21	0.8323	Tukey	0.8323
ash		Ash		NoAsh	0.001667	0.007806	32	0.21	0.8323	Tukey	0.8323
canopy*ash	Canopy	Ash	Canopy	NoAsh	0.009167	0.01104	32	0.83	0.4125	Tukey	0.8397
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.009167	0.01104	32	0.83	0.4125	Tukey	0.8397
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	0.003333	0.01104	32	0.30	0.7647	Tukey	0.9903
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	-416E-19	0.01104	32	-0.00	1.0000	Tukey	1.0000
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	-0.00583	0.01104	32	-0.53	0.6009	Tukey	0.9516
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-0.00583	0.01104	32	-0.53	0.6009	Tukey	0.9516

July No Burn Islands Resin Capsule Phosphorus (Table 1)

Program:

```
title 'Resin Capsule Phosphorus July';

proc mixed data=resin;
        class island canopy ash;
        model rP=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	32	0.00	0.9739
ash	1	32	0.03	0.8699
canopy*ash	1	32	0.03	0.8699
island	3	32	2.14	0.1140
island*canopy	3	32	0.59	0.6233
island*ash	3	32	1.03	0.3909
island*canopy*ash	3	32	0.30	0.8247

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		0.06542	0.008922	32	7.33	<.0001
canopy	NoCanopy		0.06583	0.008922	32	7.38	<.0001
ash		Ash	0.06667	0.008922	32	7.47	<.0001
ash		NoAsh	0.06458	0.008922	32	7.24	<.0001
canopy*ash	Canopy	Ash	0.06750	0.01262	32	5.35	<.0001
canopy*ash	Canopy	NoAsh	0.06333	0.01262	32	5.02	<.0001
canopy*ash	NoCanopy	Ash	0.06583	0.01262	32	5.22	<.0001
canopy*ash	NoCanopy	NoAsh	0.06583	0.01262	32	5.22	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		-0.00042	0.01262	32	-0.03	0.9739	Tukey	0.9739
ash		Ash		NoAsh	0.002083	0.01262	32	0.17	0.8699	Tukey	0.8699
canopy*ash	Canopy	Ash	Canopy	NoAsh	0.004167	0.01784	32	0.23	0.8169	Tukey	0.9954
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.001667	0.01784	32	0.09	0.9262	Tukey	0.9997
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	0.001667	0.01784	32	0.09	0.9262	Tukey	0.9997
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	-0.00250	0.01784	32	-0.14	0.8895	Tukey	0.9990
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	-0.00250	0.01784	32	-0.14	0.8895	Tukey	0.9990
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	1.44E-16	0.01784	32	0.00	1.0000	Tukey	1.0000

July No Burn Islands Resin Capsule Calcium (Table 2)

Program:

```
title 'Resin Capsule Calcium July';

proc mixed data=resin;
        class island canopy ash;
        model rCa=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	32	1.84	0.1850
ash	1	32	0.39	0.5371
canopy*ash	1	32	0.13	0.7172
island	3	32	17.80	<.0001
island*canopy	3	32	0.06	0.9790
island*ash	3	32	2.49	0.0778
island*canopy*ash	3	32	0.89	0.4553

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		64.2292	3.7275	32	17.23	<.0001
canopy	NoCanopy		71.3713	3.7275	32	19.15	<.0001
ash		Ash	66.1558	3.7275	32	17.75	<.0001
ash		NoAsh	69.4446	3.7275	32	18.63	<.0001
canopy*ash	Canopy	Ash	61.6217	5.2715	32	11.69	<.0001
canopy*ash	Canopy	NoAsh	66.8367	5.2715	32	12.68	<.0001
canopy*ash	NoCanopy	Ash	70.6900	5.2715	32	13.41	<.0001
canopy*ash	NoCanopy	NoAsh	72.0525	5.2715	32	13.67	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		-7.1421	5.2715	32	-1.35	0.1850	Tukey	0.1850
ash		Ash		NoAsh	-3.2888	5.2715	32	-0.62	0.5371	Tukey	0.5371
canopy*ash	Canopy	Ash	Canopy	NoAsh	-5.2150	7.4550	32	-0.70	0.4893	Tukey	0.8965
canopy*ash	Canopy	Ash	NoCanopy	Ash	-9.0683	7.4550	32	-1.22	0.2327	Tukey	0.6212
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	-10.4308	7.4550	32	-1.40	0.1714	Tukey	0.5090
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	-3.8533	7.4550	32	-0.52	0.6088	Tukey	0.9544
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	-5.2158	7.4550	32	-0.70	0.4892	Tukey	0.8964
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-1.3625	7.4550	32	-0.18	0.8561	Tukey	0.9978

July No Burn Islands Resin Capsule Magnesium (Table 1)

Program:

```
title 'Resin Capsule Magnesium July';

proc mixed data=resin;
        class island canopy ash;
        model rMg=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	32	3.43	0.0732
ash	1	32	0.01	0.9325
canopy*ash	1	32	0.10	0.7575
island	3	32	12.89	<.0001
island*canopy	3	32	0.12	0.9502
island*ash	3	32	0.07	0.9735
island*canopy*ash	3	32	0.84	0.4800

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		133.07	4.1750	32	31.87	<.0001
canopy	NoCanopy		144.00	4.1750	32	34.49	<.0001
ash		Ash	138.79	4.1750	32	33.24	<.0001
ash		NoAsh	138.28	4.1750	32	33.12	<.0001
canopy*ash	Canopy	Ash	132.40	5.9043	32	22.42	<.0001
canopy*ash	Canopy	NoAsh	133.73	5.9043	32	22.65	<.0001
canopy*ash	NoCanopy	Ash	145.17	5.9043	32	24.59	<.0001
canopy*ash	NoCanopy	NoAsh	142.83	5.9043	32	24.19	<.0001

Differences of Least Squares Means												
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		-10.9358	5.9043	32	-1.85	0.0732	Tukey	0.0732
ash		Ash		NoAsh	0.5042	5.9043	32	0.09	0.9325	Tukey	0.9325
canopy*ash	Canopy	Ash	Canopy	NoAsh	-1.3342	8.3499	32	-0.16	0.8741	Tukey	0.9985
canopy*ash	Canopy	Ash	NoCanopy	Ash	-12.7742	8.3499	32	-1.53	0.1359	Tukey	0.4321
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	-10.4317	8.3499	32	-1.25	0.2206	Tukey	0.6009
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	-11.4400	8.3499	32	-1.37	0.1802	Tukey	0.5267
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	-9.0975	8.3499	32	-1.09	0.2841	Tukey	0.6983
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	2.3425	8.3499	32	0.28	0.7809	Tukey	0.9921

July No Burn Islands Resin Capsule Potassium (Table 1)

Program:

```
title 'Resin Capsule Potassium July';

proc mixed data=resin;
        class island canopy ash;
        model rK=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	32	3.45	0.0724
ash	1	32	1.20	0.2810
canopy*ash	1	32	0.35	0.5567
island	3	32	1.75	0.1771
island*canopy	3	32	1.52	0.2282
island*ash	3	32	0.75	0.5319
island*canopy*ash	3	32	0.78	0.5135

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		15.4192	0.4057	32	38.01	<.0001
canopy	NoCanopy		14.3533	0.4057	32	35.38	<.0001
ash		Ash	15.2008	0.4057	32	37.47	<.0001
ash		NoAsh	14.5717	0.4057	32	35.92	<.0001
canopy*ash	Canopy	Ash	15.5633	0.5737	32	27.13	<.0001
canopy*ash	Canopy	NoAsh	15.2750	0.5737	32	26.62	<.0001
canopy*ash	NoCanopy	Ash	14.8383	0.5737	32	25.86	<.0001
canopy*ash	NoCanopy	NoAsh	13.8683	0.5737	32	24.17	<.0001

Differences of Least Squares Means												
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		1.0658	0.5737	32	1.86	0.0724	Tukey	0.0724
ash		Ash		NoAsh	0.6292	0.5737	32	1.10	0.2810	Tukey	0.2810
canopy*ash	Canopy	Ash	Canopy	NoAsh	0.2883	0.8114	32	0.36	0.7247	Tukey	0.9843
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.7250	0.8114	32	0.89	0.3782	Tukey	0.8082
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	1.6950	0.8114	32	2.09	0.0447	Tukey	0.1784
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0.4367	0.8114	32	0.54	0.5942	Tukey	0.9490
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	1.4067	0.8114	32	1.73	0.0926	Tukey	0.3236
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	0.9700	0.8114	32	1.20	0.2407	Tukey	0.6341

July No Burn Islands Resin Capsule Sulfur (Table 1)

Program:

```
title 'Resin Capsule Sulfur July';

proc mixed data=resin;
        class island canopy ash;
        model rS=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	32	0.19	0.6635
ash	1	32	0.29	0.5916
canopy*ash	1	32	0.40	0.5291
island	3	32	2.70	0.0624
island*canopy	3	32	0.63	0.6023
island*ash	3	32	0.76	0.5248
island*canopy*ash	3	32	3.09	0.0410

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		42.0567	2.5076	32	16.77	<.0001
canopy	NoCanopy		43.6142	2.5076	32	17.39	<.0001
ash		Ash	41.8746	2.5076	32	16.70	<.0001
ash		NoAsh	43.7962	2.5076	32	17.47	<.0001
canopy*ash	Canopy	Ash	39.9675	3.5462	32	11.27	<.0001
canopy*ash	Canopy	NoAsh	44.1458	3.5462	32	12.45	<.0001
canopy*ash	NoCanopy	Ash	43.7817	3.5462	32	12.35	<.0001
canopy*ash	NoCanopy	NoAsh	43.4467	3.5462	32	12.25	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		-1.5575	3.5462	32	-0.44	0.6635	Tukey	0.6635
ash		Ash		NoAsh	-1.9217	3.5462	32	-0.54	0.5916	Tukey	0.5916
canopy*ash	Canopy	Ash	Canopy	NoAsh	-4.1783	5.0151	32	-0.83	0.4109	Tukey	0.8383
canopy*ash	Canopy	Ash	NoCanopy	Ash	-3.8142	5.0151	32	-0.76	0.4525	Tukey	0.8715
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	-3.4792	5.0151	32	-0.69	0.4929	Tukey	0.8987
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0.3642	5.0151	32	0.07	0.9426	Tukey	0.9999
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	0.6992	5.0151	32	0.14	0.8900	Tukey	0.9990
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	0.3350	5.0151	32	0.07	0.9472	Tukey	0.9999

July No Burn Grass Dominated Islands Resin Capsule Nitrate (Table 3)

Program:

```
title 'July Resin Capsule Nitrate Grass Dom';

proc mixed data=resin;
        class island canopy ash;
        model rNO3=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	0.13	0.7194
ash	1	16	0.13	0.7194
canopy*ash	1	16	0.43	0.5198
island	1	16	0.26	0.6157
island*canopy	1	16	0.43	0.5198
island*ash	1	16	0.05	0.8291
island*canopy*ash	1	16	3.34	0.0862

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		0.09417	0.008058	16	11.69	<.0001
canopy	NoCanopy		0.09000	0.008058	16	11.17	<.0001
ash		Ash	0.09417	0.008058	16	11.69	<.0001
ash		NoAsh	0.09000	0.008058	16	11.17	<.0001
canopy*ash	Canopy	Ash	0.1000	0.01140	16	8.78	<.0001
canopy*ash	Canopy	NoAsh	0.08833	0.01140	16	7.75	<.0001
canopy*ash	NoCanopy	Ash	0.08833	0.01140	16	7.75	<.0001
canopy*ash	NoCanopy	NoAsh	0.09167	0.01140	16	8.04	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		0.004167	0.01140	16	0.37	0.7194	Tukey	0.7194
ash		Ash		NoAsh	0.004167	0.01140	16	0.37	0.7194	Tukey	0.7194
canopy*ash	Canopy	Ash	Canopy	NoAsh	0.01167	0.01612	16	0.72	0.4796	Tukey	0.8861
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.01167	0.01612	16	0.72	0.4796	Tukey	0.8861
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	0.008333	0.01612	16	0.52	0.6122	Tukey	0.9538
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	-694E-20	0.01612	16	-0.00	1.0000	Tukey	1.0000
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	-0.00333	0.01612	16	-0.21	0.8387	Tukey	0.9967
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-0.00333	0.01612	16	-0.21	0.8387	Tukey	0.9967

July No Burn Grass Dominated Islands Resin Capsule Ammonium (Table 3)

Program:

```
title 'July Resin Capsule Ammonium Grass Dom';

proc mixed data=resin;
        class island canopy ash;
        model rNH4=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	1.83	0.1954
ash	1	16	0.54	0.4717
canopy*ash	1	16	0.02	0.8925
island	1	16	3.19	0.0933
island*canopy	1	16	1.08	0.3135
island*ash	1	16	1.01	0.3301
island*canopy*ash	1	16	0.33	0.5712

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		0.9292	0.1631	16	5.70	<.0001
canopy	NoCanopy		0.6175	0.1631	16	3.79	0.0016
ash		Ash	0.8583	0.1631	16	5.26	<.0001
ash		NoAsh	0.6883	0.1631	16	4.22	0.0006
canopy*ash	Canopy	Ash	0.9983	0.2306	16	4.33	0.0005
canopy*ash	Canopy	NoAsh	0.8600	0.2306	16	3.73	0.0018
canopy*ash	NoCanopy	Ash	0.7183	0.2306	16	3.11	0.0067
canopy*ash	NoCanopy	NoAsh	0.5167	0.2306	16	2.24	0.0396

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		0.3117	0.2306	16	1.35	0.1954	Tukey	0.1954
ash		Ash		NoAsh	0.1700	0.2306	16	0.74	0.4717	Tukey	0.4717
canopy*ash	Canopy	Ash	Canopy	NoAsh	0.1383	0.3262	16	0.42	0.6771	Tukey	0.9735
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.2800	0.3262	16	0.86	0.4033	Tukey	0.8258
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	0.4817	0.3262	16	1.48	0.1592	Tukey	0.4733
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0.1417	0.3262	16	0.43	0.6699	Tukey	0.9717
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	0.3433	0.3262	16	1.05	0.3082	Tukey	0.7220
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	0.2017	0.3262	16	0.62	0.5451	Tukey	0.9247

July No Burn Grass Dominated Islands Resin Capsule Phopshorus (Table 3)

Program:

```
title 'July Resin Capsule Phosphorus Grass Dom';

proc mixed data=resin;
        class island canopy ash;
        model rP=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	0.73	0.4053
ash	1	16	0.48	0.4974
canopy*ash	1	16	0.09	0.7672
island	1	16	16.14	0.0010
island*canopy	1	16	0.03	0.8543
island*ash	1	16	3.63	0.0748
island*canopy*ash	1	16	1.22	0.2852

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		75.6625	7.2864	16	10.38	<.0001
canopy	NoCanopy		84.4708	7.2864	16	11.59	<.0001
ash		Ash	76.4892	7.2864	16	10.50	<.0001
ash		NoAsh	83.6442	7.2864	16	11.48	<.0001
canopy*ash	Canopy	Ash	70.5333	10.3045	16	6.84	<.0001
canopy*ash	Canopy	NoAsh	80.7917	10.3045	16	7.84	<.0001
canopy*ash	NoCanopy	Ash	82.4450	10.3045	16	8.00	<.0001
canopy*ash	NoCanopy	NoAsh	86.4967	10.3045	16	8.39	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		-8.8083	10.3045	16	-0.85	0.4053	Tukey	0.4053
ash		Ash		NoAsh	-7.1550	10.3045	16	-0.69	0.4974	Tukey	0.4974
canopy*ash	Canopy	Ash	Canopy	NoAsh	-10.2583	14.5728	16	-0.70	0.4916	Tukey	0.8940
canopy*ash	Canopy	Ash	NoCanopy	Ash	-11.9117	14.5728	16	-0.82	0.4257	Tukey	0.8454
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	-15.9633	14.5728	16	-1.10	0.2895	Tukey	0.6973
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	-1.6533	14.5728	16	-0.11	0.9111	Tukey	0.9995
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	-5.7050	14.5728	16	-0.39	0.7006	Tukey	0.9789
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-4.0517	14.5728	16	-0.28	0.7846	Tukey	0.9922

July No Burn Grass Dominated Islands Resin Capsule Potassium (Table 3)

Program:

```
title 'July Resin Capsule Potassium Grass Dom';

proc mixed data=resin;
        class island canopy ash;
        model rK=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	3.64	0.0747
ash	1	16	2.19	0.1579
canopy*ash	1	16	1.51	0.2376
island	1	16	2.41	0.1404
island*canopy	1	16	0.95	0.3436
island*ash	1	16	0.24	0.6274
island*canopy*ash	1	16	0.00	0.9590

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		15.6150	0.6762	16	23.09	<.0001
canopy	NoCanopy		13.7917	0.6762	16	20.40	<.0001
ash		Ash	15.4117	0.6762	16	22.79	<.0001
ash		NoAsh	13.9950	0.6762	16	20.70	<.0001
canopy*ash	Canopy	Ash	15.7367	0.9563	16	16.46	<.0001
canopy*ash	Canopy	NoAsh	15.4933	0.9563	16	16.20	<.0001
canopy*ash	NoCanopy	Ash	15.0867	0.9563	16	15.78	<.0001
canopy*ash	NoCanopy	NoAsh	12.4967	0.9563	16	13.07	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		1.8233	0.9563	16	1.91	0.0747	Tukey	0.0747
ash		Ash		NoAsh	1.4167	0.9563	16	1.48	0.1579	Tukey	0.1579
canopy*ash	Canopy	Ash	Canopy	NoAsh	0.2433	1.3525	16	0.18	0.8595	Tukey	0.9978
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.6500	1.3525	16	0.48	0.6373	Tukey	0.9623
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	3.2400	1.3525	16	2.40	0.0292	Tukey	0.1181
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0.4067	1.3525	16	0.30	0.7675	Tukey	0.9902
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	2.9967	1.3525	16	2.22	0.0416	Tukey	0.1611
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	2.5900	1.3525	16	1.92	0.0735	Tukey	0.2608

July No Burn Grass Dominated Islands Resin Capsule Calcium (Table 3)

Program:

```
title 'July Resin Capsule Calcium Grass Dom';

proc mixed data=resin;
        class island canopy ash;
        model rCa=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	0.75	0.3985
ash	1	16	0.07	0.8019
canopy*ash	1	16	0.13	0.7256
island	1	16	2.50	0.1332
island*canopy	1	16	0.02	0.8802
island*ash	1	16	1.63	0.2202
island*canopy*ash	1	16	0.44	0.5165

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		0.06583	0.01155	16	5.70	<.0001
canopy	NoCanopy		0.05167	0.01155	16	4.47	0.0004
ash		Ash	0.06083	0.01155	16	5.27	<.0001
ash		NoAsh	0.05667	0.01155	16	4.91	0.0002
canopy*ash	Canopy	Ash	0.06500	0.01633	16	3.98	0.0011
canopy*ash	Canopy	NoAsh	0.06667	0.01633	16	4.08	0.0009
canopy*ash	NoCanopy	Ash	0.05667	0.01633	16	3.47	0.0032
canopy*ash	NoCanopy	NoAsh	0.04667	0.01633	16	2.86	0.0114

Differences of Least Squares Means												
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		0.01417	0.01633	16	0.87	0.3985	Tukey	0.3985
ash		Ash		NoAsh	0.004167	0.01633	16	0.26	0.8019	Tukey	0.8019
canopy*ash	Canopy	Ash	Canopy	NoAsh	-0.00167	0.02309	16	-0.07	0.9434	Tukey	0.9999
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.008333	0.02309	16	0.36	0.7229	Tukey	0.9833
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	0.01833	0.02309	16	0.79	0.4389	Tukey	0.8562
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0.01000	0.02309	16	0.43	0.6708	Tukey	0.9719
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	0.02000	0.02309	16	0.87	0.3993	Tukey	0.8221
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	0.01000	0.02309	16	0.43	0.6708	Tukey	0.9719

July No Burn Grass Dominated Islands Resin Capsule Magnesium (Table 4)

Program:

```
title 'July Resin Capsule Magnesium Grass Dom';

proc mixed data=resin;
        class island canopy ash;
        model rMg=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	1.07	0.3166
ash	1	16	0.00	0.9756
canopy*ash	1	16	0.17	0.6814
island	1	16	15.59	0.0011
island*canopy	1	16	0.10	0.7520
island*ash	1	16	0.14	0.7166
island*canopy*ash	1	16	0.56	0.4671

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		141.68	7.5067	16	18.87	<.0001
canopy	NoCanopy		152.66	7.5067	16	20.34	<.0001
ash		Ash	147.34	7.5067	16	19.63	<.0001
ash		NoAsh	147.01	7.5067	16	19.58	<.0001
canopy*ash	Canopy	Ash	139.63	10.6161	16	13.15	<.0001
canopy*ash	Canopy	NoAsh	143.74	10.6161	16	13.54	<.0001
canopy*ash	NoCanopy	Ash	155.04	10.6161	16	14.60	<.0001
canopy*ash	NoCanopy	NoAsh	150.27	10.6161	16	14.16	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		-10.9742	10.6161	16	-1.03	0.3166	Tukey	0.3166
ash		Ash		NoAsh	0.3292	10.6161	16	0.03	0.9756	Tukey	0.9756
canopy*ash	Canopy	Ash	Canopy	NoAsh	-4.1100	15.0134	16	-0.27	0.7878	Tukey	0.9925
canopy*ash	Canopy	Ash	NoCanopy	Ash	-15.4133	15.0134	16	-1.03	0.3199	Tukey	0.7367
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	-10.6450	15.0134	16	-0.71	0.4885	Tukey	0.8921
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	-11.3033	15.0134	16	-0.75	0.4625	Tukey	0.8741
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	-6.5350	15.0134	16	-0.44	0.6692	Tukey	0.9715
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	4.7683	15.0134	16	0.32	0.7549	Tukey	0.9885

July No Burn Grass Dominated Islands Resin Capsule Sulfur (Table 4)

Program:

```
title 'July Resin Capsule Sulfur Grass Dom';

proc mixed data=resin;
        class island canopy ash;
        model rS=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	0.29	0.5999
ash	1	16	0.93	0.3500
canopy*ash	1	16	1.10	0.3095
island	1	16	1.36	0.2606
island*canopy	1	16	0.14	0.7101
island*ash	1	16	0.09	0.7713
island*canopy*ash	1	16	6.24	0.0237

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		48.5383	4.0455	16	12.00	<.0001
canopy	NoCanopy		45.4767	4.0455	16	11.24	<.0001
ash		Ash	44.2533	4.0455	16	10.94	<.0001
ash		NoAsh	49.7617	4.0455	16	12.30	<.0001
canopy*ash	Canopy	Ash	42.7817	5.7211	16	7.48	<.0001
canopy*ash	Canopy	NoAsh	54.2950	5.7211	16	9.49	<.0001
canopy*ash	NoCanopy	Ash	45.7250	5.7211	16	7.99	<.0001
canopy*ash	NoCanopy	NoAsh	45.2283	5.7211	16	7.91	<.0001

Differences of Least Squares Means												
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		3.0617	5.7211	16	0.54	0.5999	Tukey	0.5999
ash		Ash		NoAsh	-5.5083	5.7211	16	-0.96	0.3500	Tukey	0.3500
canopy*ash	Canopy	Ash	Canopy	NoAsh	-11.5133	8.0909	16	-1.42	0.1739	Tukey	0.5039
canopy*ash	Canopy	Ash	NoCanopy	Ash	-2.9433	8.0909	16	-0.36	0.7208	Tukey	0.9829
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	-2.4467	8.0909	16	-0.30	0.7662	Tukey	0.9900
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	8.5700	8.0909	16	1.06	0.3052	Tukey	0.7182
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	9.0667	8.0909	16	1.12	0.2790	Tukey	0.6826
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	0.4967	8.0909	16	0.06	0.9518	Tukey	0.9999

July No Burn Sedge Dominated Islands Resin Capsule Nitrate (Table 3)

Program:

```
title 'July Resin Capsule Nitrate Sedge Dom';

proc mixed data=resin;
        class island canopy ash;
        model rNO3=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	0.01	0.9387
ash	1	16	0.01	0.9387
canopy*ash	1	16	0.49	0.4923
island	1	16	3.81	0.0686
island*canopy	1	16	3.81	0.0686
island*ash	1	16	2.69	0.1206
island*canopy*ash	1	16	0.05	0.8178

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		0.09333	0.007546	16	12.37	<.0001
canopy	NoCanopy		0.09417	0.007546	16	12.48	<.0001
ash		Ash	0.09333	0.007546	16	12.37	<.0001
ash		NoAsh	0.09417	0.007546	16	12.48	<.0001
canopy*ash	Canopy	Ash	0.09667	0.01067	16	9.06	<.0001
canopy*ash	Canopy	NoAsh	0.09000	0.01067	16	8.43	<.0001
canopy*ash	NoCanopy	Ash	0.09000	0.01067	16	8.43	<.0001
canopy*ash	NoCanopy	NoAsh	0.09833	0.01067	16	9.21	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		-0.00083	0.01067	16	-0.08	0.9387	Tukey	0.9387
ash		Ash		NoAsh	-0.00083	0.01067	16	-0.08	0.9387	Tukey	0.9387
canopy*ash	Canopy	Ash	Canopy	NoAsh	0.006667	0.01509	16	0.44	0.6646	Tukey	0.9703
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.006667	0.01509	16	0.44	0.6646	Tukey	0.9703
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	-0.00167	0.01509	16	-0.11	0.9134	Tukey	0.9995
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0	0.01509	16	0.00	1.0000	Tukey	1.0000
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	-0.00833	0.01509	16	-0.55	0.5885	Tukey	0.9446
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-0.00833	0.01509	16	-0.55	0.5885	Tukey	0.9446

July No Burn Sedge Dominated Islands Resin Capsule Ammonium (Table 3)

Program:

```
title 'July Resin Capsule Ammonium Sedge Dom';

proc mixed data=resin;
        class island canopy ash;
        model rNH4=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	0.21	0.6532
ash	1	16	0.44	0.5149
canopy*ash	1	16	0.42	0.5253
island	1	16	5.28	0.0354
island*canopy	1	16	2.30	0.1492
island*ash	1	16	0.05	0.8250
island*canopy*ash	1	16	2.97	0.1041

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		1.1433	0.1416	16	8.08	<.0001
canopy	NoCanopy		1.2350	0.1416	16	8.72	<.0001
ash		Ash	1.1225	0.1416	16	7.93	<.0001
ash		NoAsh	1.2558	0.1416	16	8.87	<.0001
canopy*ash	Canopy	Ash	1.1417	0.2002	16	5.70	<.0001
canopy*ash	Canopy	NoAsh	1.1450	0.2002	16	5.72	<.0001
canopy*ash	NoCanopy	Ash	1.1033	0.2002	16	5.51	<.0001
canopy*ash	NoCanopy	NoAsh	1.3667	0.2002	16	6.83	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		-0.09167	0.2002	16	-0.46	0.6532	Tukey	0.6532
ash		Ash		NoAsh	-0.1333	0.2002	16	-0.67	0.5149	Tukey	0.5149
canopy*ash	Canopy	Ash	Canopy	NoAsh	-0.00333	0.2831	16	-0.01	0.9908	Tukey	1.0000
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.03833	0.2831	16	0.14	0.8940	Tukey	0.9991
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	-0.2250	0.2831	16	-0.79	0.4384	Tukey	0.8558
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0.04167	0.2831	16	0.15	0.8848	Tukey	0.9988
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	-0.2217	0.2831	16	-0.78	0.4451	Tukey	0.8611
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-0.2633	0.2831	16	-0.93	0.3661	Tukey	0.7894

July No Burn Sedge Dominated Islands Resin Capsule Phopshorus (Table 3)

Program:

```
title 'July Resin Capsule Phosphorus Sedge Dom';

proc mixed data=resin;
        class island canopy ash;
        model rP=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	6.03	0.0258
ash	1	16	0.07	0.7989
canopy*ash	1	16	0.11	0.7412
island	1	16	10.12	0.0058
island*canopy	1	16	0.25	0.6240
island*ash	1	16	0.00	0.9833
island*canopy*ash	1	16	3.28	0.0891

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		52.7958	1.5763	16	33.49	<.0001
canopy	NoCanopy		58.2717	1.5763	16	36.97	<.0001
ash		Ash	55.8225	1.5763	16	35.41	<.0001
ash		NoAsh	55.2450	1.5763	16	35.05	<.0001
canopy*ash	Canopy	Ash	52.7100	2.2292	16	23.64	<.0001
canopy*ash	Canopy	NoAsh	52.8817	2.2292	16	23.72	<.0001
canopy*ash	NoCanopy	Ash	58.9350	2.2292	16	26.44	<.0001
canopy*ash	NoCanopy	NoAsh	57.6083	2.2292	16	25.84	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		-5.4758	2.2292	16	-2.46	0.0258	Tukey	0.0258
ash		Ash		NoAsh	0.5775	2.2292	16	0.26	0.7989	Tukey	0.7989
canopy*ash	Canopy	Ash	Canopy	NoAsh	-0.1717	3.1526	16	-0.05	0.9572	Tukey	0.9999
canopy*ash	Canopy	Ash	NoCanopy	Ash	-6.2250	3.1526	16	-1.97	0.0658	Tukey	0.2381
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	-4.8983	3.1526	16	-1.55	0.1398	Tukey	0.4308
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	-6.0533	3.1526	16	-1.92	0.0729	Tukey	0.2589
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	-4.7267	3.1526	16	-1.50	0.1533	Tukey	0.4607
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	1.3267	3.1526	16	0.42	0.6795	Tukey	0.9741

July No Burn Sedge Dominated Islands Resin Capsule Potassium (Table 3)

Program:

```
title 'July Resin Capsule Potassium Sedge Dom';

proc mixed data=resin;
        class island canopy ash;
        model rK=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	0.24	0.6334
ash	1	16	0.06	0.8060
canopy*ash	1	16	0.60	0.4495
island	1	16	2.45	0.1374
island*canopy	1	16	2.45	0.1374
island*ash	1	16	0.03	0.8665
island*canopy*ash	1	16	0.38	0.5455

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		15.2233	0.4484	16	33.95	<.0001
canopy	NoCanopy		14.9150	0.4484	16	33.26	<.0001
ash		Ash	14.9900	0.4484	16	33.43	<.0001
ash		NoAsh	15.1483	0.4484	16	33.78	<.0001
canopy*ash	Canopy	Ash	15.3900	0.6342	16	24.27	<.0001
canopy*ash	Canopy	NoAsh	15.0567	0.6342	16	23.74	<.0001
canopy*ash	NoCanopy	Ash	14.5900	0.6342	16	23.01	<.0001
canopy*ash	NoCanopy	NoAsh	15.2400	0.6342	16	24.03	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		0.3083	0.6342	16	0.49	0.6334	Tukey	0.6334
ash		Ash		NoAsh	-0.1583	0.6342	16	-0.25	0.8060	Tukey	0.8060
canopy*ash	Canopy	Ash	Canopy	NoAsh	0.3333	0.8968	16	0.37	0.7150	Tukey	0.9818
canopy*ash	Canopy	Ash	NoCanopy	Ash	0.8000	0.8968	16	0.89	0.3856	Tukey	0.8090
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	0.1500	0.8968	16	0.17	0.8693	Tukey	0.9983
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	0.4667	0.8968	16	0.52	0.6099	Tukey	0.9530
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	-0.1833	0.8968	16	-0.20	0.8406	Tukey	0.9968
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-0.6500	0.8968	16	-0.72	0.4791	Tukey	0.8858

July No Burn Sedge Dominated Islands Resin Capsule Calcium (Table 3)

Program:

```
title 'July Resin Capsule Calcium Sedge Dom';

proc mixed data=resin;
        class island canopy ash;
        model rCa=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	0.61	0.4470
ash	1	16	0.00	1.0000
canopy*ash	1	16	0.27	0.6103
island	1	16	2.71	0.1193
island*canopy	1	16	0.37	0.5528
island*ash	1	16	1.47	0.2428
island*canopy*ash	1	16	0.12	0.7335

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		0.06500	0.01360	16	4.78	0.0002
canopy	NoCanopy		0.08000	0.01360	16	5.88	<.0001
ash		Ash	0.07250	0.01360	16	5.33	<.0001
ash		NoAsh	0.07250	0.01360	16	5.33	<.0001
canopy*ash	Canopy	Ash	0.07000	0.01924	16	3.64	0.0022
canopy*ash	Canopy	NoAsh	0.06000	0.01924	16	3.12	0.0066
canopy*ash	NoCanopy	Ash	0.07500	0.01924	16	3.90	0.0013
canopy*ash	NoCanopy	NoAsh	0.08500	0.01924	16	4.42	0.0004

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		-0.01500	0.01924	16	-0.78	0.4470	Tukey	0.4470
ash		Ash		NoAsh	1.73E-18	0.01924	16	0.00	1.0000	Tukey	1.0000
canopy*ash	Canopy	Ash	Canopy	NoAsh	0.01000	0.02721	16	0.37	0.7180	Tukey	0.9824
canopy*ash	Canopy	Ash	NoCanopy	Ash	-0.00500	0.02721	16	-0.18	0.8565	Tukey	0.9977
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	-0.01500	0.02721	16	-0.55	0.5890	Tukey	0.9448
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	-0.01500	0.02721	16	-0.55	0.5890	Tukey	0.9448
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	-0.02500	0.02721	16	-0.92	0.3718	Tukey	0.7953
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-0.01000	0.02721	16	-0.37	0.7180	Tukey	0.9824

July No Burn Sedge Dominated Islands Resin Capsule Magnesium (Table 3)

Program:

```
title 'July Resin Capsule Magnesium Sedge Dom';

proc mixed data=resin;
        class island canopy ash;
        model rMg=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
canopy	1	16	4.44	0.0512
ash	1	16	0.02	0.8971
canopy*ash	1	16	0.02	0.8846
island	1	16	12.79	0.0025
island*canopy	1	16	0.47	0.5025
island*ash	1	16	0.00	0.9672
island*canopy*ash	1	16	3.76	0.0705

Least Squares Means							
Effect	**canopy**	**ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
canopy	Canopy		124.45	3.6565	16	34.03	<.0001
canopy	NoCanopy		135.34	3.6565	16	37.01	<.0001
ash		Ash	130.24	3.6565	16	35.62	<.0001
ash		NoAsh	129.56	3.6565	16	35.43	<.0001
canopy*ash	Canopy	Ash	125.17	5.1711	16	24.21	<.0001
canopy*ash	Canopy	NoAsh	123.73	5.1711	16	23.93	<.0001
canopy*ash	NoCanopy	Ash	135.30	5.1711	16	26.17	<.0001
canopy*ash	NoCanopy	NoAsh	135.39	5.1711	16	26.18	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		-10.8975	5.1711	16	-2.11	0.0512	Tukey	0.0512
ash		Ash		NoAsh	0.6792	5.1711	16	0.13	0.8971	Tukey	0.8971
canopy*ash	Canopy	Ash	Canopy	NoAsh	1.4417	7.3130	16	0.20	0.8462	Tukey	0.9972
canopy*ash	Canopy	Ash	NoCanopy	Ash	-10.1350	7.3130	16	-1.39	0.1848	Tukey	0.5254
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	-10.2183	7.3130	16	-1.40	0.1814	Tukey	0.5188
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	-11.5767	7.3130	16	-1.58	0.1330	Tukey	0.4152
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	-11.6600	7.3130	16	-1.59	0.1304	Tukey	0.4091
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	-0.08333	7.3130	16	-0.01	0.9910	Tukey	1.0000

July No Burn Sedge Dominated Islands Resin Capsule Sulfur (Table 3)

Program:

```
title 'July Resin Capsule Sulfur Sedge Dom';

proc mixed data=resin;
        class island canopy ash;
        model rS=canopy|ash|island;
        lsmeans canopy|ash / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
canopy	1	16	2.17	0.1600
ash	1	16	0.16	0.6965
canopy*ash	1	16	0.13	0.7266
island	1	16	1.12	0.3065
island*canopy	1	16	0.00	0.9760
island*ash	1	16	1.64	0.2190
island*canopy*ash	1	16	0.03	0.8652

Least Squares Means							
Effect	canopy	ash	Estimate	Standard Error	DF	t Value	Pr > |t|
canopy	Canopy		35.5750	2.9641	16	12.00	<.0001
canopy	NoCanopy		41.7517	2.9641	16	14.09	<.0001
ash		Ash	39.4958	2.9641	16	13.32	<.0001
ash		NoAsh	37.8308	2.9641	16	12.76	<.0001
canopy*ash	Canopy	Ash	37.1533	4.1919	16	8.86	<.0001
canopy*ash	Canopy	NoAsh	33.9967	4.1919	16	8.11	<.0001
canopy*ash	NoCanopy	Ash	41.8383	4.1919	16	9.98	<.0001
canopy*ash	NoCanopy	NoAsh	41.6650	4.1919	16	9.94	<.0001

Differences of Least Squares Means											
Effect	**canopy**	**ash**	**_canopy**	**_ash**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
canopy	Canopy		NoCanopy		-6.1767	4.1919	16	-1.47	0.1600	Tukey	0.1600
ash		Ash		NoAsh	1.6650	4.1919	16	0.40	0.6965	Tukey	0.6965
canopy*ash	Canopy	Ash	Canopy	NoAsh	3.1567	5.9282	16	0.53	0.6017	Tukey	0.9499
canopy*ash	Canopy	Ash	NoCanopy	Ash	-4.6850	5.9282	16	-0.79	0.4409	Tukey	0.8578
canopy*ash	Canopy	Ash	NoCanopy	NoAsh	-4.5117	5.9282	16	-0.76	0.4577	Tukey	0.8706
canopy*ash	Canopy	NoAsh	NoCanopy	Ash	-7.8417	5.9282	16	-1.32	0.2045	Tukey	0.5625
canopy*ash	Canopy	NoAsh	NoCanopy	NoAsh	-7.6683	5.9282	16	-1.29	0.2142	Tukey	0.5798
canopy*ash	NoCanopy	Ash	NoCanopy	NoAsh	0.1733	5.9282	16	0.03	0.9770	Tukey	1.0000

May Annual Burn Study Resin Capsule Nutrients

May Burn Islands Resin Capsule Ammonium (Table 4)

Program:

```
title 'Resin Capsule Ammonium May';

proc mixed data=resin;
        class island treatment;
        model rNH4=treatment|island;
        lsmeans treatment / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
treatment	1	8	0.41	0.5419
island	2	8	3.77	0.0704
island*treatment	2	8	2.63	0.1326

Least Squares Means						
Effect	treatment	Estimate	Standard Error	DF	t Value	Pr > |t|
treatment	CanopyRe	1.4500	0.1727	8	8.40	<.0001
treatment	Control	1.6056	0.1727	8	9.30	<.0001

Differences of Least Squares Means									
Effect	treatment	_treatment	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
treatment	CanopyRe	Control	-0.1556	0.2442	8	-0.64	0.5419	Tukey	0.5419

May Burn Islands Resin Capsule Nitrate (Table 4)

Program:

```
title 'Resin Capsule Nitrate May';

proc mixed data=resin;
        class island treatment;
        model rNO3=treatment|island;
        lsmeans treatment / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
treatment	1	8	0.05	0.8354
island	2	8	1.53	0.2737
island*treatment	2	8	0.91	0.4393

Least Squares Means						
Effect	**treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
treatment	CanopyRe	0.3122	0.05856	8	5.33	0.0007
treatment	Control	0.2944	0.05856	8	5.03	0.0010

Differences of Least Squares Means									
Effect	**treatment**	**_treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
treatment	CanopyRe	Control	0.01778	0.08281	8	0.21	0.8354	Tukey	0.8354

May Burn Islands Resin Capsule Phosphorus (Table 4)

Program:

```
title 'Resin Capsule Phosphorus May';

proc mixed data=resin;
        class island treatment;
        model rP=treatment|island;
        lsmeans treatment / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
treatment	1	8	2.95	0.1242
island	2	8	0.70	0.5227
island*treatment	2	8	6.27	0.0230

Least Squares Means						
Effect	**treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
treatment	CanopyRe	0.07444	0.01326	8	5.61	0.0005
treatment	Control	0.1067	0.01326	8	8.04	<.0001

Differences of Least Squares Means									
Effect	**treatment**	**_treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
treatment	CanopyRe	Control	-0.03222	0.01876	8	-1.72	0.1242	Tukey	0.1242

May Burn Islands Resin Capsule Calcium (Table 4)

Program:

```
title 'Resin Capsule Calcium May';

proc mixed data=resin;
        class island treatment;
        model rCa=treatment|island;
        lsmeans treatment / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
treatment	1	8	0.03	0.8570
island	2	8	0.63	0.5571
island*treatment	2	8	0.99	0.4143

Least Squares Means						
Effect	**treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
treatment	CanopyRe	33.2556	12.5168	8	2.66	0.0289
treatment	Control	36.5500	12.5168	8	2.92	0.0193

Differences of Least Squares Means									
Effect	**treatment**	**_treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
treatment	CanopyRe	Control	-3.2944	17.7014	8	-0.19	0.8570	Tukey	0.8570

May Burn Islands Resin Capsule Magnesium (Table 4)

Program:

```
title 'Resin Capsule Magnesium May';

proc mixed data=resin;
        class island treatment;
        model rMg=treatment|island;
        lsmeans treatment / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
treatment	1	8	0.03	0.8732
island	2	8	0.96	0.4236
island*treatment	2	8	1.01	0.4070

Least Squares Means						
Effect	**treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
treatment	CanopyRe	82.0000	28.4642	8	2.88	0.0205
treatment	Control	88.6322	28.4642	8	3.11	0.0144

Differences of Least Squares Means									
Effect	**treatment**	**_treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
treatment	CanopyRe	Control	-6.6322	40.2544	8	-0.16	0.8732	Tukey	0.8732

May Burn Islands Resin Capsule Potassium (Table 4)

Program:

```
title 'Resin Capsule Potassium May';

proc mixed data=resin;
        class island treatment;
        model rK=treatment|island;
        lsmeans treatment / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
treatment	1	8	0.03	0.8578
island	2	8	0.72	0.5159
island*treatment	2	8	0.93	0.4335

Least Squares Means						
Effect	**treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
treatment	CanopyRe	10.9678	2.5861	8	4.24	0.0028
treatment	Control	11.6444	2.5861	8	4.50	0.0020

Differences of Least Squares Means									
Effect	**treatment**	**_treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
treatment	CanopyRe	Control	-0.6767	3.6573	8	-0.19	0.8578	Tukey	0.8578

May Burn Islands Resin Capsule Sulfur (Table 4)

Program:

```
title 'Resin Capsule Sulfur May';

proc mixed data=resin;
        class island treatment;
        model rS=treatment|island;
        lsmeans treatment / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
treatment	1	8	0.04	0.8396
island	2	8	0.64	0.5534
island*treatment	2	8	0.47	0.6389

Least Squares Means						
Effect	**treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
treatment	CanopyRe	73.7378	20.5000	8	3.60	0.0070
treatment	Control	79.8011	20.5000	8	3.89	0.0046

Differences of Least Squares Means									
Effect	**treatment**	**_treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
treatment	CanopyRe	Control	-6.0633	28.9914	8	-0.21	0.8396	Tukey	0.8396

July Annual Burn Study Resin Capsule Nutrients

July Burn Islands Resin Capsule Ammonium (Table 4)

Program:

```
title 'Resin Capsule Ammonium July';

proc mixed data=resin;
        class island treatment;
        model rNH4=treatment|island;
        lsmeans treatment / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
treatment	1	12	0.21	0.6534
island	2	12	3.81	0.0522
island*treatment	2	12	0.17	0.8438

Least Squares Means						
Effect	**treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
treatment	CanopyRe	0.6900	0.1109	12	6.22	<.0001
treatment	Control	0.6178	0.1109	12	5.57	0.0001

Differences of Least Squares Means									
Effect	**treatment**	**_treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
treatment	CanopyRe	Control	0.07222	0.1569	12	0.46	0.6534	Tukey	0.6534

July Burn Islands Resin Capsule Nitrate (Table 4)

Program:

```
title 'Resin Capsule Nitrate July';

proc mixed data=resin;
        class island treatment;
        model rNO3=treatment|island;
        lsmeans treatment / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
treatment	1	12	1.57	0.2347
island	2	12	23.00	<.0001
island*treatment	2	12	1.17	0.3423

Least Squares Means						
Effect	**treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
treatment	CanopyRe	0.08556	0.003768	12	22.71	<.0001
treatment	Control	0.07889	0.003768	12	20.94	<.0001

Differences of Least Squares Means									
Effect	**treatment**	**_treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
treatment	CanopyRe	Control	0.006667	0.005329	12	1.25	0.2347	Tukey	0.2347

July Burn Islands Resin Capsule Phosphorus (Table 4)

Program:

```
title 'Resin Capsule Phosphorus July';

proc mixed data=resin;
        class island treatment;
        model rP=treatment|island;
        lsmeans treatment / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
treatment	1	12	2.04	0.1789
island	2	12	5.61	0.0191
island*treatment	2	12	0.53	0.6027

Least Squares Means						
Effect	**treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
treatment	CanopyRe	0.06444	0.009907	12	6.50	<.0001
treatment	Control	0.08444	0.009907	12	8.52	<.0001

Differences of Least Squares Means									
Effect	**treatment**	**_treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
treatment	CanopyRe	Control	-0.02000	0.01401	12	-1.43	0.1789	Tukey	0.1789

July Burn Islands Resin Capsule Calcium (Table 4)

Program:

```
title 'Resin Capsule Calcium July';

proc mixed data=resin;
        class island treatment;
        model rCa=treatment|island;
        lsmeans treatment / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
treatment	1	12	1.10	0.3153
island	2	12	20.04	0.0001
island*treatment	2	12	1.68	0.2278

Least Squares Means						
Effect	**treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
treatment	CanopyRe	69.5133	4.9603	12	14.01	<.0001
treatment	Control	76.8644	4.9603	12	15.50	<.0001

Differences of Least Squares Means									
Effect	**treatment**	**_treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
treatment	CanopyRe	Control	-7.3511	7.0149	12	-1.05	0.3153	Tukey	0.3153

July Burn Islands Resin Capsule Magnesium (Table 4)

Program:

```
title 'Resin Capsule Magnesium July';

proc mixed data=resin;
        class island treatment;
        model rMg=treatment|island;
        lsmeans treatment / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
treatment	1	12	0.58	0.4619
island	2	12	5.38	0.0215
island*treatment	2	12	1.67	0.2288

Least Squares Means						
Effect	**treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
treatment	CanopyRe	148.74	4.8760	12	30.51	<.0001
treatment	Control	153.99	4.8760	12	31.58	<.0001

Differences of Least Squares Means									
Effect	**treatment**	**_treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
treatment	CanopyRe	Control	-5.2411	6.8957	12	-0.76	0.4619	Tukey	0.4619

July Burn Islands Resin Capsule Potassium (Table 4)

Program:

```
title 'Resin Capsule Potassium July';

proc mixed data=resin;
        class island treatment;
        model rK=treatment|island;
        lsmeans treatment / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
treatment	1	12	2.97	0.1103
island	2	12	6.86	0.0103
island*treatment	2	12	0.64	0.5448

Least Squares Means						
Effect	**treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
treatment	CanopyRe	15.8600	0.5194	12	30.54	<.0001
treatment	Control	14.5933	0.5194	12	28.10	<.0001

Differences of Least Squares Means									
Effect	**treatment**	**_treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
treatment	CanopyRe	Control	1.2667	0.7345	12	1.72	0.1103	Tukey	0.1103

July Burn Islands Resin Capsule Sulfur (Table 4)

Program:

```
title 'Resin Capsule Sulfur July';

proc mixed data=resin;
        class island treatment;
        model rS=treatment|island;
        lsmeans treatment / adjust=tukey;
RUN;
```

Output:

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
treatment	1	12	3.71	0.0780
island	2	12	3.83	0.0516
island*treatment	2	12	1.58	0.2452

Least Squares Means						
Effect	**treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
treatment	CanopyRe	52.3411	3.3590	12	15.58	<.0001
treatment	Control	43.1878	3.3590	12	12.86	<.0001

Differences of Least Squares Means									
Effect	**treatment**	**_treatment**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Adjustment**	**Adj P**
treatment	CanopyRe	Control	9.1533	4.7503	12	1.93	0.0780	Tukey	0.0780

Full References

Alberti, J., A. Mendez-Casariego, P. Daleo, E. Fanjul, B. Silliman, M. Bertness, and O. Iribarne. 2010. Aboitc stress mediates top-down and bottom-up control in a Southwestern Atlantic salt marsh. Oecologia 163:181-191.

Anisfeld, S. C., and T. D. Hill. 2012. Fertilization effects of elevation change and belowground carbon balance in a Long Island Sound tidal marsh. Estuaries and Coasts 35:201-211.

Arthur, S. C. 1931. The fur animals of Louisiana Bulletin No. 18 (revised). State of Louisiana Department of Conservation. New Orleans.

Aselmann, I., and P. J. Crutzen. 1989. Global distribution of natural freshwater wetlands and rice paddies, their net primary productivity, seasonality, and possible methand emissions. Journal of Atmospheric Chemistry 8:307-358.

Badia, D., and C. Marti. 2003. Plant ash and heat intensity effects on chemical and physical properties of two contrasting soils. Arid Land Resource Management 17:23-41.

Bertness, M. D. 1992. The ecology of a New England salt marsh. American Scientist 80:260-268.

Bickford, W. A. 2011. Plant productivity and competitive response to prescribed fire in mid-Atlantic brackish marshes. M.S. Thesis, University of Maryland, College Park, MD, USA. 229p.

Bickford, W. A., B. A. Needelman, R. R. Weil, and A. H. Baldwin. 2012. Vegetation response to prescribed fire in Mid-Atlantic brackish marshes. (In review)

Brinson, M. M., A. E. Lugo, and S. Brown. Primary productivity, decomposition and consumer activity in freshwater wetlands. Annual Review of Ecology and Systematics 12:123-161.

Buresh, R. J., R. D. DeLaune, and W. H. Patrick Jr. 1980. Nitrogen and phosphorus distribution and utilization by *Spartina alterniflora* in a Louisiana gulf coast marsh. Estuaries 3(2):111-121.

Cachier, H., C. Liousse, and P. Buat-Menard. 1995. Particulate content of savanna fire emissions. Journal of Atmospheric Chemistry 22:123-148.

Cahoon, D. R., J. W. Day Jr., D. J. Reed, and R. S. Young. 1998. Global climate change and sea-level rise: estimating the potential for submergence of coastal wetlands. In: Vulnerability of Coastal Wetlands in the Southeastern United States: Climate Change Research Results, 1992 – 1997. G. R. Guntenspergen and B. A. Vairin (Eds.), 19 – 32, U.S. Geological Survey, Biological Resources Division Biological Sciences Report USGS/BRD/BSR – 1998 – 0002.

Cahoon, D. R., M. A. Ford, and P. F. Hensel. 2004. Ecogeomorphology of *Spartina patens*-dominated tidal marshes: Soil organic matter accumulation, marsh elevation dynamics, and disturbance. Coastal and Estuarine Studies 59:247-266.

Cahoon, D.R., P. F. Hensel, T. Spence, D. J. Reed, K. L. McKee, and N. Saintilan. 2006. Coastal wetland vulnerability to relative sea-level rise: Wetland elevation trends and process controls. Pp. 271-292. In Verhoeven, J.T.A., Beltman, B., Bobboink, R., and Whigham, D., ed. Wetlands and Natural Resource Management. Ecological Studies, Volume 190, Spring-Verlag, Berlin, Heidelberg.

Cahoon D. R., G. Guntenspergen, S. Baird, J. Nagel, P. Hensel, J. Lynch, D. Bishara, P. Brennan, J. Jones, and C. Otto. 2010. Do annual prescribed fires enhance or slow the loss of coastal marsh habitat at Blackwater National Wildlife Refuge? Final Project Report (JFSP Number: 06-2-1-35). March 31, 2010. Beltsville, MD.

Carlson, R. M. 1978. Automated separation and conductimetric determination of ammonia and dissolved carbon dioxide. Analytical Chemistry 50(11):1528-1531.

Cataldo, D. A., Haroon, M., Schrader, L. E., Young, V. L. 1975. Rapid Colorimetric Determination of Nitrate in Plant Tissue by Nitration of Salicylic Acid. Communications in Soil Science and Plant Analysis 6 (1):71-80.

Climate Change Science Program (CCSP). 2009. Coastal Sensitivity to Sea-Level Rise: A Focus on the Mid-Atlantic Region. A report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. U.S. Environmental Protection Agency, Washington D.C., USA, 320 pp. Clough, J.S. 2008. Application of the sea-level affecting marshes model (SLAMM 5.0) to the Chesapeake Bay region. National Wildlife Federation, Seattle, WA. 107 p.

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U. S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. 131 pp.

Crain, C. M. 2007. Shifting nutrient limitation and eutrophication effects in marsh vegetation across estuarine salinity gradients. Estuaries and Coasts 30:26-34.

Daleo, P., J. Alberti, A. Canepuccia, M. Escapa, E. Fanjul, B. R. Silliman, M. D. Bertness, and O. Iribane. 2008. Mycorrhizal fungi determine salt-marsh plant zonation depending on nutrient supply. Journal of Ecology 96:431-437.

Darby, F. A., and R. E. Turner. 2008a. Effects of eutrophication on salt marsh roots, rhizomes, and soils. Marine Ecology Progress Series 363: 63-70.

Darby, F. A., and R. E. Turner. 2008b. Below- and aboveground biomass of *Spartina alterniflora*: response to nutrient addition in a Louisiana salt marsh. Estuaries and Coasts 31: 326-334.

Daubenmire, R. 1968. The ecology of fire in grasslands. Advances in Ecological Research 5:209-266.

DeLaune, R. D., S. R. Pezeshki, and A. Jugsujinda. 2005. Impact of Mississippi river freshwater reintroduction on *Spartina patens* marshes: responses to nutrient input and lowering of salinity. Wetlands 25:155-161.

de la Cruz, A. A. 1973. The role of tidal marshes in the productivity of coastal waters. ASB Bulletin 20:147-156.

de la Cruz, A. A., and C. T. Hackney. 1980. The effects of winter fire and harvest on the vegetational structure and primary productivity of two tidal marsh communities in Mississippi. Publication No. M-ASGP-80-013. Mississippi-Alabama Sea Grant Consortium, Ocean Springs, MS.

Douglas, B. C. 1997. Global sea rise; a redetermination. Surveys in Geophysics 18:279-292.

Emery, N. C., P. J. Ewanchuk, and M. D. Bertness. 2001. Competition and salt-marsh plant zonation: stress tolerators may be dominant competitors. Ecology 82(9):2471-2485.

Emery, K. O., and D. G. Aubrey. 1991. Sea levels, land levels, and tide gauges. Springer-Verlag, New York, 237 p.

Faulkner, S. P., and A. A. de la Cruz. 1982. Nutrient mobilization following winter fires in an irregularly flooded marsh. Journal of Environmental Quality 11:129-133.

Flores, C., D. L. Bounds, and D. E. Ruby. 2011. Does prescribed fire benefit wetland vegetation? Wetlands 31:35-44.

French, D. D. 1988. Patterns of decomposition assessed by the use of litter bags and cotton strip assay on fertilized and unfertilized heather moor in Scotland. In: Harrison, A. F., Latter, P. M., Walton, D. W. H. (Eds.), Cotton Strip Assay: An Index of Decomposition in Soils.

Gabrey, S.W., and A. D. Afton. 2001. Plant community composition and biomass in Gulf Coast Chenier Plain marshes: responses to winter burning and structural marsh management. Environmental Management 27:281-293.

Galloway, J. N., J. D. Aber, J. W. Erisman, S. P. Seitzinger, R. W. Howarth, E. B. Cowling, and B. J. Cosby. 2003. The nitrogen cascade. BioScience 53:341-356.

Garcia, F. O. 1992. Carbon and nitrogen dynamics and microbial ecology in tallgrass prairie. Ph. D. Thesis, Kansas State University, Manhattan, KS, USA.

Gratton, C., and R. F. Denno. 2003. Inter-year carryover effects of a nutrient pulse on *Spartina* plants, herbivores, and natural enemies. 84(10):2692-2707.

Griffith, R. E. 1940. Waterfowl management on Atlantic coast refuges. Transactions of the Fifith North American Wildlife Conference 5:373-377.

Gusewell, S., U. Bollens, P. Ryser, and F. Klotzli. 2003. Contrasting effects of nitrogen, phosphorus and water regime on first- and second-year growth of 16 wetland plant species. Fuctional Ecology 17:754-765.

Hackney, C. T., and A. A. de la Cruz. 1983. Effects of winter fire on the productivity and species composition of two brackish marsh communities in Mississippi. International Journal of Ecology and Environmental Sciences 27:281-293.

Haraguchi, A., H. Kojima, C. Hasegawa, Y. Takahashi, and T. Iyobe. 2002. Decomposition of organic matter in peat soil in a minerotrophic mire. European Journal of Soil Biology 38: 89 – 95.

Harrison, A. F., P. M. Latter, P. M., and D. W. H. Walton (Eds.). 1988. Cotton Strip Assay: An index of Decomposition in Soils. ITE Symposium no. 24. Institute of Terrestrial Ecology, Grange-Over-Sands, Great Britian (176 p.).

Hauer, F.R. and C. N. Spencer. 1998. Phosphorus and nitrogen dynamics in streams associated with wildfire: A study of immediate and longterm effects. International Journal of Wildland Fire 8:183-198.

Hernandez, M. E., and W. J. Mitsch. 2006. Influence of hydrologic pulses, flooding frequency, and vegetation on nitrous oxide emissions from created riparian marshes. Wetlands 26:862-877.

Hernandez, M. E., and W. J. Mitsch. 2007. Denitrification in created riverine wetlands: Influence of hydrology and season. Ecological Engineering 30:78-88.

Hinrichsen, D. 1998. Coastal waters of the world: Trends, threats, and strategies. Washington, DC: Island Press.

Hoffpauir, C. M. 1967. Marsh burning. In: Newson J. D. (ed.) Proceedings of the Marsh and Estuary management symposium. Louisiana State University, Baton Rouge, pp. 134-139.

Howarth, R. W., A. Sharpley, and D. Walker. 2002. Sources of nutrient pollution to coastal waters in the United States: Implications for achieving coastal water quality goals. Estuaries 25:656-676.

Howes, B. L., R. W. Howarth, J. M. Teal, and I. Valiela. 1981. Oxidation-reduction potentials in a salt marsh: spatial patterns and interactions with primary production. Limnology and Oceanography 26:350–360.

Ilstedt, U., R. Giesler, A. Nordgren, and A. Malmer. 2003. Changes in soil chemical and microbial properties after a wildfire in a tropical rainforest in Sabah, Malaysia. Soil Biology and Biogeochemistry 35:1071-1078.

Jefferies, R. L. 1981. Osmotic adjustment and the response of halophytic plants to salinity. Bioscience 31:42-46.

Johnson, S. R., and A. K. Knapp. 1995. The effect of fire on gas exchange and aboveground biomass production in annually vs. biennially burned *Spartina pectinata* wetlands. Wetlands 13: 299-303.

Jordan, T. E., D. L. Correll, and D. E. Weller. 1997. Effects of agriculture on discharges of nutrients from coastal plain watersheds of Chesapeake Bay. Journal of Environmental Quality 26:836-848.

Kearney, M. S., R. E. Grace, and J. C. Stevenson. 1998. Marsh Loss in Nanticoke Estuary, Chesapeake Bay. Geographical Review 78(2):205-220.

Kearney, M. S., and J. C. Stevenson. 1991. Island land loss and marsh vertical accretion rate evidence for historical sea-level changes in Chesapeake Bay. Journal of Coastal Research 7(2):403-415.

Kemp, W. M., W. R. Boynton, and J. E. Adolf. 2005. Eutrophication of Chesapeake Bay: historical trends and ecological interactions. Marine Ecology-Progress Series 303:1-29.

Kirby, R. E., S. J. Lewis, and T. N. Sexson. 1988. Fire in North America wetland ecosystems and fire-wildlife relations: an annotated bibliography. U. S. Fish and Wildlife Service, Biological Report 88(1).

Knapp, A. K. and T. R. Seastedt. 1986. Detritus accumulation limits productivity of tallgrass praries. BioScience 36:662-668.

Koch, M. S., I. A. Mendelsshon, and K. L. McKee. 1990. Mechanism for the hydrogen sulfide-induced growth limitation in wetland macrophytes. Limnology and Oceanography 35(2):399-408.

Koerselman, W., and A. F. M. Mueleman. 1996. The vegetation N:P ratio: a new tool to detect the nature of nutrient limitation. Journal of Applied Ecology 33:1441-1450.

Kuo, S. 1996. Phosphorus. In: Sparks DL (Ed.) Methods of Soil Analysis, Part 3 - Chemical Methods. Soil Science Society of America, Madison, WI.

Latter, P. M., and A. F. Harrison. 1988. Decomposition of cellulose in relation to soil properties and plant growth. In: Harrison, A. F., Latter, P. M., Walton, D. W. H. (eds.) Cotton strip assay: an index of decomposition in soils. Grange-over-Sands, NERC/ITE, 68-71.

Laubhan, M. K. 1995. Effects of prescribed fire on moist-soil vegetation and soil macronutrients. Wetlands 15(2):159-166.

Lay, D. W. 1945. Muskrat investigation in Texas. Journal of Wildlife Management 9: 56-76.

Leonard, C. A., C. Ahn, and D. Birch. 2010. Above- and below-ground vegetative responses to prescribed fire regimes in a Chesapeake Bay tidal brackish marsh. Journal of Ecology and Field Biology 33(4):351-361.

Levine, J. M., J. S. Brewer, and M. D. Bertness. 1998. Nutrients, competition and plant zonation in a New England salt marsh. Journal of Ecology 86:285-292.

Liu, G. D., J. Dunlop, T. Phung, and Y. C. Li. 2007. Physiological response of what phosphorus-effect and –inefficient genotypes in field and effects of mixing other nutrients on mobilization of insoluble phosphates in hydrophonics. Communications in Soil Science and Plant Analysis 38:2239-2256.

Liu, G. D., B. Gu, S. L. Miao, Y. C. Li, K. W. Migliaccio, and Y. Qian. 2010. Phosphorus release from ash and remaining tissues of two wetland species after a prescribed fire. Journal of Environmental Quality 29:1585-1593.

Liu, X., P. V. Espen, F. Adams, J. Cafmeyer, and W. Maenhaut. 2000. Biomass burning in southern Africa: Individual particle characterization of atmospheric aerosols and savanna fire samples. Journal of Atmospheric Chemistry 36:135-155.

Lynch, J. J. 1941. The place of burning in management of the Gulf Coast wildlife refuges. Journal of Wildlife Management 5:454-457.

Manning, D. A. C., and E. Lopez-Capel. 2009. Test procedures for determining the quantity of biochar within soils. In: J. Lehmann and S. Joseph, Editors, Biochar for Environmental Management Science and Technology, Earthscan, London, pp. 301-315.

Marion, G. M., J. M. Moren, and W. C. Oechel. 1991. Fire severity, ash deposition, and clipping effects on soil nutrient in chaparral. Soil Science Society of America Journal 55:235-240.

Marsh, A. S., D. P. Rasse, and B. G. Drake. 2005. Effect of elevated CO_2 on carbon pools and fluxes in a brackish marsh. Estuaries 28:694–704.

Matthews, E., and I. Fung. 1987. Methane emission from natural wetlands: global distribution, area, and environmental characteristics of sources. Global Biogeochemical Cycles 1:61-86.

McNaughton, S. J., N. R. H. Stronach, and N. J. Georgiadis. 1998. Combustion in natural fires and global emissions budgets. Ecological Applications 8:464-468.

Megonigal, J. P., M. E. Hines, and P. T. Visscher. 2004. Anaerobic metabolism: Linkages to trace gases and aerobic processes. In W. H. Schlesinger, ed. Biogeochemistry. Elsevier-Pergamon, Oxford, UK, pp. 317-424.

Mendelssohn, I. A. 1978. Eco-physiological aspects of the height forms of Spartina alterniflora in North Carolina: Nitrogen nutrition and soil waterlogging. Ph.D. Thesis. North Carolina State University. pp. 142.

Mendelssohn, I. A. 1979. The influence of nitrogen level, form, and application method on the growth response of *Spartina alterniflora* in North Carolina. Estuaries 2(2):106-112.

Mendelssohn, I. A., B. K. Sorrell, H. Brix, H. Schierup, B. Lorenzen, and E. Maltby. 1999. Controls on soil cellulose decomposition along a salinity gradient in a *Phragmites australis* wetland in Denmark. Aquatic Botany 64:381-398.

Mendelssohn, I. A., and M. G. Slocum. 2004. Relationship between soil cellulose decomposition and oil contamination after an oil spill at Swanson Creek, Maryland. Marine Pollution Bulletin 48:359-370.

Miller, M. W., B. A. Needelman, W. A. Bickford, E. Hutchins. (in review) Prescribed fire increases soil temperature and light availabililty in a Mid-Atlantic brackish marsh.

Mitchell, L. R., S. Gabrey, P. P. Marra, and R. M. Erwin. 2006. Impacts of marsh management on coastal-marsh bird habitats. In: Greenberg, R., Maldonado, J., Droege, S., McDonald, M.V. (eds.) Terrestrial vertebrates of tidal marshes: evolution, ecology, and conservation, studies in avian biology no. 32. Cooper Ornithological Society, Los Angeles, pp. 155-175.

Mitsch, W. J., and J. G. Gooselink. 2007. Wetlands, fourth ed. John Wiley and Sons Inc., New York.

Morris, J. T. 1991. Effects of nitrogen loading on wetland ecosystems with particular reference to atmospheric deposition. Annual Review of Ecology and Systematics 22:257-279.

Morris, J. T., and P. Bradley. 1999. Effects of nutrient loading on the carbon balance of coastal wetland environments. Limnology and Oceanography 44:699-702.

Murphy, J. D., D. W. Johnson, W. W. Miller, R. F. Walker, E. F. Carroll, and R. R. Blank. 2006. Wildfire effects on soil nutrients and leaching in a Tahoe basin watershed. Journal of Environmental Quality 35:479-489.

National Research Council. 2000. Clean Coastal Waters: Understanding and Reducing the Effects of Nutrient Pollution. National Academy Press, Washington, DC.

National Safety Council. 1998. Coastal challenges: A Guide to Coastal and Marine Issues. Environmental Health Center. Washington, DC: National Safety Council.

National Oceanic and Atmospheric Administration (NOAA). 1990. Estuaries of the United States: Vital Statistics of a National Resource Base. National Ocean Service, Ocean Assessments Division, Washington, DC, 79 p.

National Oceanic and Atmospheric Administration (NOAA). 2004. Population trends along the coastal United States: 1980-2008. National Oceanic and Atmospheric Administration, Rockville, MD.

National Wildlife Federation (NWF). 2008. Sea-level rise and coastal habitats in the Chesapeake Bay region. National Wildlife Federation, Reston, VA.

Nyman, J. A., and R. H. Chabreck. 1995. Fire in coastal marshes: history and recent concerns, in Fire in wetlands: a management perspective, edited by S. I, Cerulean and R. T. Engstrom, 134-141, Proceedings of the Tall Timbers Ecology Conference, Number 19, Tall Timbers Research Station, Tallahasssee, FL, USA.

O'Neil, T. 1949. The muskrat in the Louisiana coastal marshes. Federal Aid Section-Fish and Game Division, Louisiana Department of Wildlife and Fisheries, New Orleans, LA.

Owensby, C. E., and J. B. Wyrill. Effects of range burning on Kansas Flint Hills soil. Journal of Range Management 26:185-188.

Patrick, W. H., Jr., D. A. Antie, R. D. Delaune, and R. Engler. 1972. Nitrate removal from the water-mud interface in flooded soils and marsh sediments. Second National Coastal and Shallow Water Research Conference Abstract 174.

Packard, S., and C. Mutel. (eds.). 1997. The tallgrass restoration handbook. Island Press, Washington, DC.

Pendelton, E. C. and J. C. Stevenson. 1983. Investigations of marsh losses at Blackwater Refuge, Horn Point Environmental Laboratories, Center for Environmental and Estuarine Studies, University of Maryland, Cambridge, MD. 151p.

Penfound, W. T., and G. S. Hathaway. 1938. Plant communities in the marshland of southeastern Louisiana. Ecological Monitoring 8:1-56.

Phillips, J. D. 1986. Coastal submergence and marsh fringe erosion. Journal of Coastal Research 2(4):427-436.

Picone, L. I., G. Quaglia, F. O. Garcia, and P. Laterra. 2003. Biological and chemical response of a grassland to burning. Journal of Range Management 56:291-297.

Prestegaard, K. L., and M. O'Connell. 1995. Seasonal timing and process of nitrate delivery to streams in the Lower Chesapeake Bay drainage. p. 13-17. In University of Maryland, USA, Water Resources Research Center FY 94 Report to U. S. Dept. of Interior Grant No. 14-08-0001-G2024.

Pyne, S. J. 1995. World fire. Princeton University Press, Princeton, NJ.

Qian, Y., S. L. Miao, B. Gu, and Y. C. Li. 2009. Effects of burn temperature on ash nutrient forms and availability from cattail (*Typha domingensis*) and sawgrass (*Cladium jamaicense*) in the Florida everglades. Journal of Environmental Quality 38:451-464.

Qian, Y., S. L. Miao, B. Gu, and Y. C. Li. 2009. Estimation of postfire nutrient loss in the Florida everglades. Journal of Environmental Quality 38:1812-1820.

Raison, R. J., P. K. Khanna, and P. V. Woods. 1985. Mechanisms of element transfer to the atmosphere during vegetation fires. Canadian Journal for Restoration 15:132-140.

Rahmstorf, S. 2007. A semi-empirical approach to projecting future sea-level rise. Science 2007 315:368-370.

Reddy, K. R., and W. H. Patrick, Jr. 1984. Nitrogen transformations and loss in flooded soils and sediments. CRC Critical Reviews in Environmental Control 13:273-309.

Rhoades, C., T. Barnes, and B. Washburn. 2002. Prescribed fire and herbicide effects on soil processes during barrens restoration. Restoration Ecology 10(4):656-664.

Rice, C. W. 2000. Soil organic C and N in rangeland soils under elevated CO_2 and land management. In: Proc., Advances in Terrestrial Ecosystem Carbon Inventory, Measurements, and Monitoring. 3–5 October 2000. USDA-ARS, USDA-FS, USDA-NRCS, US Dept. Energy, NASA, and National Council for Air and Stream Improvement, Raleigh, NC, pp. 83.

Rice, C. W., and C. E. Owensby. 2000. The effects of fire and grazing on soil carbon in rangelands. Pgs. 323-343. In R.F. Follett et al., ed. The potential of U.S. Grazing lands to sequester carbon and mitigate the greenhouse effect. CRC Press, Boca Raton, FL.

Risser, P., and W. J. Parton. 1982. Ecological analysis of a tallgrass prairie: Nitrogen cycle. Ecology 63:1342-1351.

Rubio, G., and D. L. Childers. 2006. Controls on herbaceous litter decomposition in the estuarine ecotones of the Florida Everglades. Estuaries and Coasts 26(6):257-268.

Rybczyk, J. M., G. Garson, and J. W. Day Jr. 1996. Nutrient enrichment and decomposition in wetland ecosystems: models, analyses and effects. Current Topics in Wetland Biogeochemistry 2:52-72.

Saunders, C. J., J. P. Megonigal, and J. F. Reynolds. 2006. Comparison of belowground biomass in C3- and C4-dominated mixed communities in a Chesapeake Bay brackish marsh. Plant and Soil:305-322.

Schmitz, J. P. 2000. Meso-scale community organization and response to burning in mesocosms and a field salt marsh, M.S. Thesis, University of Maryland, Center for Environmental Studies, Horn Point Environmental Lab, Cambridge, MD, USA.

Schmalzner, P. A., and C. R. Hinkle. 1992. Soil dynamics following fire in *Juncus* and *Spartina* marshes. Wetlands 12:8-21.

Scudlark, J. R., and T. M. Church. 1989. The sedimentary flux of nutrients at a Delaware salt marsh site: a geochemical perspective. Biogeochemistry 7:55-75.

Sharrow, S. H. and H. A. Wright. 1977. Effects of fire, ash, and litter on soil nitrate, temperature, moisture and Tobosagrass production in the Rolling Plains. Journal of Range Management 30:266-270.

Sherman, L. A., K. R. Brye, D. E. Gill, and K. A. Koenig. 2005. Soil chemistry as affected by first-time prescribed burning of a grassland restoration on a coastal plain ultisol. Soil Science 170(11):913-927.

Sherr, B. F. and W. J. Payne. 1978. Effect of the *Spartina alterniflora* root-rhizome system on salt marsh soil denitrifying bacteria. Applied Environmental Microbiology 35:724–729.

Sipple, W. S. 1979. A review of the biology, ecology, and management of Scirpus olneyi. Vol II: a synthesis of selected references. Wetland Publication No. 4. Annapolis, MD: Maryland Department of Natural Resources, Water Resources Administration, Wetlands Permit Division. 85 p.

Smith, R. H. 1942. Management of salt marshes on the Atlantic coast of the United States. Transactions of the 7th North American Wildlife Conference 7:272-277.

Smith, S. M., S. Newman, P. B. Garrett, and J. A. Leeds. 2001. Differential effects of surface and peat fire on soil constituents in a degraded wetland of the northern Florida Everglades. Journal of Environmental Quality 30:1998-2005.

The Scientific and Technical Advisory Committee (STAC). 2003. Chesapeake Futures: Choices for the 21st Century (Annapolis, MD: Chesapeake Bay Program).

Skjemstad, J. O., P. Clarke, J. A. Taylor, J. M. Oades, and S. J. McClure. 1996. The chemistry and nature of protected carbon in soil. Australian Journal of Soil Research 34:251–271.

Skogley, E. O. 1992. The universal bioavailability environment/soil test unibest. Communications in Soil Science and Plant Analysis 23:17-20,2225-2246.

Staver, K. W., and R. B. Brinsfield. 1990. Groundwater discharge patterns in Maryland coastal plain agriculture systems. p. 593-603. In New Perspectives in the Chesapeake System: a Research and Management Partnership. Chesapeake Research Consortium, Solomans, MD, USA, Publication No. 137.

Smith, S. M., S. Newman, P. B. Garrett, and J. A. Leeds. 2001. Differential effects of surface and peat fire on soil constituents in a degraded wetland of the Northern Florida Everglades. Journal of Environmental Quality 30:1998-2005.

Stephens, S. L., T. Meixner, M. Poth, B. MuGurk, and D. Payne. 2004. Prescribed fire, soils, and stream water chemistry in a watershed in the Lake Tahoe Basin, California. International Journal of Wildland Fire 13:27-35.

Stevenson, J. C., D. R. Heinle, D. A. Flemer, R. J. Small, R. A. Rowland, and J. F. Ustach. 1977. Nutrient exchanges between brackish water marshes and the estuary. p. 219-240. In M. Wiley (ed.) Estuarine Processes, Vol. II. Academic Press, New York, NY, USA.

Stevenson, J. C., M. S. Kearney, and E. C. Pendleton. 1985. Sedimentation and erosion in a Chesapeake Bay brackish marsh system. Marine Geology 67:213-235.

Stevenson, J. C. and M. S. Kearney. 2009. Impacts of global climate change and sea-level rise on tidal wetlands. Human Impacts on Salt Marshes (ed. by B. R.Silliman, E. D.Grosholz and M. D.Bertness), pp. 171–206. University of California Press, Berkeley, California.

Stribling, J. M., and J. C. Cornwell. 2001. Nitrogen, phosphorus, and sulfur dynamics in a low salinity marsh system dominated by *Spartina alterniflora*. Wetlands 21(4):629-638.

Thomas, A. D., R. P. D. Walsh, and R. A. Shakesby. 1999. Nutrient losses in eroded sediment after fire in eucalyptus and pine forests in the wet Mediterranean environment of northern Portugal. Catena 36:283-302.

Tilman, D., and D. Wedin. 1991. Plant traits and resource reduction for five grasses growing on a nitrogen gradient. Ecology 72:685-700.

Townsend, S. A., and M. M. Douglas. 2004. The effect of a wildfire on stream water quality and catchment water yield in a tropical savanna excluded from fire for 10 years (Kakadu National Park, North Australia). Water Resources 38:3051-3058.

Turitzin, S. N., and B. G. Drake. 1981. The effect of a seasonal change in canopy structure on the photosynthetic efficiency of a salt marsh. Oecologia 48:79-84.

Turner, R. E., E. M. Swenson, C. S. Milan, J. M. Lee, and T. A. Oswald. 2004. Below-ground biomass in healthy and impaired salt marshes. Ecological Research 19:29-35.

Turner, R. E. 2011. Beneath the salt marsh canopy: loss of soil strength with increasing nutrient loads. Estuaries and Coasts 34(5): 1084-1093.

Ubeda, X., M. Lorca, L. R. Outeiro, S. Bernia, and M. Castellnou. 2005. Effects of prescribed fire on soil quality in Mediterranean grassland (Prades Mountains, north-east Spain). International Journal of Wildland Fire 14:379-384.

Uhler, F. M. 1944. Control of undesirable plants in waterfowl habitats. Transaction of the 9th North American Wildlife Conference 9:295-303.

UNEP/GPA. 2006. The State of the Marine Environment: Trends and Processes. UNEP/GPA, The Hague, 44 p.

U.S. Census Bureau. 2001. Statistical abstract of the United States: 2002 (122nd edition). Washington, DC: DOC, U.S. Census Bureau.

U.S. Climate Science Change Program (CCSP). 2009. Coastal Sensitivity to Sea-Level Rise: A Focus on the Mid-Atlantic Region. A report by the U.S. Climate Change Science Program and the

Subcommittee on Global Change Research. U.S. Environmental Protection Agency, Washington D.C., USA, 320 pp.

USDA, NRCS. 2011. The PLANTS Database (http://plants.usda.gov, 23 August 2011). National Plant Data Center, Baton Rouge, LA 70847-4490 USA.

U.S. Department of the Interior. 2001. Fire program [Online]. Available at http://www.fws.gov/blackwater/pdf/fireprogram.pdf (accessed 1/26/2011). U.S. Fish and Wildlife Service, Cambridge, MD.

U.S. Department of the Interior. 2006. Scientific review of the prescribed burn program at Blackwater National Wildlife Refuge (Chesapeake Marshlands NWR Complexes) and Fishing Bay Wildlife Management Area. Feb. 22.

U.S. Department of the Interior. 2008. Wetland restoration {Online]. Available at http://www.fws.gov/blackwater/restore.html (accessed 1/26/2011). U.S. Fish and Wildlife Service, Cambridge, MD.

U. S. Fish and Wildlife Service. 2011. Blackwater National Wildlife Refuge. http://www.fws.gov/blackwater/. Accessed September 23rd, 2011.

Valiela, I., and J. M. Teal. 1974. Nutrient limitation in salt marsh vegetation. Pages 574-563 in R.J. Reimold and W. H. Queen, editors. Ecology of halophytes. Academic Press, New York, New York, USA.

van Wijnen, H. J., and J. P. Bakker. 1999. Nitrogen and phosphorus limitation in a coastal barrier salt marsh: the implication for vegetation succession. Journal of Ecology 87:265-272.

Verhoeven, J. T. A., W. Koerselman, and A. M. F. Meuleman. 1996. Nitrogen or phosphorus limited growth in herbaceous wet vegetation: Relations with atmospheric inputs and management regimes. Trends in Ecology & Evolution 11:494-497.

Vitousek, P. M., J. Abner, R. W. Howarth, G. E. Likens, P. A. Matson, D. W. Schindler, W. H. Schlesinger, and G. D. Tilman. 1997. Human alteration of the global nitrogen cycle: Causes and consequences. Issues in Ecology 1. Ecological Society of America, Washington, DC.

Waldbusser, G. G., E. R. Voigt, H. Bergschenider, M. A. Green, R. I. E. Newell. 2011. Biocalcification in the eastern oyster (Crassostrea virginica) in relation to long-term trends in Chesapeake Bay pH. Estuaries and Coasts 34:221-231.

Wan, S., D. Hui, and Y. Luo. 2001. Fire effects on nitrogen pools and dynamics in terrestrial ecosystems: A meta-analysis. Ecological Applications 11:1349-1365.

Webster, J. R. and Benfield, E. F. 1986. Vascular plant breakdown in freshwater ecosystems. Annual Review of Ecology and Systematics 17: 567-594.

Weiss, T. E., Jr. 1980. The effects of nutrient availability on the pitcher plant Sarracenia flava L. Ph. D. Dissertation, University of Georgia, Athens, GA, USA.

Wilbur, R. B., and N. L. Christensen. 1983. Effects of fire on nutrient availability in a North Carolina coastal plain pocosin. American Midland Naturalist 110: 54-61.

White, D. S., and B. L. Howes. 1994. Translocation, mineralization, and turnover of nitrogen in the roots and rhizomes of *Spartina alternifora* (Gramineae). American Journal of Botany 81:1225–1234.

White, E. M., W. W. Thompson, and F. R. Gartner. 1973. Heat effects on nutrient release from soils under Ponderosa Pine. Journal of Range Management 26:22-24.

Wolaver, T. G., J. C. Zieman, R. Wetzel, and K. L. Webb. 1983. Tidal exchange of nitrogen and phosphorus between a mesohaline vegetated marsh and the surrounding estuary in the lower Chesapeake Bay. Estuarine, Coastal, and Shelf Science 16:321-332.

World Resources Institute (WRI). 2000. World Resources: 2000-2001. Washington, DC: World Resources.