

RECLAMATION POTENTIAL OF EXPERIMENTAL OAK MAT AND
CONVENTIONAL NATURAL GAS DRILL PAD CONSTRUCTION TECHNIQUES
IN A SAGEBRUSH STEPPE COMMUNITY

by

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ABSTRACT

Conventional cut-and-fill drill pad construction associated with natural gas production displaces existing plant communities and results in surface disturbances requiring extensive soil remediation and revegetation. At the Jonah natural gas field, Wyoming, use of an oak mat drilling platform placed atop the intact landscape was evaluated to facilitate drilling while minimizing disturbances to soil and plant resources. Concerns inherent to both techniques include adverse, long-term impacts to vegetation communities, soil compaction and soil physical and chemical characteristics.

The percent change (% Δ) in grass density at oak mat removal areas (OMRA) (+37 %) was significantly greater than at cut-and-fill locations reclaimed pre-2005 (RCAF<05) (+16 %). Forb density % Δ at OMRA (+24 %) was significantly higher than at RCAF<05 locations (-86 %). At RCAF<05 locations 99 % of forb density was contributed by weedy forb species. This indicates that OMRA were more successful in promoting high grass density, maintaining forb populations and minimizing weedy forb components than RCAF<05 locations. RCAF<05 locations indicate an -84 % Δ in shrub density whereas OMRA indicate a -33 % Δ . Wyoming big sagebrush seedling density was highest at OMRA indicating that shrub density had a greater potential to recover there relative to RCAF<05 locations.

Mean soil bulk density (ρ_b) at OMRA had -3.0, +1.8 and +3.9 % Δ in depth increments between 0-30.5 cm. The mean ρ_b at cut-and-fill locations reclaimed in 2005 or later (RCAF $\geq$ 05) had +7.0, +10.9 and +11.7 % Δ in different depth increments between 0-45.7 cm. Using a ρ_b range of 1.45-1.70 g/cm³ as an indicator of potential plant growth problems, ρ_b exceeding 1.45 g/cm³ occurred infrequently at OMRA compared to RCAF $\geq$ 05 locations.

RCAF $\geq$ 05 locations had significant increases in % Δ soil saturated-paste extract EC_e (+209 %), CaCO₃ percentage (+48 %) and sand percentage (+16 %) compared to OMRA, presumably due to mixing of soil horizons. It is counterintuitive to expect that oak mats should alter physicochemical soil properties.

Although limited to construction on slopes $\leq$ 3 %, measured vegetation and soil characteristics indicated that the reclamation success of oak mat drill pads was greater than that obtained at reclaimed cut-and-fill locations.

INTRODUCTION

Issue Background

Conventional natural gas production on public land in the Jonah Field, Sublette County, Wyoming, USA, is limited to a density of one drill pad per 16.2 hectares (ha) by Bureau of Land Management regulation (USDI 2006). Drill pad spacing constraints have been implemented to balance resource development and the management of wildlife habitat, grazing leases and multiple uses on public land. The Jonah Field is approximately 53 kilometers (km) south of the town of Pinedale in western Wyoming, U.S.A., and is estimated to contain 0.3 trillion cubic meters of natural gas (Figure 1). Managed by the Bureau of Land Management, the field has a productive area of 85 km². Because of the nature of “tight sands” natural gas reservoirs within the Jonah Field, optimum natural gas recovery requires drilling numerous closely spaced wells (USDI 2006), a practice that increases the footprint of drilling activities and impacts to surface resources. Directional drilling has been the predominant method for maximizing access to these natural gas reservoirs while minimizing the surface footprint, but is often not technically feasible or economically cost effective (USDI 2006). The Jonah Field is geographically situated in close proximity to the Trapper’s Point migration bottleneck used by ungulates moving south from the Yellowstone National Park and Jackson Hole regions, and encompasses a proportion of winter foraging grounds in the Green River Valley (Figure 1). The field itself is characterized by low, gently rolling hills interspersed with buttes dominated by Wyoming big sagebrush (*Artemisia tridentata* var.

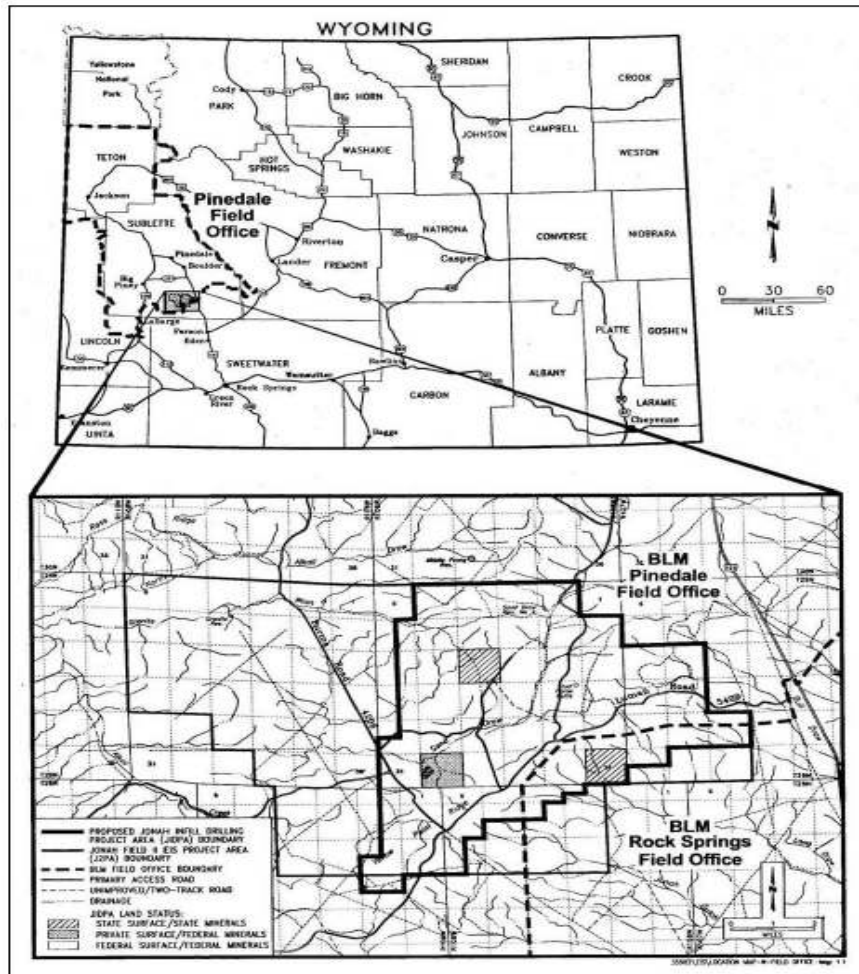


Figure 1. Wyoming map and inset containing the Jonah Field (USDI 2006).

wyomingensis) (USDI 2006).

Characteristic fauna inhabiting the field include pronghorn antelope (*Antilocapra americana*), greater sage-grouse, (*Centrocercus urophasianus*), mountain plover (*Charadrius montanus*), bald eagle (*Haliaeetus leucophalus*), ferruginous hawk (*Buteo regalis*), various raptor and passerine species, white-tailed prairie dog (*Cynomys leucurus*) and various hares, rabbits, ground squirrels, mice, rats and voles (USDI 2005; USDI 2006).

In March of 2006, the Department of Interior and Bureau of Land Management approved a proposal from EnCana Oil and Gas, U.S.A., Inc. (EnCana) to expand development in the Jonah Field by drilling as many as 3,100 additional natural gas wells on up to 6,556 ha of new surface disturbance (USDI 2006). Approval of the proposed “infill drilling” resulted in the creation of the multidisciplinary Jonah Interagency Office (JIO) who has since mandated the maximum surface disturbance acreage allowed at any one time to be 46 % of the Jonah infill drilling project area, a maximum of 5,677 ha (USDI 2006). Based on quantitative criteria developed by the JIO to determine near-term land reclamation success, “rollover credit” is granted on a hectare-by-hectare basis to natural gas producers passing those criteria. After attaining rollover credit for a reclaimed surface disturbance, an equivalent area of new disturbance is granted to the producer until the cumulative extent reaches 5,677 ha within the infill project area. As competing natural gas producers vie for the available infill acreage, additional significance has been placed on the efficacy and timeliness of drill pad reclamation.

Conventional drill pad construction at the Jonah Field uses a cut-and-fill technique to produce the level drilling surface; an approach that requires the removal of native soil and plant communities as well as costly post-drilling soil reclamation and vegetation reestablishment. Successful reclamation of cut-and-fill drill pads in the Jonah Field is impeded by the region’s continental, semi-arid, cold desert climate (USDI 2006), short frost free period (212 days in 2006), short growing season (~90 days/yr), low mean annual precipitation (19.1 cm/yr, 58 year period of record) and low mean annual temperature (2.8° C during 2006). Furthermore, previously evaluated site and seedbed

preparation techniques for conventional drill pad reclamation suggest the presence of plant growth limiting soil bulk densities may be hindering reclamation efforts (McWilliams et al. 2007).

The presented oak mat technique precludes the need to remove native soil and plant communities, stockpile soil resources and reclaim and re-vegetate drill pad areas (USDI 2005). The oak mat technique accomplishes this by placing an interlocking matrix of oak mats directly on top of soil and plant resources, enabling drilling operations with minimal surface disturbance (Figures 2, 3). At the close of drilling operations, the oak mat matrix is disassembled without trespass on native soil by retreating across the drill pad from the farthest reach back to the access road. The oak mats are then transported to the next drilling location for reuse.

Currently, 76 drilling locations at the Jonah Field have been assigned to the oak mat drill pad construction technique. Of these 76 locations, drilling and monitoring activities have been completed at 43 sites within Township 29N, Range 108W, Sections 20, 28 and 34. UTM NAD-83 coordinates for the centroid of the project area are 4700948.5748 N; 604921.557465 E. Oak mat drill pad data has been summarized by section, as well as across sections, to determine if spatially heterogeneous vegetation and soil characteristics affect reclamation success. Vegetation recovery is presented for 43 oak mat drill pad removal areas, impacts to soil bulk density are presented for 37 oak mat sites, and soil physicochemical effects are presented for 38 oak mat removal areas.

Analytical data collected from previous investigations of cut-and-fill drill pads at



Figure 2. View of a drill pad constructed with oak mats.



Figure 3. Cross section of an oak mat constructed from individual oak boards.

the Jonah Field are also presented to compare between drill pad construction techniques. Vegetation recovery is presented for 52 drill pads reclaimed before 2005 and 83 drill pads reclaimed in 2005 or later. Impacts to soil bulk density are presented for 6 sites reclaimed in 2005 or later and soil physicochemical effects are presented for 4 sites reclaimed in 2005 or later.

Objectives

The objectives of this study were to assess impacts to soils and vegetation associated with the oak mat and conventional cut-and-fill drill pad construction techniques by 1) evaluating selected plant community characteristics, and 2) evaluating impacts to selected soil physical and chemical characteristics. The goal of this study was to evaluate practices to minimize disturbance to soil and plant resources associated with natural gas drill pad construction.

LITERATURE REVIEW

Oak Mat Drill Pad Construction

Oak mat platforms were originally designed for the construction of temporary roads and aircraft landing strips on soft or sandy soils (Santoni et al. 2001). The use of mats has previously garnered attention by natural gas producers in Canadian muskeg country for the construction of temporary roads and drill pads (Houghton 2003). In the gas rich regions of the Western Canadian Sedimentary Basin (WCSB), the widespread distribution of wetlands and muskeg has made the transport of infrastructure to remote drill areas impassible after spring thaw. The use of oak and composite plastic mats in the WCSB have benefited producers by extending the window for drilling operations where only winter operations were previously logistically feasible and cost-effective (Houghton 2003).

Individual oak mat units used in the Jonah Field are 2.4 meters (m) wide by 3.7 m long and consist of three perpendicular oak planks, each 5.1 centimeters (cm) tall, which contribute to a total mat height of 15.2 cm (Figure 3). Individual oak planks are 25 cm wide and spaced at 2.5 cm intervals to help distribute the weight of the drilling equipment and increase the strength of the mats. The anticipated longevity of an oak mat in the Jonah Field is 3 to 5 years of continual use depending on the care used as oak mats are constructed, removed, transported and orientated relative to the direction of traffic (KC

Harvey, Inc. 2007). An estimated 776 mats are needed to construct a single drill pad approximately 0.81 ha in size (USDI 2005).

Oak mat drill pads require roughly half the aerial extent of the cut and fill technique as they eliminate area requirements for the soil stockpile, reserve pit and pit fill stockpile, flare pit and pit fill stockpile and condensation tanks (KC Harvey, Inc. 2007). Typically, oak mat drill pad areas are spatially arranged in a radial pattern with underground piping transporting drilling fluids and waste products to a centralized reserve pit, flare pit and condensation tank battery constructed on previously disturbed areas (KC Harvey, Inc. 2007). The approximate weight of each oak mat is 1,134 kilograms, which applies an average soil bearing pressure of 128 kg/m^2 . Because of the weight of the drill rig and auxiliary equipment, each oak mat transmits an average of 854 kg/m^2 to the soil surface (EnCana Oil and Gas Inc. et al. 2006). A maximum of $1,255 \text{ kg/m}^2$ is exerted on the area directly under the sub-structure of the drilling rig (EnCana Oil and Gas Inc. et al. 2006).

Oak mat techniques are proposed as an alternative to conventional cut-and-fill drill pad construction, but can not be used where natural site relief creates infrastructure leveling problems or safety concerns. Currently, natural gas producers believe the mats can be safely used when surface slopes are less than or equal to 3 % (USDI 2005). Site topography is currently addressed by using individual mats as “shims” to level drill platforms, or by placing a minimum amount of fill atop the oak mat matrix to level critical drilling infrastructure.

Plant Growth Response to Soil Bulk Density

Soil compaction research has shown the detrimental effects of compacted soils on the establishment and growth of agricultural plants (Taylor et al. 1966; Crockroft et al. 1969; Vorhees et al. 1975; Gerard et al. 1982, Chanasyk and Naeth 1995; Daniel et al. 2002; Donkor et al. 2002) and commercially important tree species (Minmore et al. 1969; Webster 1978; Zisa et al. 1980). In contrast, the effects of compacted soils on range plant growth in the intermountain west and the impacts of heavy machinery to soil and plant resources shielded by mats has been studied sparingly. In the absence of criteria to establish acceptable degrees of soil compaction by resource extraction activities, the “growth limiting bulk density” (GLBD) (Daddow and Warrington 1983) represents a useful concept that reflects the upper limit, or threshold bulk density where soil resistance to root penetration essentially stops plant growth. Previous research has also defined threshold bulk density as values where root elongation, root penetration, restriction or cessation of root growth, or reduction in root mass of individual plant species is attributed to a particular bulk density as a function of individual soil texture (Grimes et al 1975; Bar-Yosef and Lambert 1981; Greacen and Gardner 1982; Jones 1983; Bengough and Mullins 1991; Sumner 1999; Tokunaga 2006).

According to Daddow and Warrington (1983), soil texture has the greatest influence on the GLBD because of its effect on soil pore size and mechanical resistance. A soil with a large amount of fine particles (silt and clay) will have smaller pore diameters and a given penetration resistance at a lower bulk density than a soil with a large amount of coarse particles. Because of this relationship, coarse-textured soils will

usually have a higher GLBD than fine-textured soils. This relationship is modified by soil structure and the effects of soil aggregation. Daddow and Warrington (1983) estimated the GLBD for 80 different soils with textures distributed throughout the USDA soil textural triangle based on the packing density model developed by Gupta and Larson (1979). Isodensity lines on Figure 4 represent equal GLBD values and are used to estimate the GLBD of a soil.

Recommendations of plant root growth constraining bulk density values developed specifically for rangeland environments are uncommon. Table 1 was published by the USDA Natural Resources Conservation Service (2001) in association with other federal agencies (the USDA Soil Quality Group, Grazing Lands Technology Institute, National Soil Survey Center, Agricultural Research Service and the USDI Bureau of Land Management) to address this research gap.

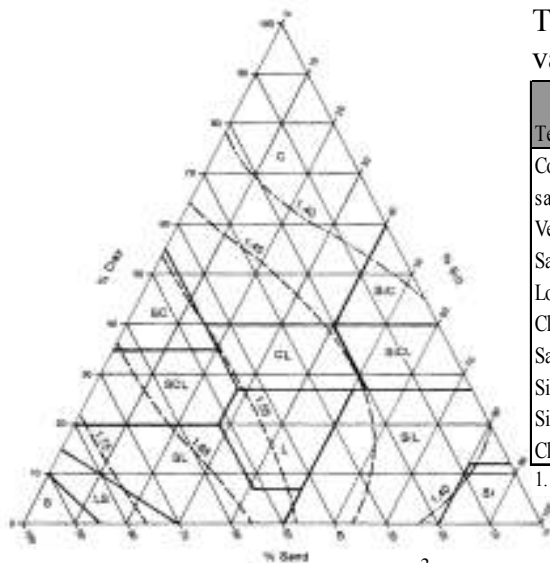


Figure 4. Isodensity lines (g/cm^3) based on soil texture that represent growth limiting bulk densities (Daddow and Warrington 1983).

Table 1. Root restricting bulk density values (USDA 2001).

Texture	Root Restricting Bulk Density (g/cm^3) ¹
Coarse, medium and fine sand and loamy sand other than loamy very fine sand.....	1.80
Very fine sand, loamy fine sand.....	1.77
Sandy Loam.....	1.75
Loam, sandy clay loam.....	1.70
Clay loam.....	1.65
Sandy clay.....	1.60
Silt, silt loam.....	1.55
Silty clay loam.....	1.45
Clay loam.....	1.40

1. Grams per cubic centimeter.

MATERIALS AND METHODS

Vegetation Sampling

During June 2007, vegetation communities were measured at 43 Jonah Field oak mat drill pads 8 to 331 days after oak mat removal. Vegetation communities were measured approximately 2 to 15+ years post reclamation at 52 cut and fill drill pads reclaimed and seeded before 2005. The Daubenmire method (Daubenmire 1959) was used to measure vegetation establishment and growth traits at these oak mat and cut and fill drill pads. During May, June and July of 2007, vegetation communities were measured by an EnCana contractor 6 to 19 months post-reclamation at 83 cut and fill drill pads reclaimed and seeded in 2005 or later using the point-intercept method.

Monitoring Oak Mat Areas and Cut and Fill Locations Reclaimed Before 2005

Two 15.2 m transects were randomly located and oriented within oak mat removal areas and pre-2005 reclaimed cut and fill drill pads. Two 15.2 m control transects were also located in the undisturbed range adjacent to each oak mat or cut and fill location to serve as a basis for comparison. A 50 x 50 cm Daubenmire frame was placed at 3.05 m intervals to the left side of each transect and plant species present were recorded. If plants could not be identified to species (e.g. young forbs), they were grouped by life-form and designated weedy or desired species if possible, with each species given a unique identifier (e.g. weedy forb 1, weedy forb 2). The number of species within a life-form equates to the term species richness. The number of stems per-

frame per-plant species were also recorded (species stem density). Non-rhizomatous plants were counted as one stem. Non-rhizomatous plants with multiple stems radiating out from one basal root were counted as one stem (e.g. sagebrush). Grasses and rhizomatous plants were counted by tiller or stem. For shrubs, those in a seedling stage (i.e. not mature) were counted separate from mature plants. Finally, canopy cover (%) per plant species, percent ground cover by rock, bare ground and litter were recorded. Canopy cover is the percentage of the soil surface covered by the vertical projection of a species regardless of what is below. Rocks less than a 0.64 cm in effective diameter were counted as bare ground.

A paired t-test was used to determine whether treatment means were significantly different ($p \leq 0.05$). Non-normal data were analyzed using the Wilcoxon Signed Rank Test.

Differentiation between Cut and Fill Locations Reclaimed Before 2005 and Those Reclaimed in 2005 or Later

At cut and fill locations reclaimed before 2005, the exact dates of reclamation, reclamation techniques used, best management practices and seeding rate were not recorded and are unknown. The seed mixes used may or may not have contained forb, shrub or undesirable plant species components and may or may not have been designed to establish a vegetative community with the same composition as the undisturbed range. Best available information indicates that these locations were reclaimed between the late 1990s and 2005. Since 2005, regulatory agencies in the Jonah Field have placed additional importance on techniques for mitigating drill pad compaction and preparing

seed beds to optimize the reclamation potential of cut and fill drill pads, indicating that the reclamation success and trajectory of drill pads reclaimed in 2005 or later may exceed that of pre-2005 reclamation efforts.

In May, June and July of 2007, vegetation communities were monitored by an EnCana contractor at 83 cut and fill drill pads reclaimed in June of 2005 or later. These 83 locations received an assortment of location specific reclamation techniques that included combinations of site ripping to mitigate compaction, site specific seed mixes and seed rates, drilling and broadcast seeding techniques, seeding of forb and shrub “islands,” seeding of grass in advance of forbs and shrubs, sage seedling plugs (one location), applying fertilizer, supplemental irrigating, crimped straw mulch, fencing, soil gypsum amendments and straw wattles. Vegetation monitoring data at these locations were recorded using the basal point-intercept method to determine vegetative frequency and basal cover along transects. Frequency is the percentage of possible plots, or points, within a sampled area occupied by a particular species or life form and is a quantitative expression of the presence or absence of individuals in a population (Elzinga et al. 1998). The relationship between plant frequency and density has been discussed previously by Greig-Smith (1983), who concluded that the relationship is only consistent with randomly distributed plants. Basal cover is defined as the area of ground surface occupied by the basal portion of plants, independent of the extent of canopy or foliar cover (Elzinga et al. 1998). High basal cover does not necessitate high canopy cover, and vice versa. Data collected at the 66 pre-2005 cut and fill drill pads, as well as the 43 oak mat removal

areas, used the Daubenmire method (Daubenmire 1959) to determine density and canopy cover.

Because of differences in sampling methodology and the incompatibility of conclusions based on vegetative density versus frequency and vegetative canopy cover versus basal cover, basal point-intercept vegetation data from the 83 cut and fill locations receiving location specific reclamation in 2005 or later must be interpreted independent of the 43 oak mat removal areas and 66 pre-2005 reclamation locations. Although presented and discussed, no direct or statistical comparisons may be made between vegetation at the 83 sites monitored using the basal point-intercept method and the other vegetation analysis generated by this study.

Monitoring Cut and Fill Drill Pads Reclaimed in 2005 or Later

One 61 m transect was randomly located and oriented within cut and fill drill pad locations reclaimed in 2005 or later and one 61 m control transect was located in the nearby undisturbed range to serve as a basis for comparison. At 0.6 m intervals, a ten pin point-frame was placed to the left and right sides of each transect and measurements concerning forb and shrub basal cover were measured to determine frequency. The number of forb and shrub species measured during pin point-frame monitoring was also recorded. Photographs were taken in each of the four cardinal directions at the beginning of each transect. At the 3.05 m mark, a photo was also taken of a 0.25 m² frame to show a sample of the vegetation.

A paired t-test was used to determine whether treatment means were significantly different ($p \leq 0.05$). Non-normal data were analyzed using the Wilcoxon Signed Rank Test.

Comparison of Plant Growth Characteristics Between Techniques.

To normalize differences in measured vegetation data between the oak mat and pre-2005 cut and fill location reference areas, reference area vegetative characteristics were averaged to facilitate unbiased comparisons between the construction techniques. Vegetation monitoring data from 83 cut and fill drill pads reclaimed in 2005 or later is not presented, as differences in the vegetation monitoring methodology preclude comparison to the oak mat dataset.

Soil Bulk Density Sampling

A Troxler nuclear density and moisture gauge (Troxler Electronic Laboratories, Inc, Research Triangle Park, NC) was used at oak mat and reclaimed conventional drill pads to measure soil bulk density (ρ_b) (Figure 5). The Troxler instrument uses an Am-241/Be radioactive source to determine soil moisture content and a Cs-137 radioactive source to determine the wet soil bulk density. An internal processor subtracts the water content from the wet bulk density value to yield the soil bulk density in pounds per cubic feet. Values were converted to grams per cubic centimeter (g/cm^3). Before measuring soil bulk density, a 2 cm diameter stake was pounded into the soil to 30.5 cm to allow entry of the radioactive probe to the prescribed depth increment.

Oak Mat Area Soil Bulk Density

Before drilling activities, ρ_b was measured at oak mat drill pads using a Troxler nuclear density and moisture gauge at six random locations across each drill pad area (Figure 6A). At each of the six locations, ρ_b was measured from 0-5.1 cm, 0-15.2 cm and 0-30.5 cm. A survey grade GPS and labeled surface markers were used to permanently locate each initial measurement location to facilitate later re-measurement after oak mat removal. A compass was used to orient the Troxler instrument north of the probe-entry hole to ensure that repeat measures of bulk density represent the same volume of soil for later value comparison. After oak mats were removed, measurement locations were relocated using the survey grade GPS / surface markers and bulk density was again measured at the same locations and depth increments with the instrument again oriented north.

The nuclear density gauge was not used to collect intermediate depth increment data at oak mat drill pad locations (i.e. 5.1-15.2 cm and 15.2-30.5 cm depths), as it requires excavation of soils subsequent to the measurement of the surface depth increment. If soils were excavated previous to oak mat construction (to facilitate measurements at distinct depth increments), bulk densities measured after oak mat removal would reflect changes in soil density inherent to previous excavation and re-filling that could not be separated from changes inherent to the drill pad construction

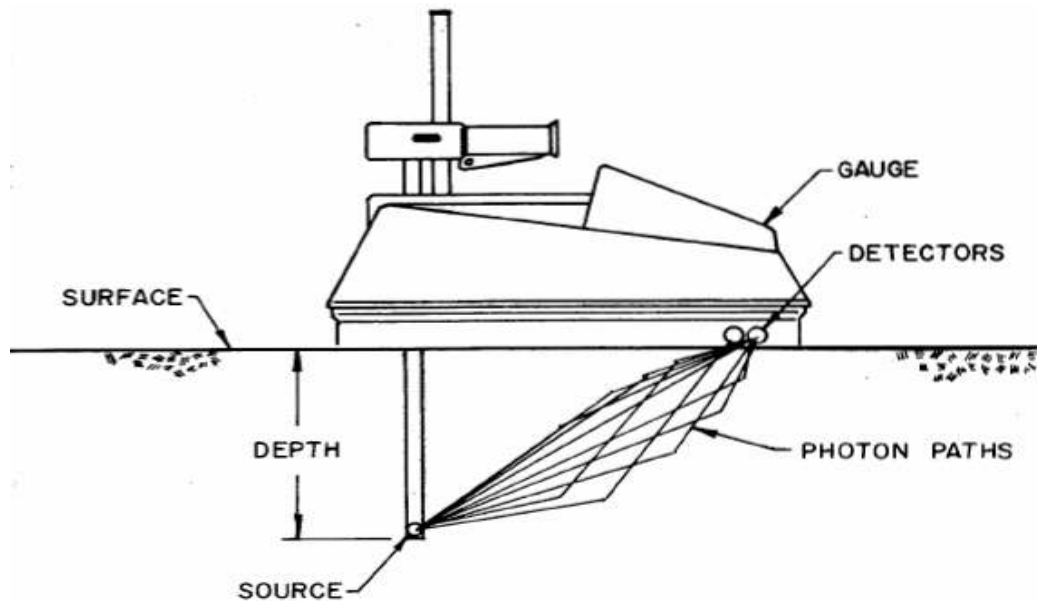


Figure 5. Cross section diagram of the Troxler nuclear density and moisture gauge used to measure soil bulk density in the Jonah Field.

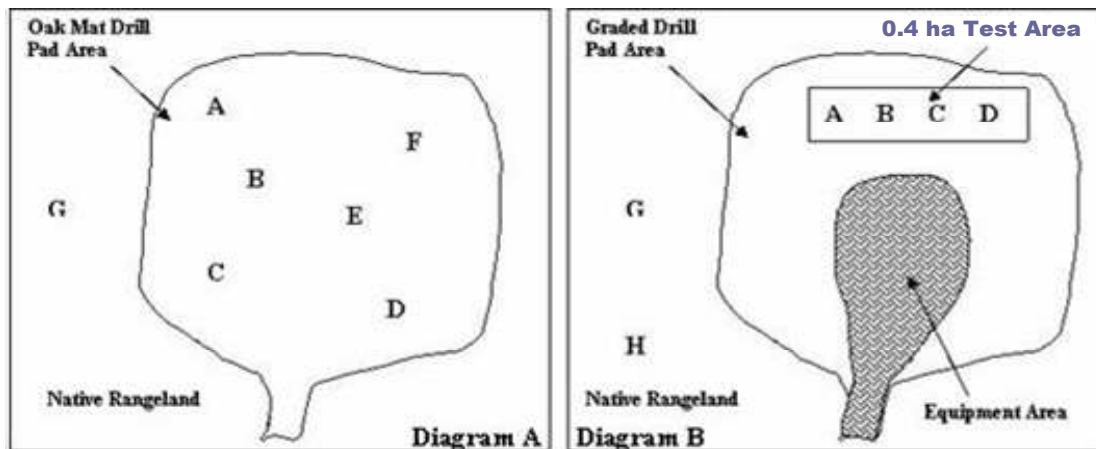


Figure 6. Plan view of generalized bulk density measurement locations at oak mat areas (diagram A) and cut and fill locations reclaimed in 2005 or later (diagram B).

technique. Data were collected to evaluate a weighted average approach to back-calculate intermediate depth increment bulk densities that were not directly measured from the current depth increment data. The weighted average approach was not capable

of predicting intermediate depth increment bulk density values to an acceptable level of accuracy.

A two way ANOVA was used to determine whether mean bulk densities measured before and after oak mat construction and removal at individual drill pad differed ($p \leq 0.05$). If mean drill pad densities measured before and after oak mat construction and removal were determined to be different, they were separated using the Tukey test. Data for two drill pad locations in Section 34 were non-normal and were analyzed using the non-parametric one-way Kruskal-Wallis ANOVA on ranks to determine whether significant differences were present ($p \leq 0.05$). A paired t-test was used to determine whether treatment means within an entire section were significantly different ($p \leq 0.05$). Data that were non-normal were analyzed using the Wilcoxon Signed Rank Test.

Soil Bulk Density at Cut and Fill Locations Reclaimed in 2005 or Later

Six cut and fill drill pad locations reclaimed in 2005 or later were selected to represent the current range in reclamation techniques used in the Jonah Field to minimize compaction and prepare the seedbed. Of the six, two sites were ripped previous to coversoil application and then chiseled, two sites were ripped subsequent to coversoil application and then chiseled and, two sites were ripped subsequent to coversoil application with an alternative ripper and then chiseled. The Troxler nuclear density and moisture unit used at oak mat areas was again used to measure ρ_b at four locations within a 0.4 hectare sub-area of each conventional drill pad and at two off-pad reference

locations in the undisturbed native range (Figure 6B). Soil bulk density measured within conventional drill pads were compared to the adjacent undisturbed control locations, as pre-disturbance bulk density measurements were not collected. At each of the six locations, ρ_b was measured at 0-5.1 cm, 5.1-15.2 cm and 15.2-45.7 cm increments. To measure ρ_b within the distinct 5.1-15.2 cm and 15.2-45.7 cm depth increments, soil was excavated to the top of each sampling depth to facilitate measurement of that increment. Measuring bulk densities at distinct depth increments with the Troxler gauge provides more insight to the distribution of soil density increases or decreases within the soil profile than can be attained by measuring overlapping depth increments, but precludes the ability to collect post disturbance density measurements from the same volume of soil measured previous to disturbance. The decision to measure distinct depth increments at cut and fill locations, as opposed to overlapping increments, was weighed in favor of characterizing the distribution of density increases in the soil profile.

A paired t-test was used to determine whether ρ_b means for individual drill pads measured before and after oak mat construction and removal were significantly different ($p \leq 0.05$). Data without equal variance were analyzed using the Wilcoxon Signed Rank Test.

Soil Bulk Density at Oak Mat Roadways

Oak mats were butted end-to-end to make a 7.3 m wide road providing access into oak mat drill pads. Except for one location, all vehicles, including those loaded with the drill rig equipment, used this access during the drilling and well completion time period.

The proposed roadway locations sampled in 2006 (prior to drill pad construction) were not sampled in 2007 because of safety limitations regarding use of the Troxler gauge near pipelines. Therefore, five alternate roadways not associated with underground pipelines were selected for soil bulk density measurements.

At each of the access roadways, six measurement locations were placed more or less equidistantly along the length of the previously matted extent. An additional six ‘control’ locations were selected within the undisturbed areas adjacent to each of the six roadway measurement locations in a pair-wise fashion. At each sample location, the 0-5.1, 0-15.2 and 0-30.5 cm depth increment ρ_b was measured.

A two way ANOVA was used to determine whether oak mat roadway ρ_b means were different ($p \leq 0.05$) from the nearby undisturbed range. If treatment means differed, they were separated using the Tukey test.

Precision of the Troxler Gauge

At seven locations, soil bulk density measurements were repeated for the 0- 5.1 cm, 0-15.2 cm and 0-30.5 cm depth increments to determine relative percent difference (RPD). RPD is calculated using:

$$RPD = [(Duplicate\ 1 - Duplicate\ 2) / ((Duplicate\ 1 + Duplicate\ 2) / 2)] * 100$$

RPD ranged from 0 to 1.6 % and suggests that as much as 1.6 % error can be introduced into soil bulk density measurements because of measurement reproducibility (Table 2).

Table 2. Relative percent difference (RPD) in soil bulk density measurements.

Soil Dry Bulk Density (g/cm ³)			
Sample	Soil Depth (cm)		
	0-5.1	0-15.2	0-30.5
SHB 34-28, Location 4			
Duplicate 1	1.40	1.54	1.59
Duplicate 2	1.39	1.54	1.59
RPD	0.70	0.00	0.00
SHB 47-28, Location 3			
Duplicate 1	1.29	1.35	1.40
Duplicate 2	1.27	1.36	1.39
RPD	1.60	0.70	0.70
SHB 31-34, Location 3			
Duplicate 1	1.32	1.37	1.44
Duplicate 2	1.32	1.38	1.45
RPD	0.00	0.70	0.70
SHB 47-34X, Location 5			
Duplicate 1	n/a [†]	n/a	1.62
Duplicate 2	n/a	n/a	1.61
RPD	n/a	n/a	0.60

Soil Dry Bulk Density (g/cm ³)			
Sample	Soil Depth (cm)		
	0-5.1	0-15.2	0-30.5
SHB 68-28, Location 1			
Duplicate 1	1.27	n/a	n/a
Duplicate 2	1.27	n/a	n/a
RPD	0.00	n/a	n/a
SHB 52-28, Location 4			
Duplicate 1	1.42	n/a	n/a
Duplicate 2	1.42	n/a	n/a
RPD	0.00	n/a	n/a
JF 7-7X, Location 3			
Duplicate 1	1.12	n/a	n/a
Duplicate 2	1.12	n/a	n/a
RPD	0.00	n/a	n/a

[†] Data not collected for specific depth increment.

Accuracy of the Troxler Gauge

Accuracy of the Troxler Gauge was addressed using four methods. First, factory calibration determined density versus count-rate computations and normalized calibration data to a standard. This effectively eliminates long term effects of source decay and electronic drift (Troxler Electronic Laboratories, Inc., 1975). Second, annual calibration tests are performed by an independent laboratory using guidelines and standards set forth by the Nuclear Regulatory Committee, ASTM and AASHTO. Third, a standard count was used daily to compensate for the decay process of both radioactive sources which enables the gauge to operate accurately within the range of the factory prescribed calibration. If the instrument accepts the daily calculated standard count, readings can be

accurately made in the field. No standard count discrepancies were encountered during the measurement of soil bulk density in the Jonah Field. Finally, soil bulk densities measured with the Troxler gauge were compared to the bulk density determined by soil sampling and laboratory procedures at a subset of locations and depth increments. Following a Troxler gauge bulk density measurement, a 5.1, 15.2 or 30.5 cm long Shelby tube was inserted vertically into the ground at 41 locations using the hydraulic foot of a Giddings soil sampling machine to procure intact soil cores from the aforementioned depth increments. After the core was inserted, a sharpshooter spade was used to excavate the Shelby tube and encased soil core and a knife was used to pare the sample flush with the bottom of the cylinder. During 2006 and 2007, twelve 5.1 cm, fourteen 15.2 cm and fifteen 30.5 cm deep cores were collected in this fashion. Shelby tube soil samples were removed from the steel cylinder and oven dried for 96 hours at 50° C, or until a constant weight was attained. The soil bulk density (ρ_b) was determined by dividing the weight of the oven dried sample (g) by the volume of the Shelby tube (cm³).

Linear regression was used to compare laboratory determined ρ_b to Troxler gauge ρ_b for the 0-5.1, 0-15.2, and 0-30.5 cm depth increments, and the coefficients of determination (r^2) were calculated.

Soil Physicochemical Sampling

Oak Mat Area Soil Physicochemical Sampling

Each oak mat drill pad was divided into six equal sub-areas. Within each sub-area, a random location was soil sampled to 61.0 cm at 0-15.2 cm, 15.2-30.5 cm, and

30.5-61.0 cm depth increments. Samples from each sub-area were composited to yield three soil samples from each drill pad (0-15.2 cm, 15.2-30.5 cm, and 30.5-61.0) for laboratory analyses. A Giddings truck-mounted hydraulic probe (Giddings Machine Company, Inc., Windsor, CO) was used to facilitate collection of a 5.1 cm diameter soil core at each location. In addition, within these same six sub-areas at each drill pad site, a 0-5.1 cm soil sample was collected with a hand trowel. These six 0-5.1 cm sub-samples were composited by drill pad to determine carbon-nitrogen ratios. This procedure was used before mat construction and after mat removal as well as at cut and fill locations reclaimed in 2005 or later. Soil samples from oak mat and cut and fill locations reclaimed in 2005 or later were analyzed by Energy Laboratories, Helena, MT. (Table 3).

Soil Physicochemical Sampling at Cut and Fill Locations Reclaimed in 2005 or Later

Based on the aerial extent of the reclaimed drill pad area, three to six 5.1 cm diameter soil cores were collected randomly at each of the four reclaimed / re-contoured drill pad locations, to a depth of 61 cm, using a Giddings Probe. At two locations, samples were collected at 0-15.2 cm and 15.2-61.0 cm depth increments, at the remaining two sites, samples were collected from 0-30.5 and 30.5-61.0 cm depth increments. Soil cores were also collected from the nearby undisturbed range as a control. Soil samples within the nearby undisturbed range were collected from 0-15.2, 15.2-30.5 and 30.5-61.0 centimeters. Both on-pad and control samples were composited by depth for analysis. Because of inconsistencies between the soil depths measured and the small available dataset, a depth weighted average was applied to data collected from each drill pad and

Table 3. Soil analytical methods.

Analyzed Parameter	Method Description
C:N	The carbon : nitrogen ratio was determined using the following relationship. Organic Carbon : (Total Kjeldahl Nitrogen + NO ₃ -N).
Total N	Method 31-3. Regular Kjeldahl method. Methods of Soil Analysis, American Society of Agronomy, 1982.
NO ₃ -N	Method 33-8.3. Copperized cadmium reduction method. Methods of Soil Analysis, American Society of Agronomy, 1982.
P	Method 24-5.4. Phosphorus soluble in sodium bicarbonate. Methods of Soil Analysis, American Society of Agronomy, 1982.
K	Method 13-3.3.1. Neutral 1M ammonium acetate extraction. Methods of Soil Analysis, American Society of Agronomy, 1982.
EC	Method 10-3.3 Determined in a water extract from a saturated soil paste (method 10-2.3.1). Methods of Soil Analysis, American Society of Agronomy, 1982.
pH	Method 10-3.2 Determined in a water extract from a saturated soil paste (method 10-2.3.1). Methods of Soil Analysis, American Society of Agronomy, 1982.
SAR	Method 10-3.4. Soluble cations (Ca, Mg, Na) determined in a water extract from a saturated soil paste (method 10-2.3.1). Methods of Soil Analysis, American Society of Agronomy, 1982.
% CaCO ₃	Method 23C. Alkaline-earth carbonates from acid neutralization. USDA Agricultural Handbook No. 60, Washington, D.C.
Organic-C	Method 29-3.5.2. Walkley-Black procedure. Methods of Soil Analysis, American Society of Agronomy, 1982.
Texture	Modified from ASTM (1992) Method D422-63 or Method (pages 383-393, 404-408). Methods of Soil Analysis, American Society of Agronomy, 1982. The hydrometer method with particle size
% Rock	Dry sieving was used after the sample passed through a mechanical 'flailer' to disaggregate soil peds.
% Saturation	% Saturation was determined using saline and alkaline soils USDA Handbook 60 method 27a. Saturation percentage = (loss in weight on drying)X 100/(weight of the oven-dry soil).

control area to calculate average analytical soil physical and chemical values from 0-61.0 cm.

A paired t-test was used to determine whether soil physical and chemical values measured at individual drill pads before disturbance and after reclamation were different ($p \leq 0.05$).

Comparison of Soil Physicochemical Characteristics Between Construction Techniques

A depth weighted average approach was used to summarize soil physical and chemical characteristics at oak mat areas to a single 0-61 cm increment, identical to the approach used at reclaimed cut and fill locations. To account for absolute changes in soil

physical and chemical characteristics associated with each construction technique relative to their reference areas, percent change for each analyte was calculated to allow direct comparison between techniques. Using the list of native plant species generated by Jonah Field vegetation monitoring, growth requirements for the proportion of species with available data were determined using the USDA Plants Database (USDA 2007) to determine whether soil physicochemical characteristics resulting from both techniques could limit the growth potential of sensitive plant species in the Jonah Field.

Effects of Soil Physicochemical Characteristics on Plant Growth Responses

Attempts to determine and quantify soil physical and chemical levels with the potential to affect resulting plant growth responses in the Jonah Field are provided in the results and discussion, but are de-emphasized because of concerns of limited criteria accuracy and applicability. Emphasis is instead placed on the relative magnitude of *changes* in soil physical and chemical characteristics associated with each construction technique.

This de-emphasis stems from region and activity specific soil, topsoil, overburden and soil substitute suitability criteria developed by regulatory agencies which suggest opposing or conflicting optimum soil physicochemical levels for reclamation activities. In general, these criteria fail to indicate research upon which their recommendations are based and fail to indicate the applicability of their recommendations to varying ecotypes, preexisting geologies, vegetation communities and climatic regimes. The utility of these

sources is based not on their accuracy, or ability to prevent negative plant growth responses, but on their regulatory and enforcement authority and their design for local or situational applicability. Oak mat and cut and fill soil physical and chemical levels were evaluated using criteria adapted from the Wyoming Department of Environmental Quality, Land Quality Division (1981) to establish suitability as topsoil, and Montana Department of Environmental Quality unsuitability criteria for soil and soil substitutes (MT DEQ 1998). Additionally, electrical conductivity of water saturated paste extracts are evaluated based on quantitative categories determined by the USDA to interpret relative plant sensitivity and by Sobek et al. (2000). These sources are presented only to provide a relative datum with which to identify potential soil physicochemical imbalances.

An alternative method to determine appropriate soil physical and chemical suitability criteria is to select peer reviewed soil suitability research on an analyte-by-analyte basis. This approach also indicated limited applicability in the Jonah Field. For example, seminal research on plant and crop tolerance to soil salinity conducted by Maas and Hoffman (1977), Francois and Maas (1978) and Mass (1990) upon which plant salinity thresholds are greatly based, represent plant production potential when salinity is the only growth limiting factor for mature plants. However, such conditions are not widely present in the Jonah Field. Besides changes in soil solute concentrations, many other plant-environment interactions may cause variations in salinity-yield relationships, such as those involving temperature, radiation, humidity, atmospheric pollutants, wind, soil water content and fertility (Maas 1990). Furthermore, differences in the dominant

soil salt species influence the interpretation of the soil electrical conductivity of the saturated paste extract (EC_e). In contrast to chloridic soils, sulfatic soils may appear to be saline when exhaustively extracted in the lab (i.e., in a saturated paste extract), but the *in situ* soil solution may be nonsaline because of the limited solubility of gypsum and other sulfate salts (Bernstein, 1975). Difficulty in applying soil salinity thresholds reported by authors such as Maas and Hoffman (1977), Francois and Maas (1978) and Mass (1990) result from differences in reported plant response to salinity under experimental conditions versus those conditions encountered in the Jonah Field. To reiterate, this study emphasizes the relative changes in soil physical and chemical characteristics inherent to each construction technique as opposed to the magnitude of resulting soil physicochemical values.

Oak Matting Duration and Seasonality

Typically, a 2.5 acre pad is covered with oak mats for six weeks during drilling. When drilling is completed, a portion of these mats are removed but a central core around the borehole remains matted during installation of the above and belowground infrastructure. The time required to attain complete oak mat removal averaged 112 days and ranged from 53 to 279 days. Oak mats were constructed during all seasons of the year and the subsequent removal also occurred during all seasons of the year (Figure 7).

Recovery of vegetation density and canopy cover, and relative soil compaction

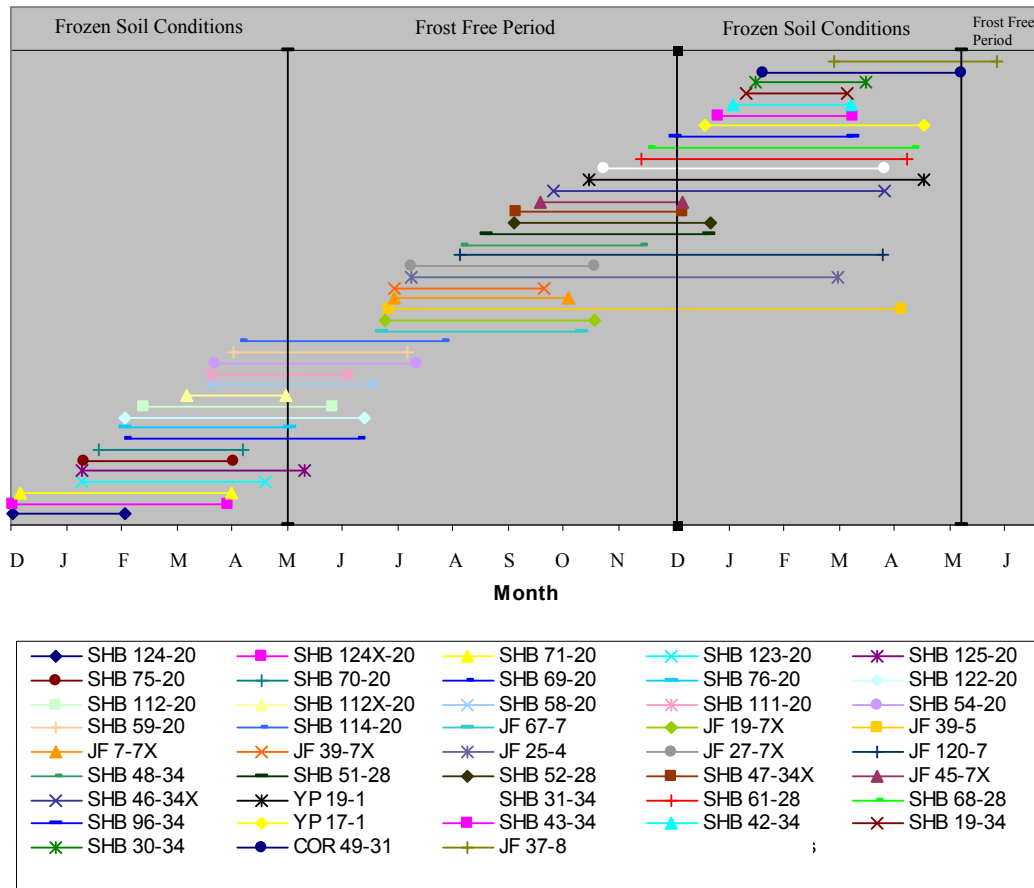


Figure 7. Duration and seasonality of oak mat coverage during 2005-2007 for 43 drill pads in the Jonah Field.

after mat removal, may be related to the duration of the matting period and the season of the year the site was matted. Furthermore, a drill pad covered with oak mats for 279 days may have a greater potential to disrupt vegetative growth compared to a drill pad covered only 53 days. An oak mat constructed and removed when the soil surface is frozen may cause less soil compaction than when the soil surface is not frozen. Therefore, oak mat construction and removal during the winter may result in less soil compaction compared to oak mat construction during the summer.

Vegetative Response to Duration of Oak Matting

Regression was used to determine whether the magnitude of plant growth characteristics measured after oak mat removal may be explained by the duration of time a drill pad was matted. Duration of matting at individual locations was determined by subtracting the date of mat construction from the date of complete mat removal. Percent change in plant *density*, relative to undisturbed rangeland, as a function of matting duration is presented for all sites investigated and for matted pads located in Sections 7, 20, 28 and 34. Regression analysis was also used to compare changes in plant *canopy cover* to the number of days required for complete mat removal.

Vegetative Response to Seasonality of Oak Matting

Additional analysis is presented to determine whether recommendations may be made to minimize vegetal and soil physical impacts based on the duration of matting and the date, or season of mat removal.

Because oak mat drill pad removal dates span from February of 2006 to May 2007, and encompass more than one winter, spring and summer period (Figure 7), the relationship of plant growth characteristics to the absolute date of oak mat removal does not follow a linear trend, and instead fluctuates sigmoidally between the active plant growth season and the season of plant dormancy. To normalize the multi season-year datasets, oak mat removal dates were given calendar dates and ordered 1 to 365 regardless of the year of removal to transform the relationship to a linear form (i.e. potential positive plant growth response when mats removed during plant dormancy and

a negative plant growth response to mat removal during the active plant growth season). Day 1 of the 365 day calendar was assigned to November 29, which corresponds to the beginning of frozen soil surface conditions in the Jonah Field as measured in 2006 and approximates the beginning of the plant dormancy season. Day 155 corresponds to May 1st, the beginning of non-frozen soil surface conditions in 2006 and approximates the beginning of the active plant growth season. Regression was used on the 365 day normalized data to determine whether the magnitude of plant growth characteristics measured after oak mat removal may be explained by the date of complete oak mat removal in relation to seasons of plant growth and dormancy.

Soil Bulk Density Response to Duration and Seasonality of Oak Matting

To quantify whether percent change in soil bulk density may be explained by matting duration and seasonality of mat removal, data were applied to correlation analyses for all sites investigated and for matted pads located in Sections 7, 20, 28 & 34.

Ancillary Plant Recovery and Soil Compaction Analysis at Oak Mat Areas

Additional analyses of the oak mat drill pad construction technique is presented to provide insight into predictor variables for vegetative growth response, to track vegetative community dynamics after oak mat removal, and to determine the utility of alternative oak mat applications (i.e. oak mat roadways). Associated analyses of cut and fill drill pads were not conducted, and are not presented.

Regression of Vegetation Traits at Oak Mat Areas

Vegetation Growth Response to Soil Bulk Density at Oak Mat Areas: Regression was used to determine whether the measured post-mat soil bulk density or the percent change in soil bulk density relative to the nearby undisturbed range could explain vegetative growth responses after oak mat removal.

Vegetation Growth Response to Soil Chemistry at Oak Mat Areas: Oak mat removal area grass, forb and shrub density and canopy cover were analyzed in response to soil physical and chemical characteristics by categorizing soil analytes for multiple regression analyses. The percent change in grass, forb and shrub responses at oak mat removal area relative to the nearby undisturbed range were also analyzed consistent to this method. To determine the plant growth response to soil alkalinity, pH and percent CaCO_3 were regressed against vegetative response. Saturation percent, EC_e , SAR and available sodium were grouped to determine the vegetative response to soil salinity and sodicity. Nitrate, total nitrogen, phosphorus and potassium were grouped to determine the vegetative response to soil fertility and calcium and magnesium were grouped for regression of micronutrients. Finally, sand and clay were grouped to determine the vegetative response to soil texture. If one of the independent variables expressed a significant multiple regression p-value and others did not, linear regression was used in attempts to isolate that variable and determine significance. Soil physical and chemical results from the post-matting 0-15.2 cm depth increment were used in each regression.

Vegetation Growth Response Interrelations at Oak Mat Areas: Regression was used to determine whether 1) grass density and/or canopy cover could be explained by forb and shrub characteristics, 2) forb density and/or canopy cover could be explained by grass and shrub characteristics, 3) shrub density and/or canopy cover could be explained by grass and forb characteristics and 4) whether plant life form canopy cover could be explained by its density. Density and canopy cover were regressed in terms of the *total* values measured after oak mat removal and the *determined* percent change relative to the nearby undisturbed range. If one of the independent variables had a significant multiple regression p-value and others did not, linear regression was used to determine whether that variable was significant when analyzed separately.

Vegetative Response after One and Two Years at Oak Mat Areas

Following mat removal, vegetation data were collected at 16 sites in SHB Section 20 during the summers of 2006 and 2007. Statistical analysis was completed for mean plant density, canopy cover and species richness for grasses, forbs, and shrubs to determine whether vegetation traits changed between the 2006 and 2007 growing seasons.

Vegetative Response at Mowed and Unmowed Oak Mat Areas

During early stages of the oak mat pilot project, concern was expressed that the presence of dense sagebrush canopies could impair assembly of oak mats. As a result, 10 sites in SHB Section 20 were mowed before oak mat construction. Relatively quickly

it became apparent that the ~760 kg mats compressed sagebrush to a degree that mat assembly was not impaired, and the mowing procedure was discontinued. Regardless, the potential exists that mowing treatments would result in differences between post-mat vegetation communities in Section 20. Vegetation recovery for mowed sites and sites not mowed was compared to the adjacent undisturbed rangeland using t-tests to determine significance.

Effect of Soil Texture on Percent Change in Bulk Density at Oak Mat Areas

Regression was used to determine whether soil bulk density measured after oak mat removal may be explained by the texture of drill pad locations. The potential exists that drill pads with high clay percentages and/or low sand percentages may be prone to increases in soil bulk density under static loading.

Statistical Analysis

All vegetation, soil bulk density and soil physical and chemical characteristics were statistically analyzed using SigmaStat statistical software at an α of 0.05 (Sigma Stat 1997). In addition to the aforementioned tests, percent change in vegetation, soil bulk density and soil physical and chemical characteristics relative to the nearby undisturbed range were compared between construction techniques using t-tests (unequal replication size within treatments). Vegetation data at mowed and unmowed oak mat removal areas

were also analyzed using t-tests. Data that was not normally distributed or did not have equal variance were analyzed using the Mann-Whitney Rank Sum Test.

Statistical analysis on the effect of matting duration and seasonality used linear regression. Linear regression was also used to compare soil bulk density values measured by the Troxler gauge to laboratory determined soil bulk density, and to compare the percent change in soil bulk density at oak mat removal areas to the measured soil texture. Linear regression data with a non-normal distribution or unequal variances were transformed. If no transformation yielded normality and equal variance, analytical results were not reported.

Finally, multiple linear regression was used to compare measured oak mat removal area vegetation characteristics, and percent change in vegetation characteristics, to 1) oak mat removal area soil bulk density, 2) percent change in bulk density and 3) soil physical and chemical characteristics. If one of the independent variables had a significant multiple regression p-value and others did not, linear regression was used to determine whether that variable was significant when analyzed separately. Linear regression data with a non-normal distribution or unequal variance were transformed. If no transformation yielded normality and equal variance, results were not reported.

RESULTS AND DISCUSSION

Plant Growth Characteristics Associated With Oak Mat Areas

Grass Density and Canopy Cover

The use of oak mats in constructing drill pad areas did not negatively impact either the density or canopy cover of grass species. Instead, oak mat use promoted greater grass density relative to the nearby undisturbed range.

Grass density was greater at oak mat areas within the all sections dataset and at Section 20 than in the comparable reference areas (Table 4, Figure 8). However, when Sections 7, 28, and 34 were analyzed separately, no difference was detected between oak mat and reference area grass density (Table 4). Placement of oak mats may facilitate increases in grass density by pressing seeds into the soil and creating favorable micro-sites for germination, minimizing evapotranspirational water losses by acting as a surface mulch and capturing winter precipitation within the oak mat matrix (EnCana Oil and Gas et al. 2006). These oak mat characteristics may be equally advantageous to each plant life form, or promote the proliferation of one at the expense of another. Grass species may have a morphological advantage over woody life forms, being less brittle and more structurally resilient to pressures temporarily applied by surface loading. Also, competition is decreased when oak mats crush older, more decadent shrubs, thereby creating openings for increased grass growth.

Grass canopy cover was similar between oak mat and reference areas for the all sections dataset, and also within each section individually (Table 4, Figure 10). The

canopy cover contribution by grass stems is usually small, on the order of 1 to 3 percent. Therefore, greater grass density (stems/m²) does not always contribute to greater canopy cover. Also, the canopy cover for a grass species averaged across an entire transect often resulted in fractional percentages, which were rounded to 1 percent for the purposes of comparison. Rounding may have resulted in more similarity between the matted and reference areas than would be expected based on the significantly higher grass density overall at oak mat areas. Furthermore, a significant positive relationship between grass cover and grass density at oak mat removal areas was determined and indicates that greater grass cover should be predicted by greater grass density (see Regression of Vegetation Traits at Oak Mat Areas)

In addition to comparing vegetative characteristics between oak mat removal areas and the nearby undisturbed range, the relative comparability of disturbed and undisturbed vegetation communities may be evaluated by differences in life form prevalence. On average, grass density comprised a 95 % proportion of the total vegetative density associated with oak mat removal areas and a 40 % proportion of the total canopy cover (Table 5). Within the nearby undisturbed range, grass contributed 93 % of the total vegetative density and 20 % of the total canopy cover. These results indicate that oak mats maintain grass density (relative to forb and shrub densities) similar to the proportion measured in the reference community. Although grass density was similar between oak mat removal areas and the reference, the grass canopy cover (relative to forbs and shrubs) was greater at oak mat removal communities. This may result from the low shrub canopy cover measured at oak mat removal areas.

Forb Density and Canopy Cover

Forb density was similar across all sites, as well as within individual sections (Table 4, Figure 9). Mean forb canopy cover was also similar across all sites as well as within individual sections. Forbs, which are of low stature (i.e. propagate in near vicinity to the soil surface) and relatively succulent and non-brittle, were likely impacted minimally by the weight of the oak mats, promoting recovery upon oak mat removal.

The forb component of total vegetative density was numerically equivalent between oak mat removal areas and the reference. Forb canopy cover within oak mat removal areas was higher, on average 25 % of the total canopy, whereas 13 % of the canopy cover within reference areas was comprised of forbs (Table 5). To a degree, greater canopy cover at oak mat removal areas can be attributed to the contribution of forb density and cover by weedy forb species. Of the total forb *density* measured at oak mat removal areas, weedy forb species constitute 21 %, whereas only 3 % of forb density within the nearby undisturbed range were weedy species (Table 6). Weedy forb species constitute 33 % of the forb *canopy cover* measured at oak mat removal areas, whereas weedy forbs contribute only 6 % to canopy cover in the nearby undisturbed range (Table 6).

Weedy forbs were identified as a component of reference vegetation communities, but oak mat removal areas have a higher proportion of undesirable weedy forbs within the vegetation community as a whole. Weedy forbs observed at oak mat removal areas were most prevalent in proximity to soil disturbances associated with gas line burial, well head installation and access roads.

Shrub Density and Canopy Cover

Oak mat use negatively impacted the density and canopy cover of shrub species. Mean shrub density and canopy cover were statistically lower across all sites, as well as within Sections 7, 20 and 34. Shrub density and canopy cover were similar between the reference and drill pads in Section 28 (Table 4, Figures 10, 11).

Although shrub density and canopy cover were lower at oak mat removal areas, this may be beneficial to the landscape as a whole by effectively removing old, brittle, more decadent shrubs which increases future forage availability and contributes to a “mosaic” type landscape, but may also constitute a reduction in habitat quality for species of concern, such as the sage-grouse, or a shift in the composition from the dominant vegetation metacommunity.

At oak mat removal areas, shrub density comprised 2 % of the total plant density and 35 % of the total canopy cover. The proportion of shrub density within reference areas was higher, 4 %, with shrub canopy cover comprising 67 % of the total (Table 5). This indicates that the density and canopy cover of shrubs, as well as the proportion of shrubs within the vegetative community is lower at oak mat removal areas relative to the nearby undisturbed range. Within reference areas, the largest single component of shrub density and cover was Wyoming big sagebrush, which contributed on average 48 % of the total shrub density and 81 % of the total shrub canopy cover (Table 7). Observations indicate that mature sagebrush are less capable of recovery when the crown is subjected to the crushing pressures of oak mats, but that smaller auxiliary branches at the periphery

of the crown tend to survive and produce seed. Juvenile sagebrush also appear to be more resilient to the oak mat technique. Thus, lower shrub density and canopy cover proportions at oak mat removal areas are partially a result of less Wyoming big sagebrush.

Wyoming Big Sagebrush and Sagebrush Seedling Density and Canopy Cover

Changes in regulatory requirements for revegetation of disturbed rangelands in the Great Plains and Great Basin of the Western U.S., have placed special attention on native shrub reestablishment, with specific consideration of Wyoming big sagebrush (*Artemisia tridentata* var. *wyomingensis*). Although much research has been accomplished to develop an understanding of Wyoming big sagebrush seed physiology, germination, dormancy, viability and seedbed ecology (Bai et al. 1997; Schuman 1999; Fortier 2000; Kleinman and Richmond 2000), conventional methods for sagebrush reestablishment in the Western U.S. typically have mixed results.

At all sites, the oak mat construction technique reduced the density and canopy cover of Wyoming big sagebrush and Wyoming big sagebrush seedlings relative to the nearby undisturbed range (Table 4). Mean Wyoming big sagebrush and sagebrush seedling density and canopy cover were lower across all sites compared to reference areas (Table 4).

The proportion of total shrub density and canopy cover contributed by Wyoming big sagebrush and Wyoming big sagebrush seedlings differed considerably between oak mat removal areas and the nearby undisturbed range. Within the nearby undisturbed

range, Wyoming big sagebrush comprised 48 % of the total shrub density and 81 % of the total shrub canopy cover. Within oak mat removal areas, 25 % of the shrub density and 39 % of the shrub canopy cover was Wyoming big sagebrush (Table 7).

According to the Final EIS for the Jonah Infill Drilling Project (USDI 2006), sagebrush canopy cover is considered a determining factor for sage-grouse habitat utility. Sage-grouse are considered a high priority management species for the Wyoming Game and Fish Department and are also listed as a sensitive species by the Wyoming BLM (USDI 2006). “Nesting habitat for sage-grouse in Wyoming is generally described as sagebrush that has a canopy cover between 15 and 30 % and heights between 11 and 32 inches (28-81 cm). Early brood rearing habitat generally has 10 to 25 % sagebrush canopy... Sage-grouse tend to select wintering sites where sagebrush is 10-14 inches above the snow (25-36 cm) with sagebrush canopy cover ranging from 10-30 %” (USDI 2006). Wyoming big sagebrush canopy cover measured at oak mat removal areas averaged 13.7 % of the *total* vegetative canopy cover of grasses, forbs and shrubs. Although sagebrush height data were not measured at oak mat removal areas, this value indicates that mean sagebrush canopy cover at oak mat removal sites is adequate for sage-grouse brooding and wintering sites, but is inadequate for nesting habitat.

Although the density and canopy cover of Wyoming big sagebrush is statistically lower at oak mat removal areas (relative to reference areas), the potential for a rebound in sagebrush populations is present. The *proportion* of Wyoming big sagebrush seedling density is higher at oak mat removal areas than in the nearby undisturbed range and considerably higher than that measured at cut and fill locations reclaimed pre-2005.

Within the nearby undisturbed range, 17 % of the total shrub density was Wyoming big sagebrush seedlings. Measured within oak mat removal areas, 23 % of the shrub density was contributed by Wyoming big sagebrush seedlings (Table 7). Wyoming big sagebrush seedling canopy cover in the Jonah Field was generally less than 1 % and was rounded up to 1 % at both areas as an indicator of presence. The proportion of these seedlings reaching maturity at oak mat removal areas and the extent of the sagebrush rebound will be dependent on a number of factors including precipitation, competitive stresses, grazing pressure, seasonal soil moisture, etc. Future vegetation monitoring at oak mat removal areas will provide insight into the recovery of Wyoming big sagebrush populations at oak mat removal areas.

Plant Growth Characteristics
Associated With Reclaimed Cut and Fill Locations

Forb and Shrub Frequency and Diversity
at Drill Pads Reclaimed and Seeded in 2005 or later

Table 8 summarizes the vegetation monitoring data received from an EnCana contractor for 83 cut and fill drill pads reclaimed in 2005 or later. Table 8 indicates that forb and shrub frequency and diversity are lower at these reclaimed cut and fill locations

Table 4. Summary of mean vegetative density and canopy cover for oak mat removal areas compared to the nearby undisturbed range ($\alpha=0.05$).^Ψ

	Number of Sites	Parameter	GRASS			FORB			SHRUB		
			Reference Area	Matted Area	p-value	Reference Area	Matted Area	p-value	Reference Area	Matted Area	p-value
All Sections	43	Mean Density [†]	182.49	217.37	0.006 [§]	6.47	6.19	0.43 [§]	7.21	3.93	<0.001
		Mean Cover [‡]	3.53	3.67	0.42 [§]	2.19	2.28	0.68 [§]	11.49	3.16	<0.001 [§]
Section 7	7	Mean Density	133.71	179.57	0.14	3.57	4.57	0.50	8.29	2.86	0.016 [§]
		Mean Cover	3.71	3.86	0.83	3.00	3.86	0.31	11.71	1.57	<0.001
Section 20	17	Mean Density	170.59	259.47	0.002	5.71	3.76	0.09	7.24	4.82	0.04
		Mean Cover	2.76	3.18	0.07 [§]	1.12	1.18	0.75 [§]	11.12	3.18	<0.001 [§]
Section 28	4	Mean Density	348.75	263.25	0.21	6.75	17.50	0.08	6.25	5.00	0.56
		Mean Cover	5.25	5.25	1.00	3.00	4.25	0.14	11.00	6.50	0.35
Section 34	9	Mean Density	196.00	184.44	0.80	10.33	8.89	0.53	6.78	3.11	0.003
		Mean Cover	3.89	3.67	0.71	2.67	2.44	0.72	13.33	3.00	<0.001

	Number of Sites	Parameter	WY Big Sage			WY Big Sage Seedling		
			Reference Area	Matted Area	p-value	Reference Area	Matted Area	p-value
All Sections	43	Mean Density [†]	3.44	1.00	<.001 [§]	5.45	3.64	0.02 [§]
		Mean Cover [‡]	9.27	1.22	<.001	1.00	0.71	<.001 [§]

Ψ For statistical output see Appendix A: pp. 111 - 144.

† Mean density values are reported as stems/m².

‡ Mean cover values are reported as a percent (%).

§ Data exhibiting a non-normal distribution were analyzed using the non-parametric Wilcoxon Signed Rank Test.

Table 5. Proportion of mean grass, forb and shrub density and canopy cover contributing to oak mat and reference vegetation communities.

	Grass Density	Grass Cover
Reference (n=43)	93%	20%
Oak Mat (n=43)	95%	40%
	Forb Density	Forb Cover
Reference (n=43)	3%	13%
Oak Mat (n=43)	3%	25%
	Shrub Density	Shrub Cover
Reference (n=43)	4%	67%
Oak Mat (n=43)	2%	35%

Table 6. Proportion of forb density and canopy cover contributed by weedy forb species at oak mat areas and nearby reference locations.

	Weedy Forb Density	Weedy Forb Cover
Reference (n=43)	3%	6%
Oak Mat (n=43)	21%	33%

Table 7. Proportion of shrub density and canopy cover contributed by WY big sagebrush at oak mat areas and nearby reference locations.

	WY. Big Sage Density	WY. Big Sage Cover
Reference (n=43)	48%	81%
Oak Mat (n=43)	25%	39%
	WY. Big Sage Seedling Density	WY. Big Sage Seedling Cover
Reference (n=43)	17%	1%
Oak Mat (n=43)	23%	1%

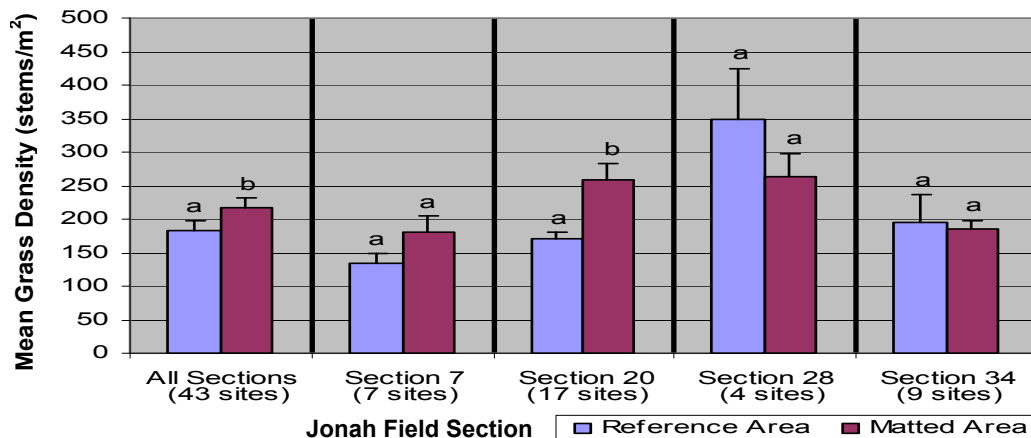


Figure 8. Mean grass density and standard error of the mean at oak mat removal areas and associated reference areas. Mean values within a section, followed by a different letter were determined to be statistically significant ($p \leq 0.05$). For statistical output see Appendix A: pp. 111 – 144.

and the percent of bare ground is higher than in the nearby undisturbed range. Not a single forb was measured during the 2007 vegetation monitoring within cut and fill drill pad areas reclaimed in 2005 or later. Shrub frequency ranged from 0.0-0.15 at reclaimed

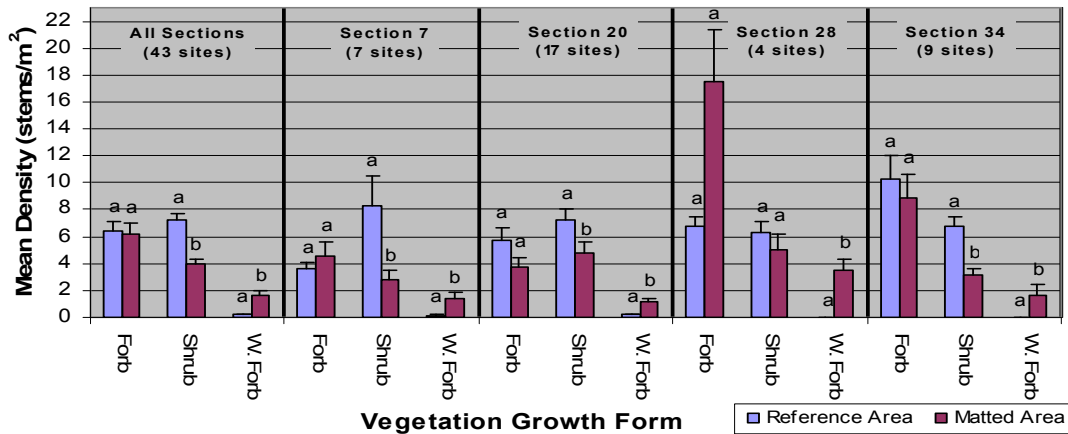


Figure 9. Mean forb, shrub, and weedy forb density and standard error of the mean at oak mat removal areas and associated reference areas. Paired mean reference and mean mat values within a section, followed by a different letter were determined to be statistically significant ($p \leq 0.05$). For statistical output see Appendix A: pp. 111 – 144.

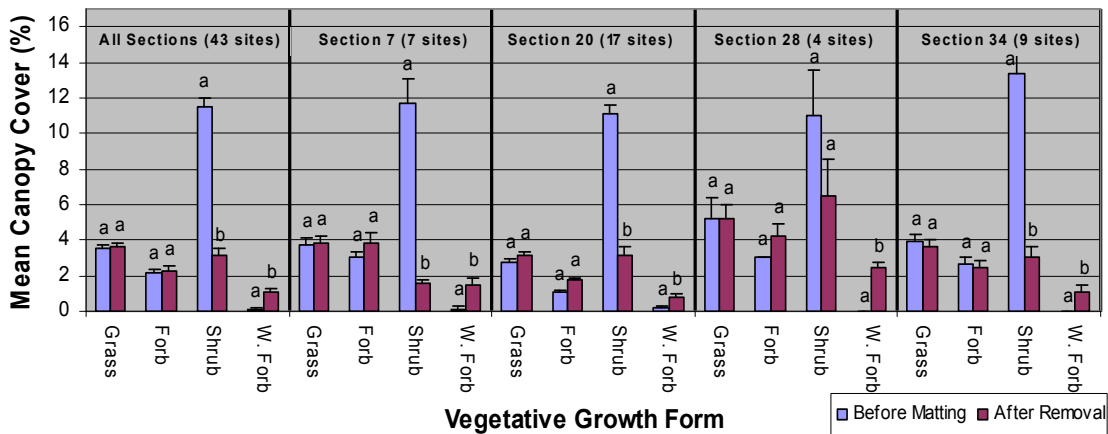


Figure 10. Mean grass, forb, shrub, and weedy forb canopy cover and standard error of the mean at oak mat removal areas and associated reference areas. Paired mean before-and-after values within a section, followed by a different letter were determined to be statistically significant ($p \leq 0.05$). For statistical output see Appendix A: pp. 111 – 144.

areas (median of 0.0) compared with a range of 0.4-4.2 at the reference (median of 1.8).

Although vegetation monitoring data were collected from within a relatively short time since seeding (6 to 19 months), using even the most advanced reclamation strategies, the

recovery of vegetation communities at these drill pads will require decades to centuries before resembling plant communities in the nearby undisturbed range.

Table 8. Statistical analysis of basal point-intercept vegetation data collected at cut and fill locations reclaimed in 2005 or later relative to the nearby undisturbed range.¹

Vegetation Data Source	Forb Frequency	p-value	Shrub Frequency	p-value	Forb Diversity	p-value	Shrub Diversity	p-value	% Bare Ground	p-value
NUR ² (n=83)	0.78	<0.001 §	1.89	<0.001 §	2.12	<0.001 §	3.17	<0.001 §	68.43	<0.001 §
RCAF ³ (n=83)	0.00		0.01		0.00		0.05		84.99	

1. For statistical output see Appendix A: pp. 145-149.

2. NUR = nearby undisturbed range.

3. RCAF = cut and fill locations reclaimed in 2005 or later.

§ Data exhibiting a non-normal distribution were analyzed using the nonparametric Wilcoxon Signed Rank Test.

Grass Density and Canopy Cover at Drill Pads Reclaimed and Seeded Pre-2005

Trends observed during 2006 indicate that overall grass density was similar between reclaimed cut and fill locations and the reference areas, whereas mean grass canopy cover was greater at reclaimed cut and fill locations (Table 9). This indicates that reclamation of pre 2005 cut and fill drill pads was successful in establishing a grass community with equal to, or greater than, density and canopy cover than the nearby undisturbed range. At reclaimed cut and fill sites, grass density comprised 99 % of the total plant community density and 79 % of the canopy cover. Within the nearby undisturbed range, grass density comprised 85 % of the total plant density and 18% of the canopy cover (Table 10). This indicates that grass community establishment was successful at reclaimed cut and fill locations, but the proportion of grasses to forbs and shrubs within that community is higher than that within the nearby undisturbed range.

Larger grass canopy cover compositions at reclaimed cut and fill locations may be attributed to less shrub canopy cover and the potential for an associated release in competition among plant life forms (Table 9).

Forb Density and Canopy Cover at Drill Pads Reclaimed and Seeded Pre-2005

Overall forb density and canopy cover at reclaimed cut and fill locations was lower than that in the reference area. Numerically, mean forb density and canopy cover at the 66 locations was an order of magnitude lower than in the nearby undisturbed range (Table 9). At the time of monitoring, data indicates that reclamation of pre-2005 cut and fill drill pads was unsuccessful in reestablishing forb communities comparable to the nearby undisturbed range. At reclaimed cut and fill sites, forb density comprised 0.4 % of the total plant density measured and 5 % of the canopy cover. The proportion of forb density within the nearby undisturbed range was higher, with forb density contributing to 5 % of total and forb canopy cover contributing 14 % (Table 10).

The proportion of total forb density and canopy cover contributed by weedy forb species differed drastically between reclaimed cut and fill sites and the nearby undisturbed range. Within the nearby undisturbed range, 1 % of the total forb density and 1 % of the total forb canopy cover measured were weedy forb species. Measured within reclaimed cut and fill locations, 99 % of the total forb density and 82 % of the forb canopy cover were weedy forb species (Table 11). These data were collected anywhere from 1 to 15+ years post reclamation and indicate that measured weedy forb populations may be established and self sustaining and that these reclaimed cut and fill drill pads pose

a significant vector for weedy forb dispersal in the Jonah Field. Currently, techniques used to contain or eliminate weedy forb populations in the Jonah Field are limited in scope and duration.

Shrub Density and Canopy Cover at Drill Pads Reclaimed and Seeded Pre-2005

Shrub density and canopy cover were also lower than that measured in the nearby undisturbed range, with mean values an order of magnitude smaller than those in reference areas (Table 9). At reclaimed cut and fill sites, shrub density comprised 1 % of the total plant density encountered during sampling and 16 % of the canopy cover. The proportion of shrub density within the nearby undisturbed range was higher, with shrub density contributing to 11 % of total, and shrub canopy cover contributing 68 % (Table 10). These data indicate that reclamation of pre-2005 cut and fill drill pads was unsuccessful in reestablishing a shrub community comparable to the nearby undisturbed range.

In theory, plant community succession at these 66 cut and fill drill pads reclaimed pre-2005 may enhance shrub establishment relative to current conditions by recruitment from the nearby range. However, this scenario is unlikely as the potential for shrub recruitment is stifled by the established grass and weedy forb populations. Currently it is uncertain whether the original seed mixes contained shrub components, however if they did, reductions in drilled shrub seed viability with time may further hinder the potential for shrub population reestablishment (Young and Evans 1989).

Wyoming Big Sagebrush and Sagebrush Seedling Density
and Canopy Cover at Drill Pads Reclaimed and Seeded Pre-2005

The proportion of total shrub density and canopy cover attributed to Wyoming big sagebrush and Wyoming big sagebrush seedlings was considerably different between reclaimed cut and fill sites and the nearby undisturbed range. Within the nearby undisturbed range, Wyoming big sagebrush comprised 25 % of the total shrub density measured and 78 % of the total shrub canopy cover. Conversely, 6 % of the shrub density and 9 % of the shrub canopy cover was Wyoming big sagebrush within reclaimed cut and fill locations (Table 12).

Within the nearby undisturbed range, 11 % of the total shrub densities measured were Wyoming big sagebrush seedlings compared with 1 % at reclaimed cut and fill locations (Table 12). Wyoming big sagebrush seedling canopy cover was again rounded to 1 % to indicate presence. Reclaimed cut and fill drill pads consistently produced lower sagebrush and sagebrush seedling density and canopy cover values than the nearby undisturbed range, indicating that the potential recovery of sagebrush populations is also inhibited at cut and fill drill pads reclaimed before 2005.

Percent Change in Grass Density
and Canopy Cover between Techniques

Based on comparisons with nearby undisturbed range, grass density and canopy cover were greater at oak mat removal areas and pre-2005 reclaimed cut and fill locations. The percent change in grass density at oak mat removal areas (+37 %) was

Table 9. Summary of mean vegetation density and canopy cover for pre-2005 reclaimed cut and fill locations compared to nearby reference areas.^Ψ

Number of Sites	Parameter	GRASS			FORB			SHRUB		
		Reference Area	Cut and Fill	p-value	Reference Area	Cut and Fill	p-value	Reference Area	Cut and Fill	p-value
66	Mean Density [†]	161.3	169.8	0.83 [§]	9.1	0.8	0.001 [§]	20.3	1.6	0.001 [§]
	Mean Cover [‡]	4.2	6.9	0.001 [§]	3.4	0.5	0.001 [§]	16.1	1.4	0.001 [§]
Number of Sites	Parameter	WEEDY FORB			WY Big Sage			WY Big Sage Seedling		
		Reference Area	Cut and Fill	p-value	Reference Area	Cut and Fill	p-value	Reference Area	Cut and Fill	p-value
66	Mean Density	0.1	71.9	0.001 [§]	5.0	0.1	<.001 [§]	11.2	0.2	<.001 [§]
	Mean Cover	0.1	2.2	0.001 [§]	12.6	0.1	<.001	0.8	0.2	<.001 [§]

^Ψ For statistical output see Appendix A: pp. 159-170.

[†] Mean density values are reported as stems/m².

[‡] Mean canopy cover values are reported as a percent (%).

[§] Data exhibiting a non-normal distribution were analyzed using the non-parametric Wilcoxon Signed Rank Test.

Table 10. Proportion of grass, forb and shrub density and canopy cover contributing to plant communities at pre-2005 reclaimed cut and fill locations and nearby reference areas.

	Grass Density	Grass Cover
Reference (n=66)	85%	18%
Cut and Fill (n=66)	99%	79%
	Forb Density	Shrub Cover
Reference (n=66)	5%	14%
Cut and Fill (n=66)	0.40%	5%
	Shrub Density	Forb Cover
Reference (n=66)	11%	68%
Cut and Fill (n=66)	1%	16%

Table 11. Proportion of forb density and canopy cover contributed by weedy forb species at pre-2005 reclaimed cut and fill locations and nearby reference areas.

	Weedy Forb Density	Weedy Forb Cover
Reference (n=66)	1%	1%
Cut and Fill (n=66)	99%	82%

Table 12. Proportion of shrub density and canopy cover contributed by Wy. big sagebrush at pre-2005 reclaimed cut and fill locations and nearby reference areas.

	Wy. Big Sage Density	Wy. Big Sage Cover
Reference (n=66)	25%	78%
Cut and Fill (n=66)	6%	9%
	Wy. Big Sage Seedling Density	Wy. Big Sage Seedling Cover
Reference (n=66)	11%	1%
Cut and Fill (n=66)	1%	1%

greater than at reclaimed cut and fill locations (+16 %), whereas the percent change in grass canopy cover was lower (Table 13). This indicates the oak mat technique is comparatively more successful in promoting high grass density at drill pad areas, but that high grass density does not necessarily equate to a large grass canopy cover component.

At cut and fill locations reclaimed before 2005, 99 % of the plant community density and 79 % of the canopy cover was comprised of grass species, with a lower contribution by forbs and shrubs (Table 14). The success of grass at pre-2005 reclaimed cut and fill locations may reflect climatic, soil physical and/or soil chemical constraints to forb and shrub germination and survival, or because forb and shrub seeds may have not been included in the seed mixes used during reclamation. From a grass density and canopy cover perspective, oak mat removal areas more closely match the undisturbed plant community than do cut and fill locations reclaimed before 2005 (Table 14).

Increases in grass density, canopy cover and grass composition associated with each construction technique can effectively decrease erosion potentials, encourage site stability and enhance forage production, but may represent departures from the composition of the undisturbed plant community at the Jonah Field or present limited habitat utility to species of concern (i.e. sage-grouse) (USDI 2006).

Percent Change in Forb Density and Canopy Cover between Techniques

Using the nearby undisturbed range as a datum for comparison, percent change in forb density and canopy cover at oak mat removal areas was higher than at cut and fill locations reclaimed before 2005 where percent change was negative (Table 13). This trend suggests that oak mat removal areas are successful in maintaining forb populations relative to the nearby undisturbed range and that cut and fill locations reclaimed before 2005 are relatively unsuccessful. Furthermore, the proportion of weedy forbs to total

forb density was approximately fifty times higher at cut and fill locations reclaimed before 2005 than within the nearby undisturbed range and five times higher than at oak mat removal areas (Table 15). This indicates that both construction techniques potentially result in areas where weedy forbs proliferate, but that this potential is considerably higher at cut and fill locations reclaimed before 2005.

Percent Change in Shrub Density
and Canopy Cover between Techniques

Shrub density and canopy cover at oak mat removal and pre-2005 reclaimed cut and fill locations were lower relative to the nearby undisturbed range. Pre-2005 reclaimed cut and fill locations had a -84 % change in shrub density and a -87 % change in canopy cover, whereas oak mat removal areas had a -33 % change in density and a -66 % change in canopy cover (Table 13).

Reductions in shrub density and canopy cover at reclaimed cut and fill locations may be potentially explained by increases in soil bulk density imparted by soil stockpiling and reapplication by heavy machinery, changes in soil chemistry imparted from soil mixing, and climatological barriers to seeded shrub germination and emergence (assuming shrub seeds were included as a component of the reclamation seed mix). As previously discussed, increases in future shrub populations at reclaimed cut and fill locations are limited by the seemingly established grass and weedy forb populations.

Reductions in shrub density and canopy cover at oak mat removal areas may be explained by the physical crushing of deciduous shrubs, including sagebrush species, by

oak mats. Again, mature sagebrush were observed to be less capable of recovery when the crown crushed, but that smaller auxiliary branches at the periphery of the crown tend to survive and produce seed.

Percent Change in Wyoming Big Sagebrush and Sagebrush Seedling Density and Canopy Cover between Techniques

The contribution of Wyoming big sagebrush density and canopy cover to shrub communities at oak mat removal areas and reclaimed cut and fill locations was lower than that in the nearby undisturbed range (Table 16). The proportion of Wyoming big sagebrush seedling density is highest at oak mat removal areas, greater even than in the nearby undisturbed range, indicating that the density of sagebrush at oak mat removal areas has a greater potential to recover relative to pre-2005 reclaimed cut and fill locations (Table 16).

Table 13. Summary of percent change in plant growth characteristics between oak mat removal areas (OMRA) and pre-2005 reclaimed cut and fill locations (RCAF).^Ψ

Plant Growth Data Source	Mean % Change in Grass Density	p- value	Mean % Change in Forb Density	p- value	Mean % Change in Shrub Density	p- value
OMRA (n=43)	37	0.01 §	24	<0.001 §	-33	<0.001 §
RCAF (n=66)	16		-86		-84	
Plant Growth Data Source	Mean % Change in Grass Cover	p- value	Mean % Change in Forb Cover	p- value	Mean % Change in Shrub Cover	p- value
OMRA (n=43)	13	0.02 §	16	<0.001 §	-66	<0.001 §
RCAF (n=66)	85		-80		-87	

^Ψ For statistical output see Appendix A: pp. 162-167.

§ Data exhibiting a non-normal distribution were analyzed using the non-parametric Wilcoxon Signed Rank Test.

Table 14. Proportion of mean grass, forb and shrub density and canopy cover contributing to plant communities at reference areas, oak mat areas and cut and fill locations reclaimed before 2005.

	Grass Density	Grass Canopy Cover
Reference (n=109)	89%	19%
Oak Mat ¹ (n=43)	95%	40%
Cut and Fill ² (n=66)	99%	79%
	Forb Density	Forb Canopy Cover
Reference (n=109)	4%	13.5%
Oak Mat ¹ (n=43)	3%	25%
Cut and Fill ² (n=66)	0.4%	5%
	Shrub Density	Shrub Canopy Cover
Reference (n=109)	7%	67.5%
Oak Mat ¹ (n=43)	2%	35%
Cut and Fill ² (n=66)	1%	16%

1. Vegetation data presented from oak mat removal areas.

2. Vegetation data presented from cut and fill locations reclaimed previous to 2005.

Table 15. Proportion of forb density and canopy cover contributed by weedy forb species at reference areas, oak mat areas and cut and fill locations reclaimed before 2005.

	Weedy Forb Density	Weedy Forb Canopy Cover
Reference (n=109)	2%	3.5%
Oak Mat ¹ (n=43)	21%	33%
Cut and Fill ² (n=66)	99%	82%

Table 16. Shrub density and canopy cover contributed by Wy. big sagebrush at reference areas, oak mat areas and cut and fill locations reclaimed before 2005.

	Wy. Big Sage Density	Wy. Big Sage Canopy Cover
Reference (n=109)	36.5%	79.5%
Oak Mat ¹ (n=43)	25%	39%
Cut and Fill ² (n=66)	6%	9%
	Wy. Big Sage Seedling Density	Wy. Big Sage Seedling Canopy Cover
Reference (n=109)	14%	1%
Oak Mat ¹ (n=43)	23%	1%
Cut and Fill ² (n=66)	11%	1%

Soil Bulk Density Associated with Oak Mat Areas

In addressing the accuracy of the Troxler Gauge, ρ_b measured by the Troxler gauge and the Shelby tube laboratory method at a subset of locations and depth increments were regressed. Regression lines for the 0-5.1, 0-15.2, and 0-30.5 cm soil increments varied from each other, and varied from the regression that included all 41 calibration soil samples (Figure 11). Since all regressions were significant and had coefficients of determination of 0.81 or greater, ρ_b values measured by the Troxler Gauge were corrected using the unique regression equations derived for each depth increment.

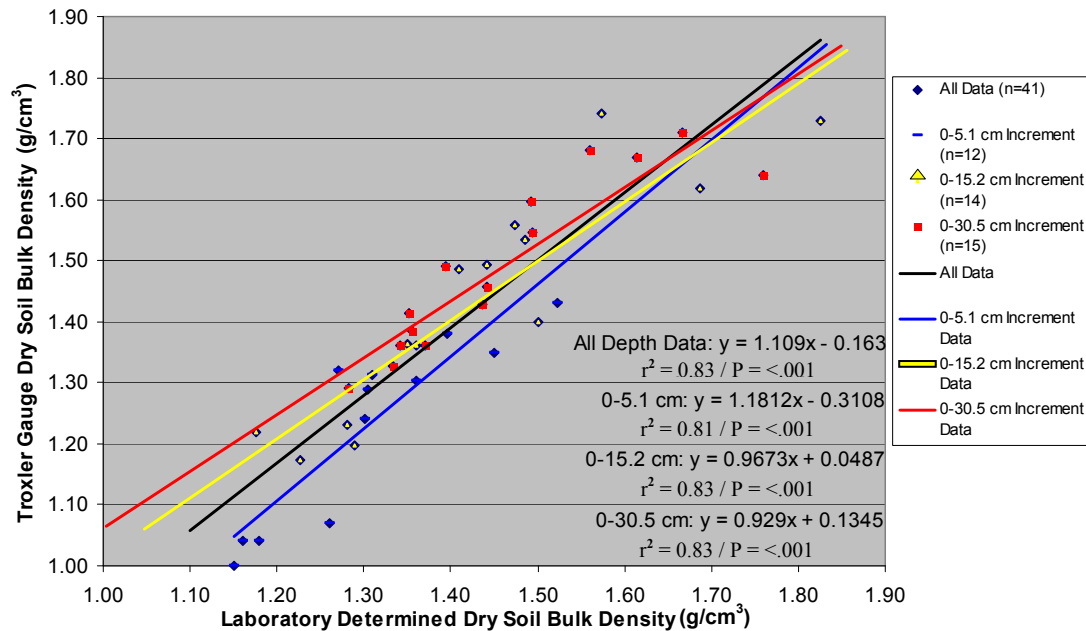


Figure 11. Linear regression between the Troxler gauge and laboratory determined soil bulk density. For statistical output see Appendix B: pp. 169-172.

To apply the guidelines of Daddow and Warrington (1983) and the USDA-NRCS (2001) in estimating potential effects of soil bulk density on plant growth response, an understanding of the study area's dominant soil texture is necessary. Soil textural data collected from oak mat drill pad locations in the Jonah Field indicate that clay loam and loam textures dominate surface soils (Figure 12). Based on GLBD isodensity lines in Figure 4, soil bulk densities of 1.45 and 1.55 g/cm³ or greater are growth limiting for clay loam and loam textured soils, respectively. Table 1 indicates that bulk density values of 1.65 and 1.70 g/cm³ will restrict root development for these soils. In interpreting measured changes to ρ_b , this study discusses the presence of mean drill pad ρ_b values in the range of 1.45 to 1.70 g/cm³, which Daddow and Warrington (1983) and the USDA-NRCS (2001) suggest as potentially indicating plant growth problems associated with

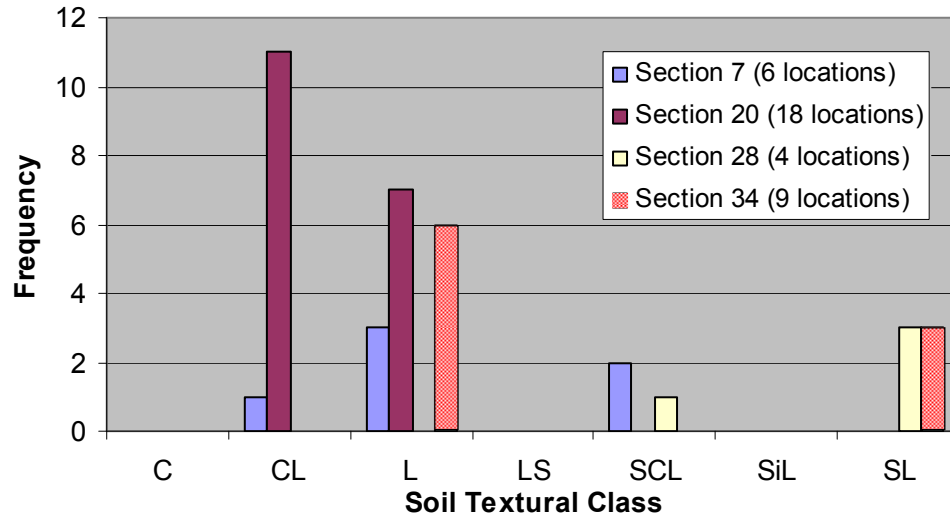


Figure 12. Frequency of USDA soil textural classes present in the 0-15.2 cm depth increment for oak mat removal areas.

soil bulk density in the dominantly clay loam and loam textured environments of the Jonah Field.

Oak Mat Area Soil Bulk Density

Across all 38 sites, mean soil ρ_b within the 0-5.1 cm increment was slightly lower, 1.36 versus 1.32 g/cm³, following oak mat removal, compared to pre-disturbance ρ_b (Table 17). Decreases in 0-5.1 cm increment ρ_b are potentially due to the widespread presence of dry, unconsolidated surface soils. On an individual site level, 9 of the 38 sites measured indicated changes in bulk density, with an average decrease of 0.07 g/cm³ within the 0-5.1 cm increment after oak mats were removed. Although mean soil bulk density within the 0-15.2 cm increment increased from 1.35 to 1.38 g/cm³ following oak mat removal, only 2 of the 38 individual sites had increases in bulk density after oak mats

were removed (Table 17). Mean ρ_b within the 0-30.5 cm increment increased from 1.35 to 1.41 g/cm³ following oak mat removal (Table 17). On an individual basis, 18 of the 38 drill pads indicated increases in ρ_b within the 0-30.5 cm increment after oak mats were removed. Although increases in ρ_b were present, they were small (0.06 g/cm³ on average) and are not expected to cause measurable changes in plant growth.

Soil Bulk Density Associated with Cut and Fill Locations Reclaimed in 2005 or Later

Soil bulk density values measured by the Troxler Gauge at cut and fill locations reclaimed in 2005 or later were also corrected using regression equations derived from laboratory analysis of soil cores. Because of differences in depth increments measured at reclaimed cut and fill locations, ρ_b values measured from 5.1-15.2 cm and 15.2-45.7 cm were corrected using the regression equation derived for the entire dataset, across all depth increments (Figure 11).

Across all 6 sites, mean soil ρ_b within the 0-5.1 cm increment increased slightly, from 1.36 to 1.45 g/cm³, as a result of drilling and reclamation (Table 18). On an individual site level, 3 of the 6 sites measured had increases in mean drill pad bulk density, with an average increase of 0.14 g/cm³ within the 0-5.1 cm increment after reclamation of cut and fill drill pads.

Across all 6 sites, mean soil bulk density within the 5.1-15.2 cm increment increased from 1.31 to 1.45 g/cm³ following reclamation of cut and fill locations (Table 18). Two of the 6 sites showed significant changes in bulk density after reclamation in

Table 17. Mean soil bulk density before oak mat construction and after removal at 38 oak mat drill pad locations.^ψ

Drill Pad	Soil Bulk Density (g/cm ³) [†]					
	0-5.1 cm		0-15.3 cm		0-30.5 cm	
	Before	After	Before	After	Before	After
Section 7						
JF 7-7X	1.42 a	1.32 a	1.47 a	1.42 a	1.5 a	1.45 a
JF 19-7X	1.35 a	1.34 a	1.37 a	1.41 a	1.41 a	1.46 a
JF 27-7X	1.28 a	1.31 a	1.30 a	1.35 a	1.33 a	1.45 a
JF 39-7X	1.36 a	1.22 b	1.39 a	1.38 a	1.41 a	1.43 a
JF 67-7	1.38 a	1.21 a	1.43 a	1.35 a	1.43 a	1.38 a
JF 120-7	1.37 a	1.35 a	1.42 a	1.39 a	1.46 a	1.43 a
Section Mean [‡]	1.36 a	1.29 a	1.40 a	1.38 a	1.42 a	1.43 a
Section 20						
SHB 53-20	1.35 a	1.30 a	1.27 a	1.32 a	1.24 a	1.37 b
SHB 54-20	1.40 a	1.38 a	1.34 a	1.42 a	1.31 a	1.43 b
SHB 58-20	1.31 a	1.36 a	1.27 a	1.35 a	1.26 a	1.38 b
SHB 59/113-20	1.37 a	1.45 b	1.34 a	1.47 b	1.29 a	1.48 b
SHB 60/114-20	1.36 a	1.28 b	1.32 a	1.32 a	1.29 a	1.35 a
SHB 69-20	1.38 a	1.33 a	1.34 a	1.33 a	1.25 a	1.32 b
SHB 70-20	1.32 a	1.29 a	1.28 a	1.28 a	1.25 a	1.29 b
SHB 71-20	1.36 a	1.35 a	1.32 a	1.33 a	1.3 a	1.38 b
SHB 75-20	1.33 a	1.30 a	1.31 a	1.31 a	1.26 a	1.33 b
SHB 76-20	1.35 a	1.34 a	1.31 a	1.33 a	1.25 a	1.36 b
SHB 111-20	1.44 a	1.30 b	1.35 a	1.37 a	1.30 a	1.40 b
SHB 112-20	1.39 a	1.35 a	1.38 a	1.40 a	1.32 a	1.41 b
SHB 112X-20	1.36 a	1.37 a	1.30 a	1.42 a	1.26 a	1.42 b
SHB 122-20	1.36 a	1.35 a	1.32 a	1.36 a	1.26 a	1.36 b
SHB 123-20	1.32 a	1.31 a	1.29 a	1.32 a	1.30 a	1.36 a
SHB 124-20	1.37 a	1.37 a	1.31 a	1.37 a	1.32 a	1.37 a
SHB 124X-20	1.33 a	1.34 a	1.31 a	1.32 a	1.33 a	1.31 a
SHB 125-20	1.35 a	1.34 a	1.29 a	1.35 a	1.24 a	1.35 b
Section Mean	1.36 a	1.34 a	1.32 a	1.36 b	1.28 a	1.37 b
Section 28						
SHB 51-28	1.36 a	1.33 a	1.37 a	1.42 a	1.43 a	1.49 b
SHB 52-28	1.47 a	1.39 a	1.56 a	1.54 a	1.56 a	1.57 a
SHB 61-28	1.51 a	1.44 a	1.60 a	1.57 a	1.58 a	1.60 a
SHB 68-28	1.44 a	1.39 a	1.48 a	1.53 a	1.50 a	1.51 a
Section Mean	1.45 a	1.39 b	1.50 a	1.52 a	1.52 a	1.54 a §
Section 34						
SHB 19-34	1.27 a	1.24 a	1.25 a	1.36 a	1.33 a	1.33 a
SHB 30-34	1.35 a	1.27 b	1.39 a	1.38 a	1.41 a	1.33 a
SHB 31-34	1.33 a	1.23 b	1.34 a	1.30 a	1.37 a	1.42 b
SHB 42-34	1.34 a	1.20 b	1.31 a	1.27 b	1.35 a	1.38 a
SHB 43-34	1.28 a	1.21 a	1.27 a	1.31 a	1.30 a	1.34 b
SHB 46-34X	1.33 a	1.31 b	1.29 a	1.49 a [†]	1.31 a	1.45 a
SHB 47-34X	1.36 a	1.34 b	1.39 a	1.43 a	1.40 a	1.44 a
SHB 48-34	1.29 a	1.27 a	1.30 a	1.35 a	1.32 a	1.39 a
SHB 96-34	1.28 a	1.24 a	1.36 a	1.32 a	1.39 a	1.41 a
Section Mean	1.32 a	1.26 b	1.32 a	1.36 a	1.35 a	1.39 a
All Sections						
Total Mean	1.36 a	1.32 b	1.35 a	1.38 b	1.35 a	1.41 b

^ψ For statistical output see Appendix B: pp. 173-321.

[†] Mean value of six measurements per drill pad.

[‡] Means within a depth increment followed by a different letter are significantly different ($p \leq 0.05$).

§ Due to a non-normal distribution, data were analyzed using the non-parametric Wilcoxon Signed Rank Test.

[†] Due to non-normal distribution, data were analyzed using the non-parametric one-way Kruskal-Wallis ANOVA on ranks to determine whether significant differences were present ($p \leq 0.05$).

Table 18. Comparison of cut and fill drill pad soil bulk density reclaimed in 2005 or later relative to the nearby undisturbed range.^ψ

	Soil Bulk Density (g/cm ³)								
	0-5.1 cm			5.1-15.2 cm			15.2-45.7 cm		
Drill Pad	Nearby Undisturbed Range	Cut and Fill	p-value	Nearby Undisturbed Range	Cut and Fill	p-value	Nearby Undisturbed Range	Cut and Fill	p-value
SHB 2-29	1.40	1.35	0.13	1.32	1.45	0.03	1.37	1.56	0.11
SHB 7-29	1.25	1.45	0.03	1.21	1.42	0.02	1.25	1.37	0.11
SHB 10-29	1.46	1.47	0.90	1.43	1.51	0.26	1.41	1.52	0.36
SHB 12-29	1.43	1.59	0.11 §	1.43	1.60	0.22	1.44	1.63	0.11
SHB 11-34	1.34	1.45	0.04	1.23	1.38	0.13 §	1.35	1.47	0.14
SHB 12-34	1.28	1.40	0.03	1.25	1.36	0.30	1.25	1.46	0.02
Mean [†]	1.36 a	1.45 a	0.06	1.31 a	1.45 b	<.001	1.35 a	1.50 b	<.001

^ψ For statistical output see Appendix B: pp. 322-342.

[†] Means within a depth increment followed by a different letter are significantly different ($p < 0.05$).

§ Mann Whitney Rank Sum Test used due to data lacking equal variance.

that increment, averaging a 0.17 g/cm³ increase, which is the most substantial increase in mean ρ_b measured within all depth increments and construction techniques.

Across all 6 sites, mean ρ_b within the 15.2-45.7 cm increment increased from 1.35 to 1.50 g/cm³ following reclamation (Table 18). Only one of the six sites had a significant increase in ρ_b .

Comparison of Soil Bulk Density between Techniques

Corrected Troxler bulk density values ranged from 1.20 to 1.60 g/cm³ among the 38 oak mat drill pads after mat removal and 1.21 to 1.63 g/cm³ throughout the 6 cut and fill drill pads reclaimed in 2005 or later (Tables 17, 18). Soil bulk density at oak mat drill pads decreased 3.0 % in the 0-5.1 cm depth, increased by 1.8 % in the 0-15.2 cm depth and increased by 3.9 % in the 0-30.5 cm depth. The mean change in soil bulk density at reclaimed conventional drill pads (across all reclamation treatments) increased 7.0 % in

the 0-5.1 cm depth, increased 10.9 % in the 5.1-15.2 cm depth and increased 11.7 % in the 15.2-45.7 cm depth (Table 19). Except for the 0-5.1 cm increment, differences in the depth increment values measured at oak mat and cut and fill drill pads preclude meaningful comparisons of relative bulk density increases and decreases through the soil profile. In the 0-5.1 cm increment, the percent change in bulk density at cut and fill locations was greater than that at oak mat removal areas (Table 19). A general comparison of the remaining depth increments indicate that less soil profile compaction is attained using the oak mat procedure compared to reclaimed cut and fill drill pad locations (Table 19).

These data also indicate that increases in soil bulk density from both drill pad construction techniques result in greater compaction at greater depths. From a reclamation perspective, this result might pose a constraint to the use of oak mats, as the use of subsoilers or vibratory ripper-shanks for mitigating compaction negate the advantage of its minimum impact approach to *in situ* soil and vegetation disturbance. However, mean soil bulk densities measured previous to drilling at oak mat locations, and in the nearby undisturbed range at reclaimed cut and fill locations are not unreasonably high relative to their soil textural classes. Of the 38 mean bulk density

Table 19. Summary of average percent change in soil bulk density by depth increment for each construction technique.¹

Oak Mat Locations (n=38)	% Change 0-5.1 cm Depth Increment	% Change 0-15.2 cm Depth Increment	% Change 0-30.5 cm Depth Increment	RCAF Drill Pad Locations ³ (n=6)	% Change 0-5.1 cm Depth Increment	% Change 5.1-15.2 cm Depth Increment	% Change 15.2-45.7 cm Depth Increment
Average ²	-3.0a	1.8b	3.9c	Average ²	7.0a	10.9a	11.7a

1. For statistical output see Appendix B: pp. 343-348.

2. One way ANOVA used to determine significance. All data passed model assumptions. Means within each construction technique, followed by a different letter are significantly different ($p \leq 0.05$).

3. RCAF = cut and fill locations reclaimed in 2005 or later.

values calculated for oak mat removal areas, none had bulk densities greater than 1.45 g/cm³ in the 0-5.1 cm depth increment. In the 0-15.2 cm depth increment, five drill pad locations had mean bulk densities in the range of 1.45 to 1.70 g/cm³ (Table 17), which are suggested by Daddow and Warrington (1983) and the USDI-NRCS (2001) as detrimental to plant growth potentials. However, before oak mat disturbances five drill pads had natural bulk densities in the 0-15.2 cm depth increment in the range of 1.45 to 1.70 g/cm³. In the 0-30.5 cm depth increment, ten oak mat removal areas had mean bulk densities in the range of 1.45 to 1.70 g/cm³ (Table 17). Before oak mat disturbances, six drill pad areas had natural bulk densities in the 0-30.5 cm depth increment in this range. This indicates that soil bulk densities from 1.45 to 1.70 g/cm³ are occurring naturally and that oak mat removal areas constitute a minimal increase in the frequency of soil densities within this range.

Of the six mean bulk density values calculated for reclaimed cut and fill drill pads, four and three drill pads had mean soil densities in the range of 1.45 to 1.70 g/cm³ in the 0-5.1 and 5.1-15.2 cm depth increments, and five had values in the range of 1.45 to 1.70 g/cm³ in the 15.2-45.7 cm depth increment. In the absence of disturbance, only one cut and fill reference area had a natural soil density in the range of 1.45 to 1.70 g/cm³ throughout all depth increments measured (Table 18). These analyses indicate that neither construction technique substantially impacts soil bulk density.

Soil Physicochemical
Characteristics Associated with Oak Mat Areas

For all drill pads, soil pH tended to increase with depth which is attributable to increasing calcium carbonate content (Figure 13). Mean soil pH in the 0-15.2 and 15.2-30.5 cm increments were 6.5 to 7.5, with soil in the 30.5-61 cm increment often exceeding a pH of 7.5. Trends in soil pH at Sections 7, 20 and 34 indicated similar results. Soil pH at Section 28 also tends to become larger with depth, but with lower pH values than at other sections. Based on criteria adapted from the Wyoming Department of Environmental Quality, Land Quality Division (1981) to establish suitability as topsoil and unsuitability criteria for soil and soil substitutes (MT DEQ 1998), mean soil pH in each increment was rated “good” and considered suitable (Tables 20, 21). As discussed in the literature review, reliance on sources such as Tables 20 and 21 to determine the appropriate magnitude of soil physicochemical analytes in the Jonah Field are limited in accuracy and applicability and are presented to provide a relative datum to determine physicochemical imbalances. Ratings of “good” or “suitable” are not appropriate in all instances.

In general, the availability of nitrogen is highest in soils with a pH range of 6 to 8, whereas the availability of phosphorus declines in the soil pH range of 7.5 to 8.5 (Tucker et al. 1987). Calcium and magnesium availability is also limited in alkaline soils because of the formation of carbonates like lime and dolomite. The oak mat procedure precludes soil mixing; any macro and micronutrient deficiencies attributable to soil pH are assumed to be pre-existing and associated with undisturbed soil chemistry.

For all drill pads, soil electrical conductivity of the saturated paste extract tended to become larger with depth. At oak mat removal areas, EC_e in the 0-15.2 cm depth averaged 0.68 dS/m, 0.51 dS/m in the 15.2-30.5 cm increment and 1.40 dS/m in the 30.5-61 cm increment (Figure 14). Except for one drill pad location in Section 7, all average drill pad EC_e s were below 4 dS/m in all depth increments. Saline soils are defined as nonsodic soils containing sufficient soluble salts to impair productivity, a value placed at $EC_e > 4.0$ dS/m (SSSA 2007). Based on this criterion, the majority of oak mat removal area soils were considered non-saline. However, this classification does not necessitate that osmotic plant stresses are absent in the Jonah Field.

Soluble salt contents in the 0-15.2 and 15.2-30.5 cm increments were generally suitable for all plant growth based on qualitative soil EC_e categories to interpret relative plant sensitivity (USDA 2007) and by Sobek et al. (1973) (Table 22). Soluble salt in the 30.5-61 cm increment was often at levels that could impair plants with low salinity tolerance. Finally, except for one drill pad, mean soil EC_e for each oak mat removal area and depth increment was rated good and considered suitable based on Wyoming and Montana DEQ criteria (Tables 20, 21). Again, relative EC_e tolerances reported by sources such as the Wyoming and Montana DEQ criteria, USDA Plants Database (2007) and Sobek et al. (1973) represent plants responses when salinity is the only growth limiting factor, and such conditions are unlikely to exist widely in the Jonah Field. Many other plant-environment interactions cause departures from salinity-yield relationships indicating caution should be used when interpreting and implementing these criteria.

Soil EC_e after mat removal was generally similar to that present before mat construction, but notable fluctuations in EC_e were measured in the 30.5-61 cm increment. This discrepancy is presumably attributed to scatter associated with natural soil variation. Drill pads in Section 28 had the lowest soil profile EC_e and were thereby most suitable for plant growth with respect to salinity compared with drill pads in other sections (Figure 14).

For all drill pads, mean sodium adsorption ratio (SAR) was low, averaging 1.0, 1.1 and 3.0 in the 0-15.2, 15.2-30.5 and 30.5-61cm depth increments, respectively (Figure 15). Sodic soils contain sufficient exchangeable sodium to interfere with the growth of most crop plants, as determined by sodium adsorption ratios >13 (SSSA 2007). The maximum SAR encountered within all drill pads and depth increments was 12, indicating that sodic soils were not present at oak mat removal areas. Soil profile distribution of SAR after mat removal was generally similar to that present before mat construction. Drill pads in Section 28 had the lowest soil profile SAR compared with drill pads in other sections (Figure 15). Except for the single SAR value in excess of 10.0, mean soil SAR for each drill pad and depth increment is considered to be suitable and categorized as good (Tables 20, 21).

Saturation percentage of the water saturated paste extract (saturation percentage) is often strongly correlated with clay percentage, and therefore CEC, surface area, macroscopic swelling and percent sand (Reeve et al. 1948; Banin and Amiel 1969; Bauer et al. 1976). In agreement with the MT-DEQ unsuitability criteria for soil and soil substitutes, Merrill et al. (1987) recommended that 25 % saturation be used as an

indicator for significantly low water holding capacity and that 90-95 % be used as an indicator of swelling tendency associated with sodic hazard. For all oak mat removal areas and soil depth increments, mean soil saturation percentage averaged 42.1 %, with a maximum value of 61.1 %, indicating 1) these values are above the indicator point for soils with significantly low water-holding capacity, and 2) the clay matrix should not disperse upon being wetted which is an undesirable trait leading to crust formation and low permeability. Saturation percentages before mat construction and after mat removal were very similar. Drill pads in Section 28 had the lowest saturation percentages, which are attributed to its higher sand content (Figure 16).

Soil carbon to nitrogen ratio (C:N) at all oak mat areas before mat construction and after mat removal was in the suitable range (6-13) for plant growth which indicates that net ammonium production should be greater than inorganic nitrogen immobilization (Sylvia et al. 1998) (Figure 17). Soil profile distribution of C:N after mat removal was generally similar to that present before mat construction. Drill pads in Section 28 had the lowest soil profile C:N indicating greater nitrogen was available for organic matter decomposition compared to drill pads in other sections (Figure 17).

For all drill pads, mean soil calcium carbonate (CaCO_3) concentration increased with depth which is common in rangeland soils and is generally attributed to downward salt translocation via precipitation induced leaching events over several centuries. CaCO_3 percentages at oak mat drill pads ranged from 0.2 to over 30 %, and averaged 5.5 %, 10.1 % and 13.0 % in the in the 0-15.2 cm, 15.2-30.5 and 30.5-61 cm depth increments, respectively (Figure 18). Soil profile CaCO_3 distribution after mat removal was generally

similar to that present before mat construction. The oak mat procedure should not affect soil CaCO_3 concentration or distribution in the soil profile. Similar to soil EC_e , drill pads in Section 28 had very low soil profile CaCO_3 concentration. Based on Wyoming DEQ criteria to establish suitability as topsoil (Table 20), mean soil CaCO_3 % in each increment is considered good. The maximum CaCO_3 percentage encountered, 30 %, is considered fair.

For all oak mat removal areas, mean soil nitrate content tended to have the highest concentration at the surface, decreasing into the subsurface depths, a trend also observed previous to oak mat construction (Figure 19). Mean phosphorus and potassium contents also followed this pattern (Figures 20, 21). An exception to this result was present in Section 7 where two drill pads had 5 times greater plant available phosphorus before mat construction compared to after mat removal. This result can not be explained. The absence of changes in the magnitude and distribution of soil nitrate, phosphorus and potassium before and after the oak mat construction indicate nutrient availability is relatively unaffected by the oak mat technique.

In summary, soil physicochemical traits before mat construction and after mat removal were similar. Small numerical differences measured before and after oak mat use are attributed to natural soil variation as opposed to actual impacts from the matting procedure. In general, soil physicochemical traits were similar between sections 7, 28 and 34. Section 28 contained lower mean soil pH, EC_e , SAR, C:N ratio, rock content, % silt and % clay relative to the others.

Table 20. Criteria to establish suitability as topsoil or topsoil substitutes (WYDEO 1981).¹

Parameter	Suitability			
	Good	Fair	Poor	Unsuitable
Soil Reaction (pH)	6.0-8.4	5.5-6.0 8.4-8.8	5.0-5.5 8.8-9.0	<5.0 >9.0
Conductivity (dS/m) ²	0-4	4-8	8-16	>16
Saturation Percentage of the H ₂ O Saturated Paste Extract	25-80		> 80 < 25	-- --
Texture ³	SL, L, SIL VFSL, FSL	CL, SICL, SC LS, LFS	C, SIC, S	
Sodium Adsorption Ratio	<6	6-10	10-15 10-12	>15 >12
Calcium Carbonate	0-15 %	15-30 %	>30 %	--
Coarse Fragments (% vol)				
7.6-25.4 cm	0-15	15-25	25-35	>35
>25.4 cm	0-3	3-7	7-10	>10

1. Adapted from Wyoming Department of Environmental Quality Land Quality Division (1981).

2. Conductivity of >8 dS/m may prove difficult to revegetate.

3. Soil Conservation Service (1978).

Table 21. Unsuitability criteria for soil or soil substitutes (MTDEQ 1998).

Parameter	Suspect Level ¹	
pH		<5.5
		>8.5
EC (dS/m)	Lift 1	>4.0
	Lift 2	>4.0-8.0 ²
Saturation Percentage		>90 %
		<25 %
SAR	Lift 1	>10.0
	Lift 2	>15.0
Textural Class	c, sc, si, s, sc	
Rock	Lift 1	>20 % ^{3, 4}
Fragments	Lift 2	>35 % ^{3, 4}

Notes

1. The suspect levels are to be used as a guide in evaluating the suitability of a soil material for reclamation. An evaluation should take into account the 'total system', including post-mining land use, topography, plant communities, wildlife habitat needs, etc. Interactive parameters may either nullify or verify the significance of a potential problem.
2. The actual maximum acceptable salt level will depend on the plant species proposed in the revegetation plan and the potential for upward salt movement.
3. These values may vary depending upon the plant species proposed for revegetation and wildlife habitat reestablishment in specific locations (e.g., a soil with a very high rock fragment content throughout its profile may be completely salvaged if used for certain shrub or tree plantings).
4. These values are based upon the >2mm fraction found in soils; this fraction can be determined by summing field % volume estimates of the 20-75, 75-250 and >250mm fractions and the laboratory % weight (converted to volume) of the 2-20mm fraction.

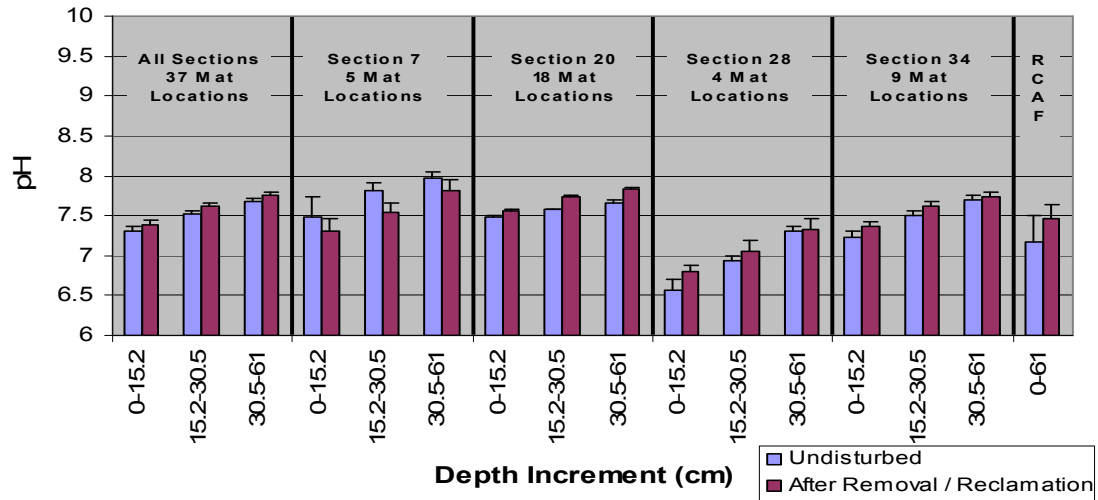


Figure 13. Soil pH values before and after oak mat construction and after reclamation at cut and fill drill pads (RCAF). Bars indicate 1 S.E.M.

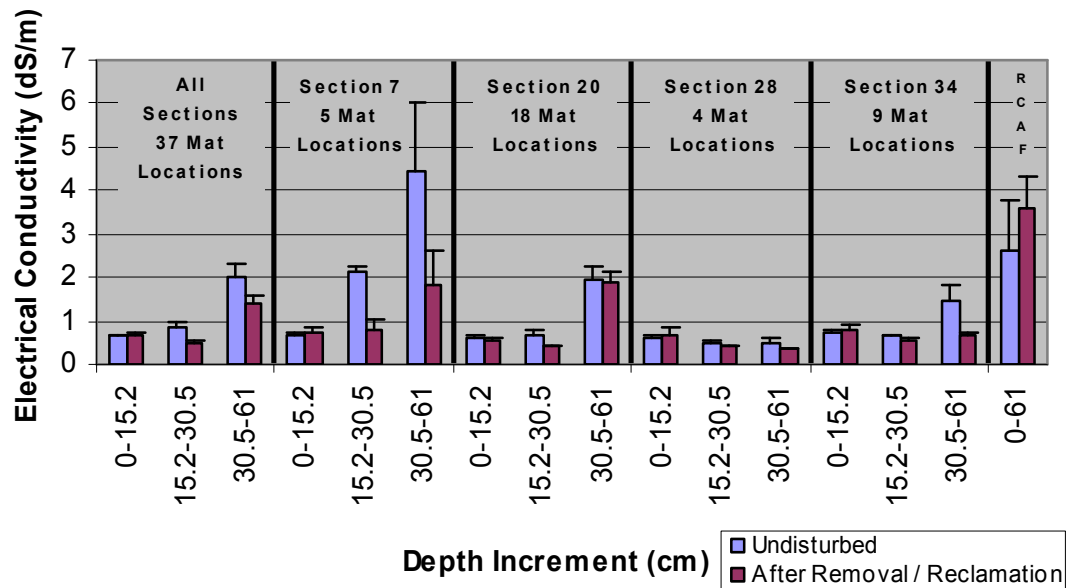


Figure 14. Soil electrical conductivity before and after oak mat construction and after reclamation at cut and fill drill pads (RCAF). Bars indicate 1 S.E.M.

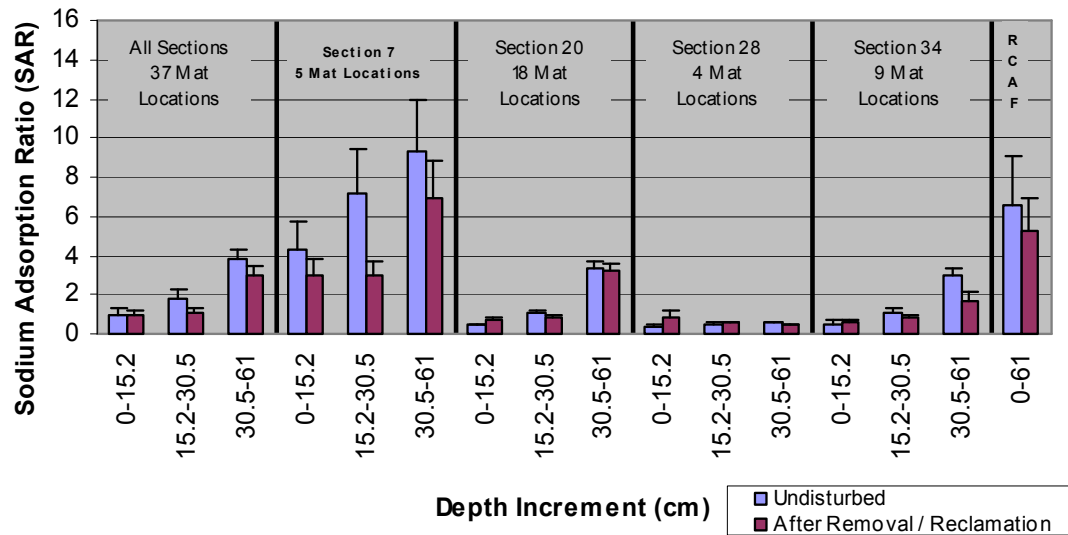


Figure 15. Soil sodium adsorption ratio (SAR) before and after oak mat construction and after reclamation at cut and fill drill pads (RCAF). Bars indicate 1 S E M

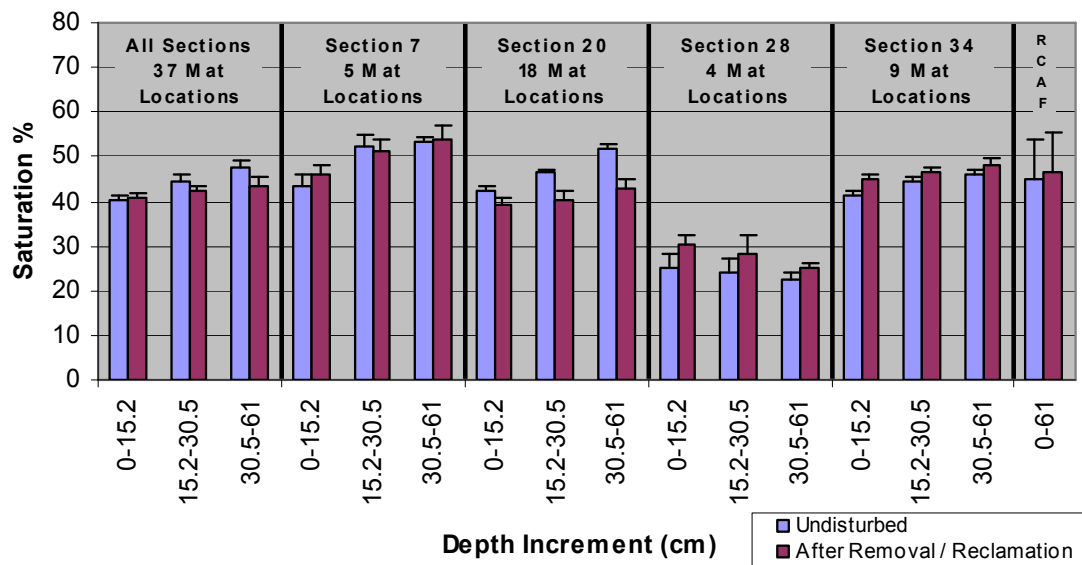


Figure 16. Soil saturation percent before and after oak mat construction and after reclamation at cut and fill drill pads (RCAF). Bars indicate 1 S E M

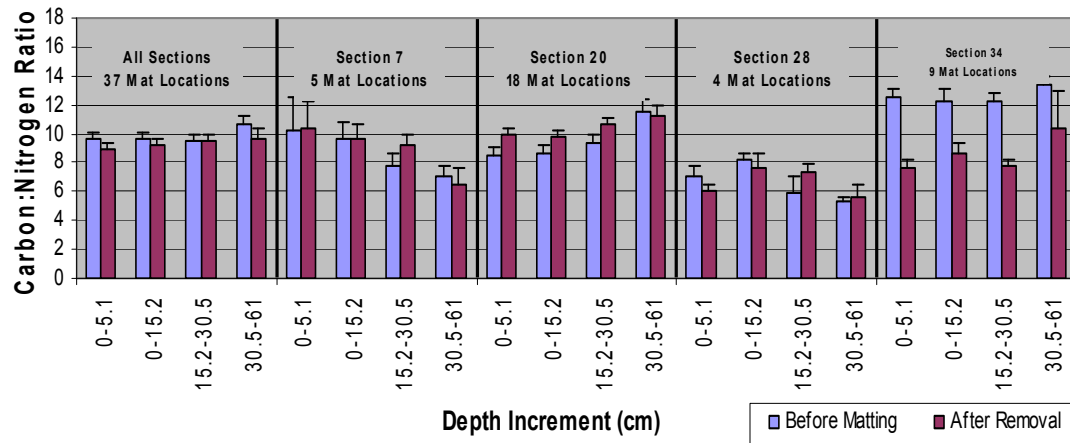


Figure 17. Soil carbon to nitrogen ratio values before and after oak mat construction. Bars indicate 1 S.E.M.

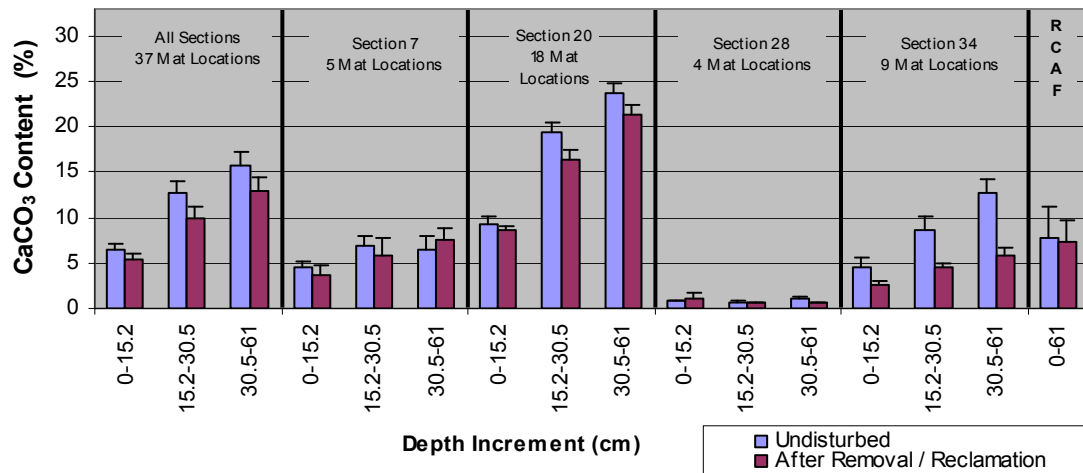


Figure 18. Soil calcium carbonate (CaCO_3) values before and after oak mat construction and after reclamation at cut and fill drill pads (RCAF). Bars indicate 1 S.E.M.

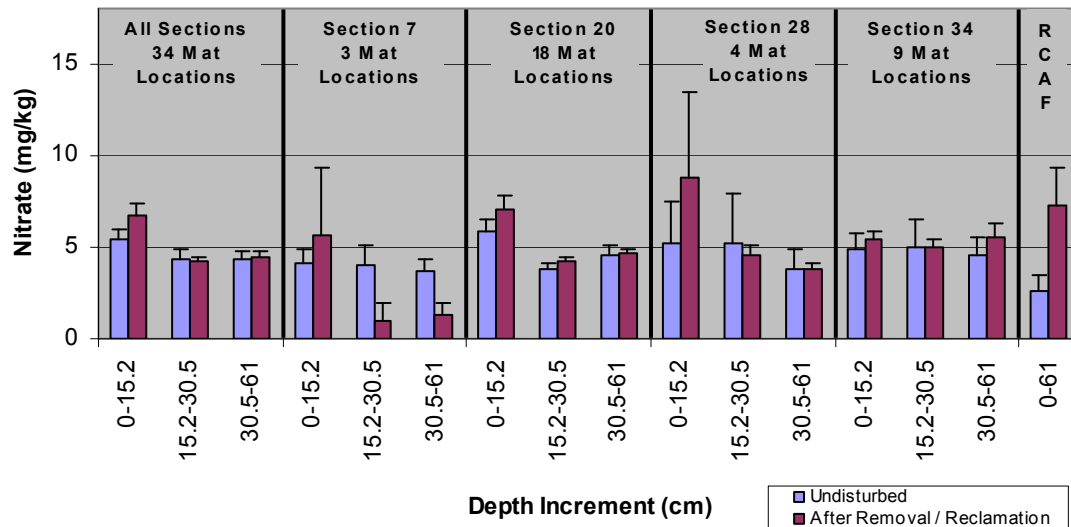


Figure 19. Soil nitrate values before and after oak mat construction and after reclamation at cut and fill drill pads (RCAF). Bars indicate 1 S.E.M.

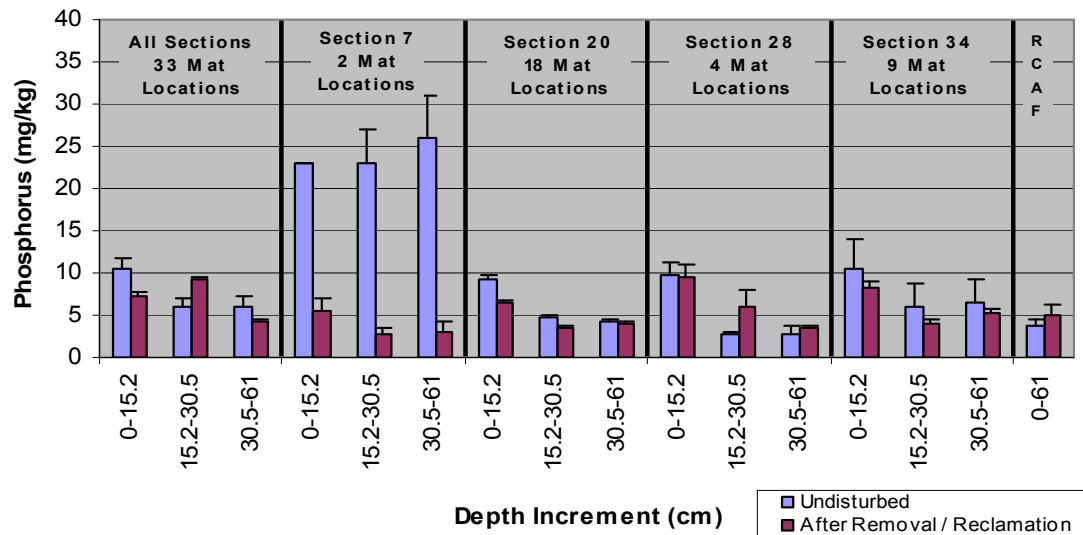


Figure 20. Soil phosphorus values before and after oak mat construction and after reclamation at cut and fill drill pads (RCAF). Bars indicate 1 S E M

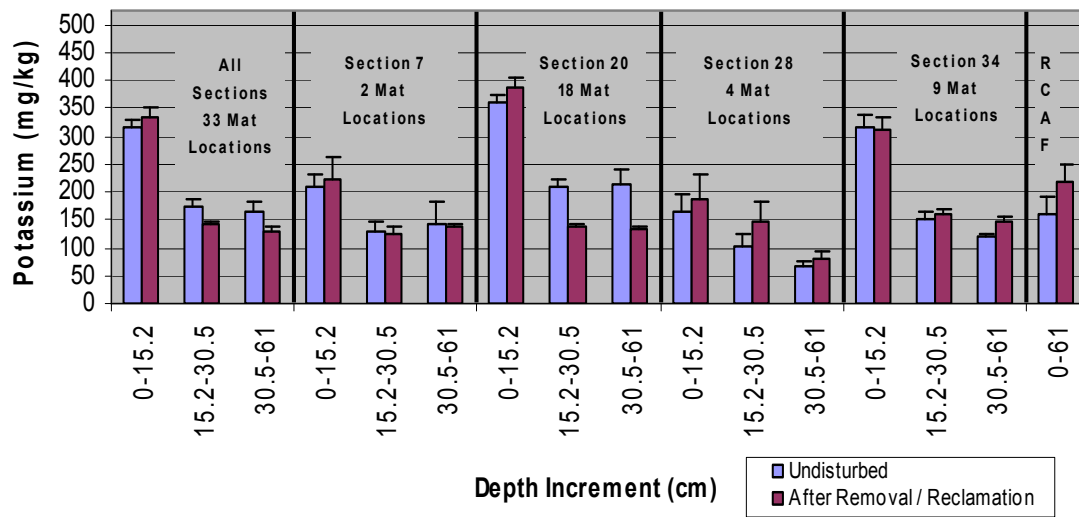


Figure 21. Soil potassium values before and after oak mat construction and after reclamation at cut and fill drill pads (RCAF). Bars indicate 1 S.E.M.

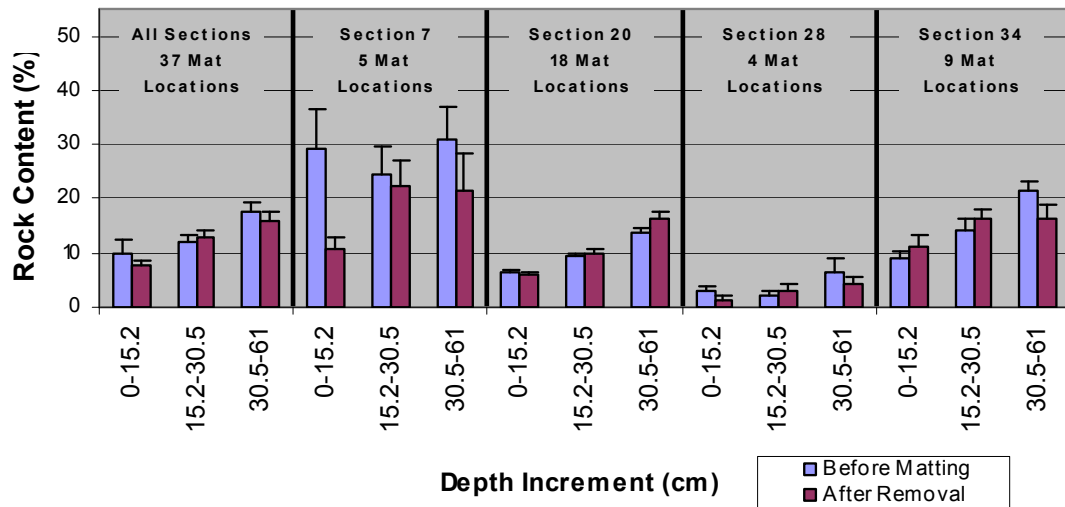


Figure 22. Soil rock content before and after oak mat construction. Bars indicate 1 S.E.M.

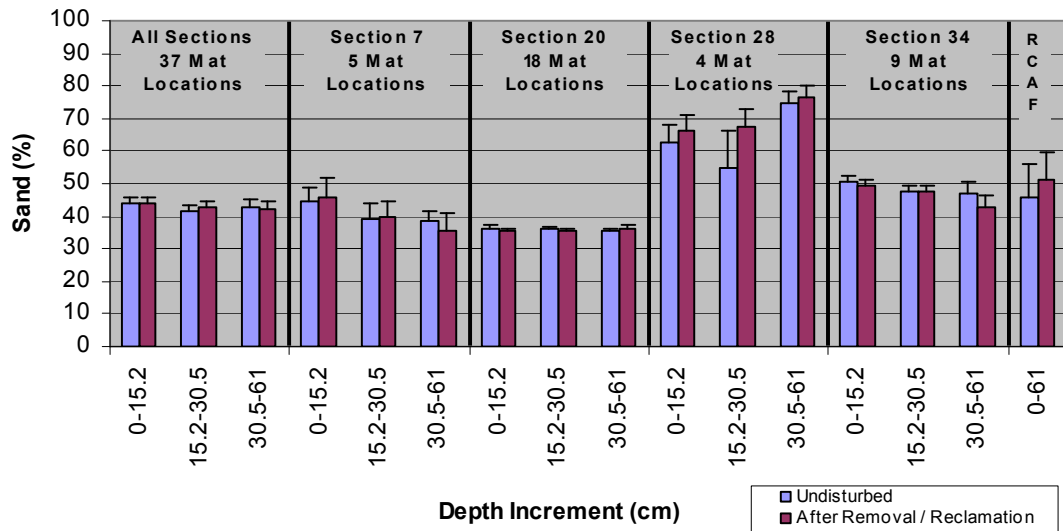


Figure 23. Soil sand content before and after oak mat construction and after reclamation at cut and fill drill pads (RCAF). Bars indicate 1 S.E.M.

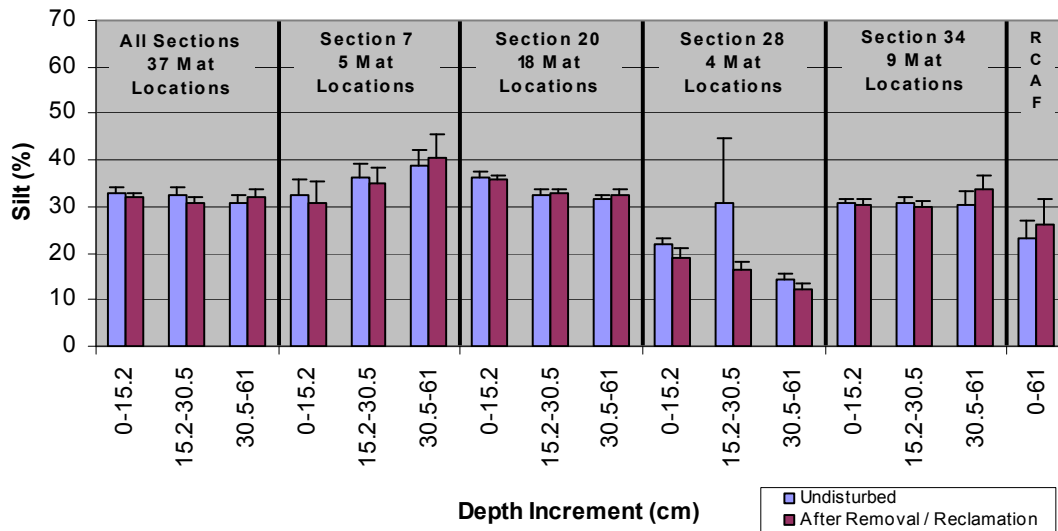


Figure 24. Soil silt content before and after oak mat construction and after reclamation at cut and fill drill pads (RCAF). Bars indicate 1 S.E.M.

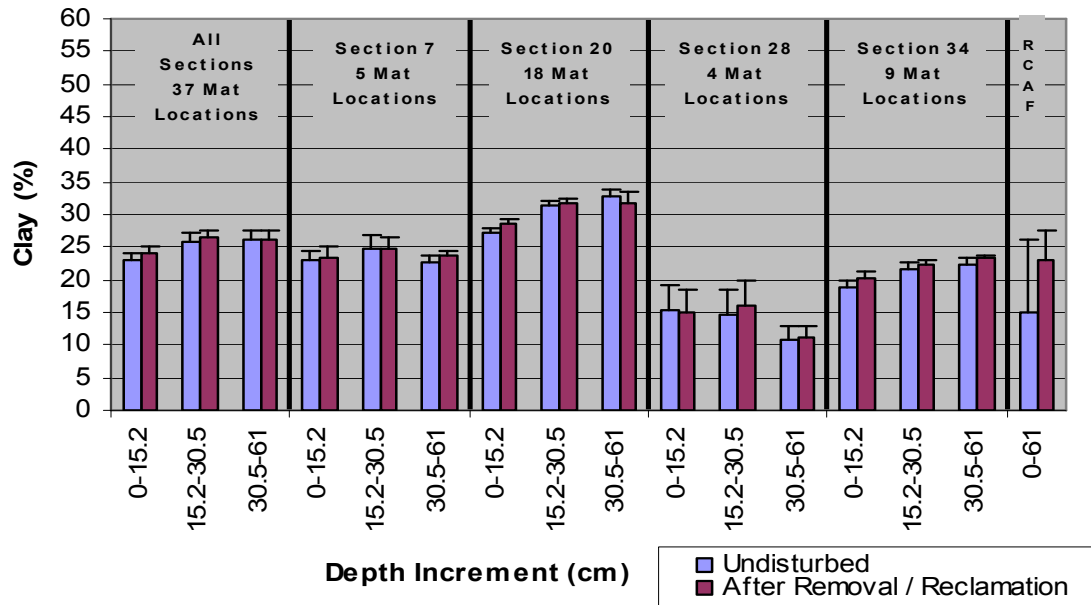


Figure 25. Soil clay content and standard error of means before and after oak mat construction and after reclamation at cut and fill drill pads (RCAF).

Table 22. Salinity ranges affecting plant growth.

USDA Plants Database		Sobek et al. 1973	
Ec _e (dS/m)	Sensitivity resulting in ≤10 % reduction in plant growth	Ec _e (dS/m)	Effect on plant growth
0-2.0	None	< 2.0	Negligible
2.1-4.0	Low	2.0-4.0	Slight
4.1-8.0	Medium	4.0-8.0	Moderate
> 8.0	High	8.0-16.0	Severe
		> 16.0	Very Severe

Soil Physicochemical Characteristics Associated
with Cut and Fill Locations Reclaimed in 2005 or later

Soil physicochemical data collected from the 4 cut and fill drill pads reclaimed in 2005 or later represents a small fraction of the total number of cut and fill drill pads

reclaimed in the Jonah Field. Because of the small available soil physicochemical dataset for cut and fill locations reclaimed in 2005 or later, conclusions are considered preliminary.

For all drill pads, soil pH ranged from 7.1 to 7.9 after reclamation in the 0-61 cm depth increment indicating nitrogen and phosphorus availabilities should not be hindered by soil pH. Soil pH was not different than the nearby undisturbed range (Table 23, Figure 13). Based on Wyoming and Montana DEQ criteria (Tables 20, 21), soil pH to a depth of 61 cm was rated good and considered suitable.

Measured soil EC_e ranged from 0.32 to 4.83 dS/m and averaged 2.6 dS/m after reclamation. Except for one drill pad area, these soils are considered non-saline, appropriate for plants with a low salinity tolerance (SSSA 2007; USDA 2007) and pose a slight effect on plant growth (Sobek et al. 1973). Post reclamation soil EC_e was equivalent to the nearby undisturbed range (Table 23, Figure 14). Based on WDEQ and MDEQ criteria to establish suitability as topsoil and unsuitability criteria for soil and soil substitutes (Tables 20, 21), mean soil EC_e to a depth of 61 cm was categorized as good and considered suitable.

At reclaimed cut and fill drill pads, soil SAR averaged 5.2 in the 0-61 cm depth increment, with a maximum value of 10.4. Because all SAR values were <13 , none of the soils measured are considered saline-sodic or sodic (SSSA 2007). SAR ratios measured after reclamation were equivalent to those measured in the nearby undisturbed range (Table 23, Figure 15). Based on criteria in Tables 20 and 21, mean soil SAR to a depth of 61 cm is considered good or fair and suitable. The maximum SAR of 10.4 is

categorized as “poor” and considered unsuitable for lift 1 topsoil materials (Tables 20, 21).

For all drill pads, mean saturation percentage averaged 45.1 %, with a maximum value of 56.4 % indicating the soil water holding capacity of reclaimed cut and fill drill pad soils should not be impaired, and the clay matrix is not prone to disperse upon being wetted (Table 23, Figure 16). Saturation percentages at cut and fill drill pads reclaimed in 2005 or later were not different from the nearby range (Table 23). Based on Wyoming and Montana DEQ criteria (Tables 20, 21), all measured soil saturation percentage values to a depth of 61 cm are considered good and are of suitable quality.

For all drill pads, mean soil CaCO_3 concentrations ranged from 1.3 to 12.8 % and averaged 7.3 %. Mean soil CaCO_3 concentration measured post reclamation was not different than that measured in the nearby undisturbed range (Table 23). Based on criteria to establish suitability as topsoil (Table 20), all measured CaCO_3 percentages to a depth of 61 cm are categorized as good.

For all reclaimed cut and fill locations, mean soil nitrate, phosphorus and potassium concentrations were similar to the nearby undisturbed range (Table 23, Figures 19-21). The absence of changes in the magnitude of soil macronutrients indicate nutrient availability is not affected by reclamation of cut and fill locations (at the time of sampling).

Mean sand, silt and clay contents measured at reclaimed cut and fill locations were not different than those measured in the nearby undisturbed range (Table 23,

Figures 23-25). Loam, clay loam, sandy loam and sandy clay loam textures were determined for the four reclaimed cut and fill locations. Based on criteria in Table 21, loam, sandy loam and sandy clay loam textures are considered good whereas clay loam textures are considered fair.

In summary, no measured soil physicochemical traits at reclaimed cut and fill locations were different than those measured in the nearby undisturbed range (Table 23). The depth of coversoil salvage at the 4 cut and fill locations reclaimed in 2005 or later is unknown, indicating that a proportion the 61 cm soil samples collected may consist of chemically and physically undisturbed native subsoils. Analysis of soil samples on a 61 cm basis may not provide an appropriate basis to detect physicochemical changes within the disturbed salvaged soil when it constitutes only a small increment of the entire 61 cm profile analyzed.

Comparison of Soil Physicochemical Characteristics Between Construction Techniques

Relative to reference soil characteristics, the reclaimed cut and fill drill pads had increased percent changes in soil EC_e , percent $CaCO_3$, nitrate, phosphorus, potassium and percent sand compared to oak mat areas (Table 24). Physical mixing of reclaimed soils

Table 23. Comparison of soil physicochemical characteristics from 0-61 cm between cut and fill drill pads reclaimed in 2005 or later (RCAF) and the nearby undisturbed range (NUR).¹

Location	pH	p-value	EC (dS/m) ²	p-value	% Sat ³	p-value	SAR ⁴	p-value	Ca (meq/L)	p-value
RCAF	7.5	0.96	3.6	0.25	46.7	0.25	5.2	0.36	18.7	0.11
NUR	7.2		2.6		45.1		6.5		10.2	
Location	Mg (meq/L)	p-value	Na (meq/L)	p-value	% Rock	p-value	OM (%) ⁵	p-value	% Lime	p-value
RCAF	9.9	0.14	20.3	0.83	15.4	0.81	1.1	0.41	7.3	0.61
NUR	5.6		21.4		16.1		0.9		7.9	
Location	NO ₃ (mg/kg)	p-value	P (mg/kg)	p-value	K (mg/kg)	p-value	Sand (%)	p-value	Clay (%)	p-value
RCAF	7.3	0.11	5.1	0.09	216.1	0.19	51.0	0.21	22.9	0.35
NUR	2.6		3.7		161.6		45.8		31.1	

1. For statistical output see Appendix C: pp. 351-365.

2. EC = electrical conductivity, dS/m = deciseimens per meter.

3. % Sat = percent saturation.

4. SAR = sodium adsorption ratio, unitless.

5. OM = organic matter.

increases salts, sodium and CaCO₃ as chemical gradients developed through leaching and pedogenic processes are homogenized. At oak mat drill pad areas, soil chemical gradients are not disturbed, implying that soil chemistry should closely match the nearby undisturbed range.

Although a subset of chemical characteristics had percent change increases at reclaimed cut and fill locations (Table 24), reclamation practitioners may be more concerned with the effects of these increases on resulting plant growth potentials. The USDA Database indicates that the most limiting and sensitive species within the Jonah Field have medium tolerance to calcareous soil, medium fertility requirements, sensitivity to soil pH greater than 7.5 and low salinity tolerance (2.1-4.0 dS/m) (Table 25).

Although many of these characteristics are qualitative, both drill pad construction techniques indicate minimal or insignificant changes in percent CaCO₃ and plant macronutrients and the majority of drill pads and depth increments contained soil EC_e values below 4.0 dS/m and soil pH less than 7.5. Using the Wyoming DEQ criteria to

establish suitability as topsoil (Table 20), soil physical and chemical characteristics at oak mat removal areas, and reclaimed cut and fill drill pad locations were good or fair, with few drill pad analyte levels considered poor. Except for a few cases, analyte levels were suitable based on Montana DEQ criteria for soil and soil substitutes (Table 21). These results indicate both techniques may have growth media characteristics adequate for native plant species in the Jonah Field

Effect of Matting Duration and Seasonality

Vegetative Response to Duration of Oak Matting

Trends relating the length of time between mat construction and removal to vegetative responses would indicate whether an optimum oak mat-drilling duration may exist. Coefficients of determination (i.e. r^2 -value) were small and not significant (Table 26), indicating that vegetative density is independent of the duration of matting at a drill pad location. Identical results were determined for each section (7, 20, 28, 34), and when all pads were analyzed together.

Change in plant canopy cover as a function of matting duration is presented for all sites investigated and for matted pads located in Sections 7, 20, 28 and 34 (Table 26). Again, coefficients of determination were small and not significant indicating no relationship was present between the number of days a pad was matted and the percent change in plant canopy cover (Table 26).

Table 24. Percent change in soil chemical characteristics from 0 to 61 cm between measurements at oak mat removal areas (OMRA) and cut and fill locations reclaimed in 2005 or later (RCAF). Percent change in analytes are interpreted using the individual units listed for each.¹

Location	pH	p-value	EC (dS/m) ²	p-value	% Sat. ³	p-value	SAR ⁴	p-value	C:N Ratio	p-value	% Rock	p-value
OMRA (n=37)	1.3 %	0.50 §	-6.0 %	0.03 §	-6.1 %	0.39 §	-12.1 %	0.98 §	5.1 %	na	13.7 %	0.98 §
RCAF (n=4)	0.2 %		209 %		4.0 %		55.0 %		na		13.0 %	
Location	% Lime	p-value	NO ₃ (mg/kg)	p-value	P (mg/kg)	p-value	K (mg/kg)	p-value	% Sand	p-value	% Clay	p-value
OMRA (n=37)	-18.0 %	0.01	23.6 %	0.02 §	-6.5 %	0.03 §	-2.3 %	0.06 §	-0.1 %	0.03	2.6 %	0.27 §
RCAF (n=4)	48.0 %		24.7 %		41.0 %		44.0 %		15.7 %		-10.1 %	

1. For statistical output see Appendix C: pp. 366-376.

2. EC = electrical conductivity, dS/m = deciseimens per meter.

3. % Sat = percent saturation.

4. SAR = sodium adsorption ratio, unitless.

§ Data exhibiting non-normality or unequal variance were analyzed using the Mann-Whitney Rank Sum Test.

Table 25. Plant growth requirements for plant species native to the Jonah Field as determined by the USDA Plants Database (USDA 2007).

Species	Life Form	Common Name	Scientific Name	Limiting Soil Texture(s) ¹	Calcareous Soil Tolerance ²	Fertility Requirement ³	Maximum pH Tolerated ⁴	Salinity Tolerance ⁵
ARTRW	Forb	Woollypod milkvetch	<i>Astragalus purshii</i>	Fine	Medium	Low	7.5	Low
ASPU	Forb	Longleaf phlox	<i>Phlox longifolia</i>	Fine	Medium	Low	8.5	Low
ATCA	Forb	Scarlet globemallow	<i>Sphaeralcea coccinea</i>	Fine	High	Low	7.5	Low
ATCO	Grass	Squirreltail	<i>Elymus elymoides</i>	Coarse	High	Low	8.4	Low
ATGA	Grass	Thickspike wheatgrass	<i>Elymus lanceolatus</i>	None	Medium	Medium	8.4	Low
CHVI	Grass	Needle and thread	<i>Hesperostipa comata</i>	fine	Medium	Low	8.6	None
ELEL	Grass	Indian ricegrass	<i>Achnatherum hymenoides</i>	fine	High	Low	8.6	Low
ELLA	Grass	Muttongrass	<i>Poa fendleriana</i>	fine	High	Low	8.0	None
GRSP	Shrub	Wyoming big sagebrush	<i>Artemisia tridentata</i> var. <i>wyomingensis</i>	None	High	Low	8.5	Low
HECO	Shrub	Fourwing saltbush	<i>Atriplex canescens</i>	None	High	Low	9.5	High
KRLA	Shrub	Shadscale	<i>Atriplex confertifolia</i>	None	High	Medium	9.0	High
ORHY	Shrub	Gardner's saltbush	<i>Atriplex gardneri</i>	None	High	Low	9.0	High
PHLO	Shrub	Yellow rabbitbrush	<i>Chrysothamnus vicidiflorus</i>	Fine	High	Low	8.5	Low
POFE	Shrub	Spiny hopsage	<i>Grayia spinosa</i>	None	High	Low	9.0	High
SPCO	Shrub	Winterfat	<i>Krascheninnikovia lanata</i>	Coarse	High	Low	8.5	Low

1. Coarse soil defined by USDA soil textures of; sand, coarse sand, fine sand, loamy coarse sand, loamy fine sand,

loamy very fine sand, very fine sand and loamy sand. Fine soil defined by USDA soil textures of; sandy clay, silty clay and clay.

2. Calcareous soil defined as containing sufficient free carbonates to effervesce visibly and/or audibly when treated with cold 0.1M HCl.

3. Defined as the relative level of nutrition (N, P, K) required for normal growth and development.

4. pH tolerance considered for the surficial 30.5 cm of the soil profile.

5. Defined as the sensitivity to soil salinity resulting in ≤10 % reduction in plant growth. Levels are as follows: None, 0-2 dS/m; Low, 2.1-4 dS/m; Medium, 4.1-8; High, >8 dS/m.

Vegetative Response to Seasonality of Oak Matting

Percent change in plant density and canopy cover, relative to undisturbed

rangeland, as a function of the date of complete mat removal is presented for all sites

Table 26. Regression of duration of matting and the percent change in plant density and canopy cover.^ψ

Plant Density	Linear Coefficient of Determination r^2 -value	Regression p-value
All Drill Pads (n=43)		
Grass	— §	—
Forb	— §	—
Shrub	— §	—
Drill Pads in Section 7 (n=7)		
Grass	1.00E-06	0.99
Forb	0.006	0.86
Shrub	0.260	0.24
Drill Pads in Section 28 (n=4)		
Grass	0.005	0.93
Forb	0.102	0.68
Shrub	0.168	0.59
Drill Pads in Section 34 (n=9)		
Grass	0.005	0.86
Forb	0.230	0.20
Shrub	— §	—
Drill Pads in Section 20 (n=17)		
Grass	— §	—
Forb	— §	—
Shrub	0.017	0.62

Plant Cover	Linear Coefficient of Determination r^2 -value	Regression p-value
All Drill Pads (n=43)		
Grass	0.008	0.56
Forb	— §	—
Shrub	— §	—
Drill Pads in Section 7 (n=7)		
Grass	0.023	0.75
Forb	0.303	0.20
Shrub	0.073	0.56
Drill Pads in Section 28 (n=4)		
Grass	0.624	0.21
Forb	0.578	0.25
Shrub	0.032	0.82
Drill Pads in Section 34 (n=9)		
Grass	0.168	0.27
Forb	0.185	0.25
Shrub	— §	—
Drill Pads in Section 20 (n=17)		
Grass	0.029	0.51
Forb	— §	—
Shrub	4.00E-04	0.95

^ψFor statistical output see Appendix D, pp. 378-397.

§ Data does not meet the assumption of normality and could not be normalized.

investigated. Identical analyses were also performed for matted drill pads on a section by section basis to determine whether spatial trends were present (Table 27).

Trends relating the season of mat removal to vegetative responses would indicate whether oak mat-drilling may be timed to facilitate optimum plant growth. Except for the shrub response to oak mat removal dates in Section 34, coefficients of determination were small and not significant, indicating change in plant density and canopy cover are similar a) whether mats are removed over frozen soil surfaces compared with non-frozen soil surfaces, b) whether mats were removed in the spring (higher soil water content)

compared with the fall (lower soil water content), and c) whether mats were removed during the summer plant growth season. Identical results were determined for Sections 7, 20 and 28, and when all pads were analyzed together (Table 27). In Section 34, shrub density and canopy cover had a significant relationship to the date of complete mat removal (Table 27). The regression equation indicates change in shrub density and canopy cover in Section 34 becomes more positive as the date of complete mat removal shifts from frozen to non-frozen surface soil conditions, indicating percent change in shrub growth becomes increasingly positive as oak mats were removed in the late summer and early fall, or during the plant growth season, compared with during frozen surface soil conditions.

Effect of the Duration and Seasonality of Oak Matting on Soil Bulk Density

Trends relating the season of oak mat removal and the length of time between mat construction and removal to bulk density responses would indicate whether an optimum oak mat-drilling season or duration exists. Except for one significant regression in Section 34, these data indicate no consistent trend is present such that percent change in bulk density could be predicted by the duration of matting or the date of complete mat removal. Change in soil bulk density was similar regardless of the number of days required for drilling, whether mats were constructed/removed over frozen surface soils compared with non-frozen surface soils and whether mats were constructed/removed in the spring (higher soil water content) compared with the fall (lower soil water content). This was the result for all depth increments (i.e. 0-5.1, 0-15.2, and 0-30.5 cm), within

Table 27. Regression of the date of complete mat removal and the percent change in plant density and canopy cover.^Ψ

Density	Linear Coefficient of Determination r^2 -value	Regression p-value	Cover	Linear Coefficient of Determination r^2 -value	Regression p-value
All Drill Pads (n=43)			All Drill Pads (n=43)		
Grass	— §	—	Grass	0.044	0.17
Forb	— §	—	Forb	— §	—
Shrub	— §	—	Shrub	— §	—
Drill Pads in Section 7 (n=7)			Drill Pads in Section 7 (n=7)		
Grass	0.176	0.35	Grass	0.410	0.12
Forb	9.00E-4	0.95	Forb	0.012	0.82
Shrub	0.384	0.14	Shrub	0.109	0.47
Drill Pads in Section 28 (n=4)			Drill Pads in Section 28 (n=4)		
Grass	0.137	0.63	Grass	0.116	0.66
Forb	0.221	0.53	Forb	0.490	0.30
Shrub	0.023	0.85	Shrub	0.176	0.58
Drill Pads in Section 34 (n=9)			Drill Pads in Section 34 (n=9)		
Grass	9.00E-4	0.95	Grass	0.023	0.70
Forb	9.00E-4	0.94	Forb	0.005	0.88
Shrub	0.927	<.001	Shrub	0.810	<.001
Drill Pads in Section 20 (n=17)			Drill Pads in Section 20 (n=17)		
Grass	— §	—	Grass	— §	—
Forb	0.002	0.86	Forb	— §	—
Shrub	0.014	0.67	Shrub	0.004	0.82

^Ψ For statistical output see Appendix D: pp. 398-419.

§ Data does not meet the assumption of normality and could not be normalized.

each section (7, 20, 28, 34), and when all pads were analyzed together (Tables 28, 29).

The exception to this result was present for nine drill pads in Section 34 where the p-value was significant for bulk density in the 0-30.5 cm increment. These data indicate that percent change in soil bulk density became more positive as the mat coverage period increased (Figure 26). The 0-5.1 cm and 0-15.2 cm increments for these same nine drill pads in Section 34 did not indicate a trend of increasing soil bulk density as a function of the matting period (Table 28). As a result, soil bulk density increases were not consistently related to the duration or seasonality of matting at oak mat drill sites.

Table 28. Regression of the duration of matting and the percent change in soil bulk density.^Ψ

Soil Depth Increment (cm)	Linear Coefficient of Determination r^2 -value	Regression p-value
All Drill Pads (n=38)		
0-5.1	0.036	0.25
0-15.2	4.00E-04	0.93
0-30.5	0.002	0.82
Drill Pads in Section 7 (n=6)		
0-5.1	0.109	0.53
0-15.2	0.003	0.93
0-30.5	0.109	0.53
Drill Pads in Section 28 (n=4)		
0-5.1	— §	—
0-15.2	— §	—
0-30.5	— §	—
Drill Pads in Section 34 (n=9)		
0-5.1	0.044	0.6
0-15.2	0.109	0.38
0-30.5	0.624	0.01
Drill Pads in Section 20 (n=18)		
0-5.1	4.00E-04	0.95
0-15.2	0.102	0.21
0-30.5	0.048	0.39

Table 29. Regression of the date of complete mat removal and the percent change in soil bulk density.^Ψ

Soil Depth Increment (cm)	Linear Coefficient of Determination r^2 -value	Regression p-value
All Drill Pads (n=38)		
0-5.1	0.012	0.52
0-15.2	0.004	0.71
0-30.5	0.017	0.46
Drill Pads in Section 7 (n=6)		
0-5.1	0.036	0.72
0-15.2	0.017	0.80
0-30.5	0.144	0.45
Drill Pads in Section 28 (n=4)		
0-5.1	— §	—
0-15.2	— §	—
0-30.5	— §	—
Drill Pads in Section 34 (n=9)		
0-5.1	0.020	0.73
0-15.2	0.014	0.76
0-30.5	0.053	0.54
Drill Pads in Section 20 (n=18)		
0-5.1	0.020	0.59
0-15.2	0.053	0.37
0-30.5	0.250	0.04

Ψ For statistical output see appendix D: pp. 420-440 (Table 30) and pp. 441-455 (Table 31).

§ Data did not exhibit constant variance and could not be transformed.

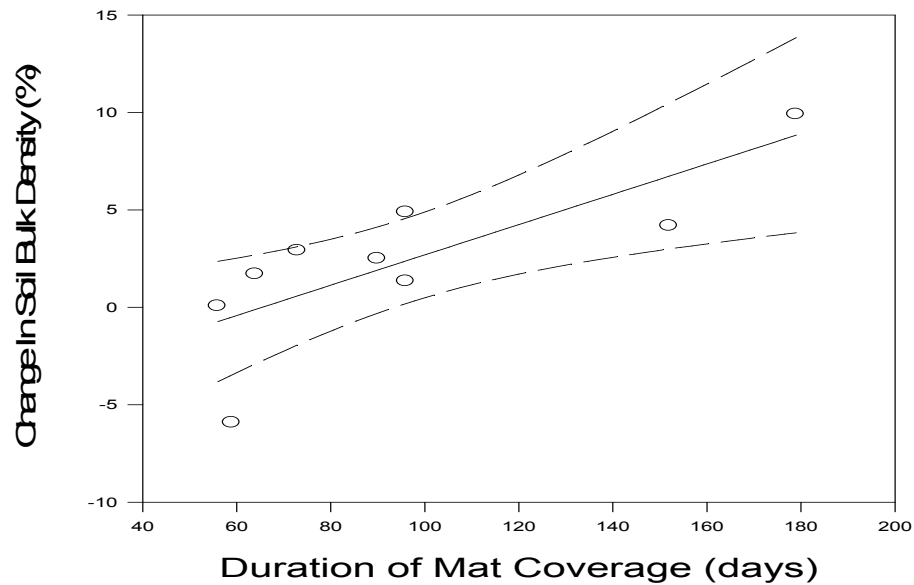


Figure 26. Duration of oak mat coverage in Section 34 and percent change in soil bulk density from 0-30.5 cm ($p = 0.01$, $r^2 = 0.62$).

Ancillary Plant Recovery and Soil
Compaction Analysis at Oak Mat Areas

Regression of Vegetation Traits at Oak Mat Areas

Vegetation Growth Response Interrelations at Oak Mat Areas: Relationships between grass, forbs and shrub populations would indicate whether inter-lifeform competition is prevalent in the Jonah Field. No significant relationships were determined between 1) grass density and/or canopy cover to forb and shrub characteristics, 2) forb density and/or canopy cover to grass and shrub characteristics, 3) shrub density and/or canopy cover to grass and forb characteristics and 4) whether plant life form canopy cover could be explained by its density. Total forb canopy cover is positively related to grass canopy cover (Figure 27; Table 30-Eq # 1) and total shrub density is positively related to grass density (Figure 28; Table 30-Eq # 2). These equations indicate that the success of one plant life form does not necessarily come at the expense of the others.

The absence of significant negative regressions between grass, forb and shrub density and canopy cover indicates that the magnitude of inter-species resource competition is minimal between life forms in the Jonah Field. Although increases in the proportion of grass density and canopy cover have been measured within oak mat removal plant communities (Table 5), these results indicate the success of grasses may not negatively affect the growth response of forb canopy cover and shrub density. No significant regressions were determined among *percent* change in grass, forb and shrub density and canopy cover relative to the other plant life forms. Finally, grass canopy cover could be predicted from grass density whereas forb and shrub canopy cover could

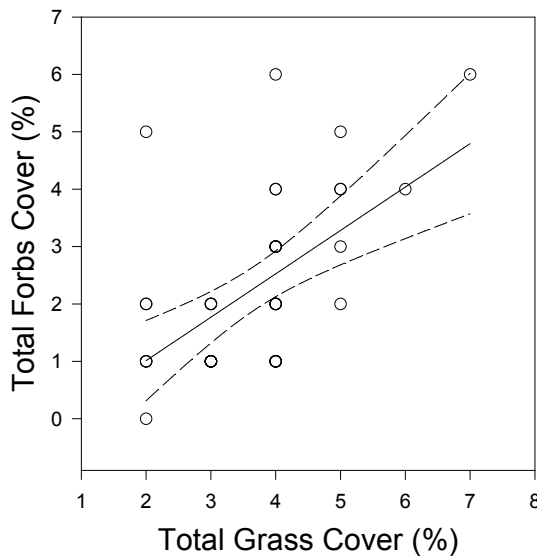


Figure 27. Regression of grass canopy cover and forb canopy cover.

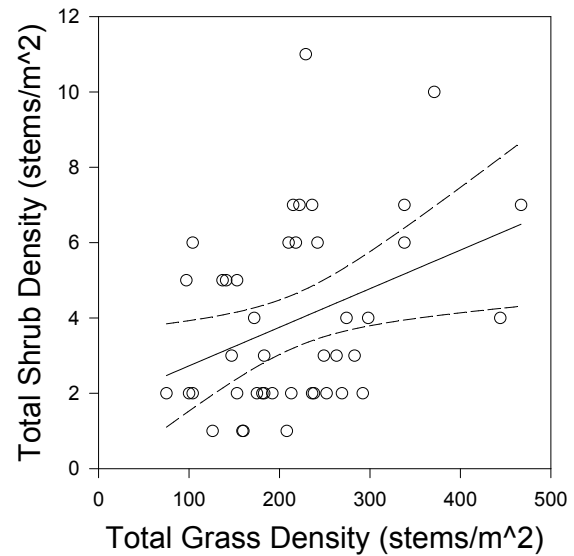


Figure 28. Regression of grass density and shrub density.

not be predicted from forb and shrub density at oak mat removal areas (Table 30-Eq #3).

Vegetation Growth Response to Soil Bulk Density at Oak Mat Areas:

Relationships between soil bulk density and vegetative growth responses would indicate whether grasses, forbs and shrubs proliferate within specific bulk density ranges. Except for two significant forb regressions, grass, forb and shrub density and canopy cover could not be predicted by mean bulk density or the percent change in bulk density for all depth increments. Forb density and canopy cover were predicted by the 0-30.5 and 0-15.2 cm increment post-mat bulk density, respectively (Table 30-Eq #4, 5). Regression equations for forb density and canopy cover indicate a positive growth response to increasing bulk density (Table 30). Although this relationship may in fact be genuine, coefficients of determination were generally small. Furthermore, no significant regressions were

determined between *percent change* in grass, forb and shrub density and canopy cover relative to mean and percent change bulk density.

Vegetation Growth Response to Soil Chemistry at Oak Mat Areas: Relationships between soil chemistry and vegetative growth responses would indicate whether grasses, forbs and shrubs proliferate within specific soil chemical ranges. No significant multiple regressions to soil alkalinity were determined, however, regression of grass canopy cover to soil pH yielded a significant relationship. Oak mat removal area grass canopy was negatively related to soil pH, indicating that increasing soil alkalinity results in decreasing grass canopy cover (Table 30- Eq #6).

Surprisingly, plant growth responses to soil salinity and sodicity indicate no significant relationships between all analytes, or when EC_e , SAR, saturation percent and available sodium were analyzed independently. One explanation for this result is that soil salinity and sodicity at oak mat removal areas may be below levels that produce negative plant growth responses. This explanation is partially substantiated by the criteria for establishing topsoil suitability, unsuitability criteria for soil and soil substitutes and growth requirement characteristics determined by the USDA Plants Database for species native to the Jonah Field. These sources indicate soil salinity and sodicity at oak mat removal areas are generally low and benign from a plant growth perspective. A second explanation may be that other factors such as soil moisture, soil temperature and length of growing season are more limiting to plant growth in the Jonah Field, resulting in the low coefficients of determination associated with regressions of soil salinity and sodicity.

Plant growth response to soil fertility and soil micronutrients indicate 1) total shrub density can be predicted by available soil phosphorus, 2) total grass density can be predicted from a combination of soil nitrate and total nitrogen levels, or by total nitrogen alone, 3) grass canopy cover may be predicted from available soil calcium and, 4) forb canopy cover can be predicted by total soil nitrogen (Table 30-Eq #7-11).

Based on these regression equations, consistent trends were not indicated. Grass density improved as total soil nitrogen levels became larger, whereas forb canopy cover improved as total soil nitrogen levels became lower. Increases in available soil calcium lowered total grass canopy cover, whereas no relationship was associated with increases in available soil sodium (Table 30-Eq #7-11).

If the grass, forb and shrub density and canopy cover responses to soil macro and micronutrient levels were consistently significant, the relative Jonah Field plant life form preferences for soil nitrate, total nitrogen, phosphorus, potassium, calcium, magnesium and sodium would be more apparent. With many non-significant relationships, it is unknown whether macro and micro nutrient levels at oak mat removal areas are optimum for each plant life form, and challenging to determine whether the current levels will promote the success of one life form at the expense of another.

Finally, plant response to soil texture indicated that forb density and canopy cover are greater when the percent sand content is greater (Table 30-Eq #13, 14). This result agrees with the USDA Plants Database which indicates that fine soil textures tend to restrict forbs. A single multiple regression between percent change in grass canopy cover and percent sand and silt were determined to be significant (Table 30-Eq #12).

Table 30. Significant multiple and linear regression of oak mat removal area vegetation growth response interrelations, and vegetation response to soil bulk density and physicochemical analytes.¹

Regression Type	Dependent Variable	Independent Variable(s)	Regression Equation ²	Eq. No. ³	r ² -value	p-value
Vegetation Growth Response Interrelations	Forb Cover	Grass Cover	$y = (0.756x) - 0.5$	3)	0.31	<0.001
	Shrub Density	Grass Density	$y = e^{(0.523 \ln x)} - 1.597$	4)	0.11	0.03
	Grass Cover	Grass Density	$y = (0.0483x) + 2.625$	5)	0.14	0.01
Vegetation Growth Response to Bulk Density	Forb Density	Bulk Density (0-30.5 cm)	$y = e^{(5.952 \ln x)} - 0.455$	6)	0.12	0.04
	Forb Cover	Bulk Density (0-15.2 cm)	$y = (9.068x) - 10.249$	7)	0.19	0.01
Vegetation Growth Response to Soil Alkalinity	Grass Cover	pH	$y = (-2.254x) + 20.345$	8)	0.35	<0.001
Vegetation Growth Response to Soil Fertility and Micronutrients	Grass Density	Nitrate and Total Nitrogen	$y = (-10.265 \text{NO}_3) + (0.174 \text{TKN}) + 93.919$	9)	0.40	0.02
	Grass Density	Total Nitrogen	$y = (0.142x) + 66.665$	10)	0.25	0.03
	Forb Cover	Total Nitrogen	$y = e^{(-1.178 \ln x)} + 8.718$	11)	0.52	<0.001
	Shrub Density	Phosphorus	$y = e^{(-0.938 \ln x)} + 3.023$	12)	0.22	0.004
	Grass Cover	Calcium	$y = (-0.252x) + 4.741$	13)	0.10	0.05
Vegetation Growth Response to Soil Texture	% Change Grass Cover	% Sand and Clay	$y = (2.145 \text{Sand}) + (5.895 \text{Clay}) - 221.497$	14)	0.23	0.01
	Forb Density	% Sand	$y = e^{(2.180 \ln x)} - 6.636$	15)	0.44	<0.001
	Forb Cover	% Sand	$y = e^{(1.801 \ln x)} - 6.142$	16)	0.55	<0.001

1. For statistical analysis see Appendix E: pp. 457-470.

2. All data fulfilled assumptions of normality and equal variance.

3. Eq. No. = Equation number.

In summary, significant relationships between measured grass, forb and shrub characteristics, plant growth responses to soil bulk density, and responses to soil physical and chemical characteristics were infrequent. Few regressions of a single independent variable were determined to be significant. Of the significant regressions, few present insight into the dynamics of predicting plant growth response at oak mat removal areas or determining optimum bulk density and soil physical and chemical characteristics. Significant regressions that adequately predict an optimum plant growth characteristic often do it in the absence of an understanding of the response of the other plant life forms. As a result, it is difficult to suggest criteria for screening potential oak mat drill pad locations and predicting reclamation success or failure based on antecedent grass, forb or shrub density and canopy cover, soil bulk density or soil physical and chemical characteristics.

Vegetative Response after One and Two Years at Oak Mat Areas

Grass density and canopy cover significantly increased in 2007 compared with 2006 (Table 31). These data indicate the increased vigor of grass after oak mat removal continued through a second growing season.

Forb canopy cover and density were not significantly different in 2006 compared with 2007 (Table 31). Comparing forb growth traits at oak mat removal sites to their respective reference areas also indicated no differences were present. These data indicate forb canopy cover and density were stable through the 2006 and 2007 growing season.

As discussed previously, shrub canopy cover and density were negatively affected by the oak mat technique. However, shrub canopy cover increased from 2006 through 2007 at oak mat removal areas (Table 31). This trend indicates shrub canopy cover appears to be recovering with time following oak matting.

Species richness of grasses, forbs and shrubs significantly increased in 2007 compared to species richness in 2006 (Table 31). Because shrub canopy cover and density are negatively affected by oak matting in the Jonah Field, the reduced competition from shrubs may be enough to attract new native grass, forb and shrub species to colonize the area.

Vegetative Response at Mowed and Unmowed Oak Mat Areas

Except for one drill pad, recovery of all vegetative traits on mowed sites were not different compared to sites not mowed (Table 32, 33). Based on this analysis, mowing the

Table 31. Change in measured vegetation traits from 2006 to 2007 at oak mat removal areas.^ψ

Drill Pad	Canopy Cover (%)			Density (stems/m ²)			Species Richness (number of species present)		
	2006	2007	Change	2006	2007	Change	2006	2007	Change
Grass									
SHB 54-20	0.4	3.0	2.6	44.8	159.0	114.2	0.9	2.0	1.1
SHB 58-20	1.3	4.0	2.8	193.6	215.0	21.4	1.2	3.0	1.8
SHB 59/113-20	0.7	2.0	1.3	88.8	100.0	11.2	1.2	2.0	0.8
SHB 69-20	0.3	4.0	3.7	29.6	229.0	199.4	0.6	3.0	2.4
SHB 70-20	4.3	2.0	-2.3	389.6	283.0	-106.6	1.2	2.0	0.8
SHB 71-20	0.7	3.0	2.3	135.6	210.0	74.4	1.1	3.0	1.9
SHB 75-20	0.9	3.0	2.1	192.8	274.0	81.2	1.2	2.0	0.8
SHB 76-20	1.1	4.0	3.0	128.0	467.0	339.0	1.1	3.0	1.9
SHB 111-20	0.9	3.0	2.1	123.6	213.0	89.4	1.2	2.0	0.8
SHB 112-20	2.2	4.0	1.9	194.0	444.0	250.0	1.4	3.0	1.6
SHB 112X-20	1.9	4.0	2.1	181.6	338.0	156.4	1.3	3.0	1.7
SHB 122-20	0.9	3.0	2.1	139.6	222.0	82.4	1.3	2.0	0.7
SHB 123-20	0.4	3.0	2.7	89.2	269.0	179.8	0.9	2.0	1.1
SHB 124-20	2.6	3.0	0.4	81.2	249.0	167.8	1.0	2.0	1.0
SHB 124X-20	0.5	2.0	1.5	61.6	242.0	180.4	1.0	2.0	1.0
SHB 125-20	1.3	4.0	2.7	174.4	371.0	196.6	1.0	3.0	2.0
MEAN [†]	1.3 a	3.2 b [‡]	1.9	140.5 a	267.8 b	127.3	1.1 a	2.4 b [‡]	1.3
Forb									
SHB 54-20	0.5	1.0	0.5	1.2	3.0	1.8	0.2	1.0	0.8
SHB 58-20	0.0	2.0	2.0	3.2	11.0	7.8	0.3	1.0	0.7
SHB 59/113-20	1.1	1.0	-0.1	7.2	3.0	-4.2	0.6	1.0	0.4
SHB 69-20	0.3	2.0	1.8	0.4	9.0	8.6	0.1	2.0	1.9
SHB 70-20	0.4	1.0	0.7	0.8	2.0	1.2	0.2	1.0	0.8
SHB 71-20	0.3	1.0	0.7	0.8	2.0	1.2	0.2	1.0	0.8
SHB 75-20	1.5	2.0	0.6	5.6	8.0	2.4	0.7	3.0	2.3
SHB 76-20	1.9	1.0	-0.9	8.4	3.0	-5.4	0.7	1.0	0.3
SHB 111-20	1.7	1.0	-0.7	3.6	2.0	-1.6	0.4	1.0	0.6
SHB 112-20	0.0	1.0	1.0	2.8	3.0	0.2	0.1	1.0	0.9
SHB 112X-20	3.2	1.0	-2.2	19.2	3.0	-16.2	0.9	1.0	0.1
SHB 122-20	1.7	1.0	-0.7	4.0	5.0	1.0	0.8	1.0	0.2
SHB 123-20	0.4	1.0	0.7	4.0	1.0	-3.0	0.3	1.0	0.7
SHB 124-20	2.6	1.0	-1.6	8.4	3.0	-5.4	0.8	1.0	0.2
SHB 124X-20	0.8	1.0	0.3	1.6	3.0	1.4	0.3	1.0	0.7
SHB 125-20	0.1	1.0	1.0	0.4	2.0	1.6	0.1	1.0	0.9
MEAN	1.0 a	1.2 a	0.2	4.5 a	3.9 a	-0.5	0.4 a	1.2 b [‡]	0.8
Shrub									
SHB 54-20	2.0	1.0	-1.0	1.6	1.0	-0.6	0.3	1.0	0.7
SHB 58-20	0.9	4.0	3.2	6.8	7.0	0.2	0.5	3.0	2.5
SHB 59/113-20	3.2	2.0	-1.2	4.8	2.0	-2.8	0.7	2.0	1.3
SHB 69-20	0.8	5.0	4.3	0.8	11.0	10.2	0.2	4.0	3.8
SHB 70-20	2.2	3.0	0.8	2.8	3.0	0.2	0.3	3.0	2.7
SHB 71-20	0.3	2.0	1.8	2.4	6.0	3.6	0.6	2.0	1.4
SHB 75-20	2.6	3.0	0.5	8.4	4.0	-4.4	1.1	3.0	1.9
SHB 76-20	2.2	8.0	5.9	6.0	7.0	1.0	1.1	4.0	2.9
SHB 111-20	1.9	2.0	0.2	4.0	2.0	-2.0	0.7	2.0	1.3
SHB 112-20	3.2	3.0	-0.2	2.8	4.0	1.2	0.6	3.0	2.4
SHB 112X-20	2.4	3.0	0.6	6.4	6.0	-0.4	0.9	3.0	2.1
SHB 122-20	6.3	6.0	-0.3	6.0	7.0	1.0	1.0	5.0	4.0
SHB 123-20	0.8	3.0	2.3	2.0	2.0	0.0	0.4	2.0	1.6
SHB 124-20	0.6	2.0	1.4	6.8	3.0	-3.8	0.5	2.0	1.5
SHB 124X-20	0.6	2.0	1.5	0.8	6.0	5.2	0.2	2.0	1.8
SHB 125-20	2.7	4.0	1.3	3.2	10.0	6.8	0.7	2.0	1.3
MEAN	2.0 a	3.3 b	1.3	4.1 a	5.1 a [‡]	1.0	0.6 a	2.7 b	2.1

^ψ For statistical analysis see Appendix E: pp. 471-479.[†] Means followed by a different letter are statistically different ($p < 0.05$).[‡] Data were transformed prior to analysis in order to normalize the distribution.

sites prior to mat assembly had no significant impact on vegetative growth. Following two growing season after mat removal, results indicated vegetation traits on mowed sites were not different from vegetation traits on sites not mowed.

Effect of Soil Texture on Percent Change in Bulk Density at Oak Mat Areas

Effect of sand and clay content on soil compaction for 37 mat removal sites is shown in Figures 29 and 30. Soils with textures minimizing bulk density increases in the presence of surface loading would be good candidates for the use of oak mats. Changes in soil bulk density, resulting from the construction and removal of oak mats, as a function of either sand or clay content were not significant. This indicates there is no rationale to exclude oak matting procedures from any areas evaluated in the Jonah Field, based on perceived increases to soil bulk density resulting from soil texture.

Impacts to Soil Bulk Density under Oak Mat Roadways

Statistical analysis of differences between soil bulk densities on five matted roads compared with adjacent undisturbed rangeland are presented in Table 34. Use of oak mats in constructing drill pad access roadways presents an alternative to reclamation intensive engineered roadway construction but may have limited applicability if it results in severe soil compaction. Three oak mat road removal areas (JF 67-7, JF 120-7, and JF 37-8), had no significant change in soil bulk density (Table 34).

Table 32. Comparison of vegetation traits after oak mat removal at mowed and unmowed sites.^ψ

Vegetation Traits	Mowed (n=10)	Not Mowed (n=7)	P-value
Grass			
Mean Canopy Cover	3	3	0.88 [†]
Mean Density (stems/m ²)	290	217	0.06 [†]
Mean Species Richness [‡]	3	2	0.49 [†]
Forb			
Mean Canopy Cover	1	1	0.88 [†]
Mean Density (stems/m ²)	4	4	0.81 [†]
Mean Species Richness [‡]	1	1	0.96 [†]
Shrub			
Mean Canopy Cover	3	4	0.88 [†]
Mean Density (stems/m ²)	5	4	0.66
Mean Species Richness [‡]	3	3	0.96 [†]

^ψ For statistical analysis output see Appendix E: pp. 480-488.

[†] Nonparametric Mann-Whitney Rank Sum Test used for analysis of significance due to non-normality of data.

[‡] Species richness is measured by the number of species present.

Table 33. Recovery of vegetation traits compared to the nearby undisturbed range at oak mat areas that were either mowed or not mowed.^ψ

Plant Trait	Mat Removal Area Compared to Undisturbed Rangeland		p-value
	Mowed (n=10)	Not Mowed (n=7)	
	% Change		
Grass			
Density	71	38	0.13 \$
Canopy Cover	31	4	0.12 \$
Species Richness	2	0	0.66 \$
Forb			
Density	4	-27	1.0 \$
Canopy Cover	24	14	1.0 \$
Species Richness	5	14	0.79 \$
Shrub			
Density	18	-56	0.04
Canopy Cover	-74	-69	0.60
Species Richness	8	-10	0.54

^ψ Statistical analysis, Appendix E. pp. 480-488.

§ Data exhibiting a non-normal distribution was analyzed using the Mann-Whitney Rank Sum Test.

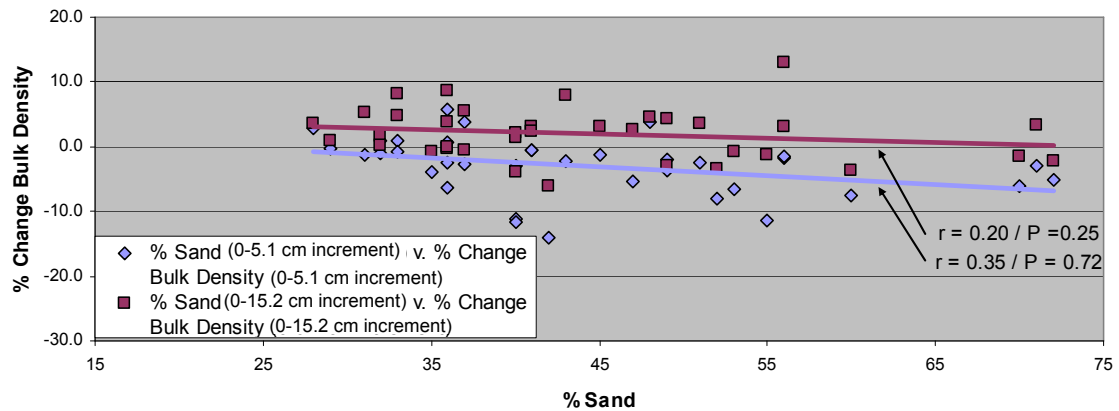


Figure 29. Percent change in soil bulk density, before mat construction and after mat removal, as a function of the soil sand percentage. For statistical output see Appendix E: pp. 489-490.

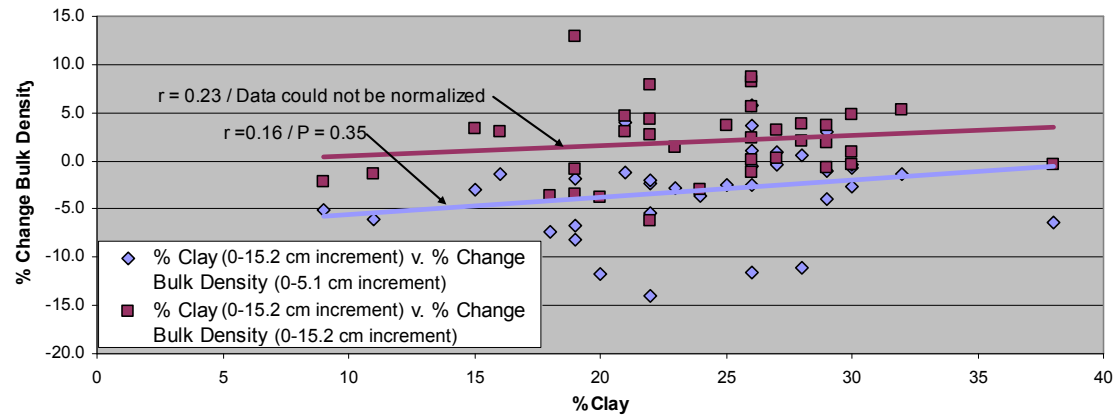


Figure 30. Percent change in soil bulk density, before mat construction and after mat removal, as a function of the soil clay percentage. For statistical output see Appendix E: pp. 491.

The matted road area associated with drill pad JF 19-7 had a higher bulk density in the 0-5.1 cm increment as a result of the technique, but neither the 0-15.2 nor 0-30.5 cm increment bulk densities were higher than the control. The 0-5.1 cm mean bulk density was 0.07 g/cm³ higher than the control (Table 34).

The matted road area leading into pad JF 38-5 had higher soil bulk densities in the 0-5.1, 0-15.2, and 0-30.5 cm depth increments relative to the control. Most notably, the

0-5.1 cm increment mean bulk density was 0.26 g/cm^3 greater than the control. In the 0-15.2 and 0-30.5 cm increments, bulk densities were 0.12 and 0.08 g/cm^3 larger respectively (Table 34).

Based on analysis of these five oak mat roadways, compacted soil materials did not consistently reach soil densities in the range of 1.45 to 1.70 g/cm^3 in the 0-5.1 and 0-15.2 cm depth increments. Studies of additional oak mat roadways may provide insight in determining whether access roadways constructed with oak mats may impair successful plant germination and growth to a degree that engineering practices should be changed.

Table 34. Comparison of soil bulk density measured at oak mat roadways and in the nearby undisturbed range.¹

Location	Measurement Type	Depth Increment ²		
		0-5.1	0-15.2	0-30.5
JF 38-5	Oak Mat Roadway	1.31a	1.49a	1.54a
	Nearby Undisturbed Range	1.05a	1.37b	1.46b
JF 19-7	Oak Mat Roadway	1.19a	1.42a	1.50a
	Nearby Undisturbed Range	1.12b	1.39a	1.48a
JF 67-7	Oak Mat Roadway	1.12a	1.37a	1.49a
	Nearby Undisturbed Range	1.15a	1.39a	1.49a
JF 120-7	Oak Mat Roadway	1.28a	1.50a	1.53a
	Nearby Undisturbed Range	1.19a	1.41a	1.51a
JF 37-8	Oak Mat Roadway	1.20a	1.46a	1.54a
	Nearby Undisturbed Range	1.19a	1.38a	1.46a

1. For statistical output see Appendix E: pp. 492-506.

2. Statistical analysis valid within individual locations only. Means followed by the same letter, within the same depth increment are not significantly different ($p \leq 0.05$).

SUMMARY AND CONCLUSIONS

Impacts to Vegetative Communities

The percent change in grass density at oak mat removal areas (+37 %) was significantly greater than at cut and fill locations reclaimed before 2005 (+16 %). Grass contributed a smaller proportion of density and canopy cover to the oak mat removal area vegetation community (95 % and 40 %, respectively) compared to reclaimed cut and fill locations (99 % and 79 %, respectively).

Percent change in forb density and canopy cover at oak mat removal areas (+24 %, +16 %, respectively) was significantly higher than at cut and fill locations reclaimed pre-2005 where percent change was negative (-86 %, -80 %, respectively). Furthermore, the proportion of weedy forb to total forb density is approximately fifty times higher at reclaimed cut and fill locations (99 %) than within the nearby undisturbed range (2 %) and five times higher compared to oak mat removal areas (21 %).

Shrub density and canopy cover at cut and fill locations reclaimed before 2005 were reduced relative to the control (-84 % and -87 %, respectively), whereas oak mat removal area density and canopy cover was reduced to a lesser degree (-33 % and -66 %, respectively) relative to the control. The potential for future rebounds in shrub populations is greater at oak mat removal areas, as the proportion of Wyoming big sagebrush seedling density is highest there (23 %), greater even than in the nearby undisturbed range (14 %).

The Jonah Interagency Office (JIO) has determined reclamation criteria for “rollover credit” in the Jonah Field, which provide quantitative measures of reclamation success. The JIO has currently examined only a few oak mat and reclaimed cut and fill areas for credit. Assessments of those drill pad areas submitted to the JIO for rollover credit in 2007 were not available at the time of publication.

Thus, in the absence of JIO rulings, comparisons between construction techniques can be made solely in regard to the criteria established, and not the JIO record of decision. Based on comparisons of measured vegetation characteristics to the JIO criteria, 27 of the 43 presented oak mat removal sites merit approval of rollover acreage in 2007 (EnCana Oil and Gas et al. 2006). Although some of the 27 sites do not meet all JIO reclamation criterion, these sites have similar vegetation and stability traits to the adjacent native range and have healthy and vigorous grass, forb and shrub components and small weed populations. No rollover acreage request will be made in 2007 for 16 mat removal sites (EnCana Oil and Gas et al. 2006) because of deficient shrub components.

Currently, none of the 66 cut and fill drill pad locations reclaimed before 2005 have been submitted to the JIO for assessment. Of the 83 cut and fill drill pads which received contemporary and science based reclamation and site specific seeding prescriptions, it is likely that none will pass the JIO criteria and attain rollover credit because of low native forb and shrub density and diversity and enhanced non-native weed components.

Based on the JIO criteria and the numerical and statistically significant vegetation

growth characteristic advantages, the oak mat drill pad construction technique has a greater potential to minimize impacts to the vegetative communities associated with the construction of natural gas drill pads in the Jonah Field.

Impacts to Soil Bulk Density

Relative increases and decreases in soil bulk density resulting from both drill pad construction techniques have direct effects on resulting plant growth potentials and reclamation success. Soil bulk density at oak mat drill pads decreased 3.0 % in the 0-5.1 cm depth increment, increased 1.8 % in the 0-15.2 cm depth and increased 3.9 % in the 0-30.5 cm depth. The mean soil bulk density at reclaimed conventional drill pads (across all reclamation treatments) increased 7.0 % in the 0-5.1 cm depth, increased 10.9 % in the 5.1-15.2 cm depth and increased 11.7 % in the 15.2-45.7 cm depth (Table 19).

Several trends in soil bulk density are apparent. Between construction techniques, an evaluation of percent change in soil bulk density and the percentage of sites with bulk densities in the range of 1.45 to 1.70 g/cm³ indicate 1) both techniques result in greater compaction at greater depths, 2) the percent change in bulk density within each measured depth increment was higher at reclaimed cut and fill drill pad locations, and 3) increases in soil bulk density with the potential to impact plant growth are more prevalent at reclaimed cut and fill locations. Based on this assessment, the oak mat drill pad construction technique reduces impacts to soil bulk density and minimizes associated negative plant growth responses relative to the cut and fill technique in the Jonah Field.

Impacts to Soil Physical and Chemical Characteristics

Cut and fill drill pads reclaimed in 2005 or later had increases in the mean percent change in soil EC_e (+209 %), percent $CaCO_3$, (+48 %), nitrate (+25 %), phosphorus (+41 %), potassium (+41 %) and percent sand (+16 %) compared with oak mat areas. At oak mat drill pad areas, soil chemical gradients are not disturbed, implying that soil chemistry should closely, if not exactly, match the nearby undisturbed range. Measured changes in soil physical and chemical characteristics at oak mat drill pad areas are generally attributed to soil spatial variability as opposed to impacts from the matting procedure.

Comparative Evaluation of Drill Pad Construction Techniques

Advantages of the oak mat drill pad construction technique resulted from relatively unchanged soil physical and chemical characteristics and comparatively lower soil bulk density along with climatic barriers to germination and establishment of forbs and shrubs at reclaimed cut and fill locations, absence of soil handling, and physical oak mat properties. The oak mat drill pad construction technique retained a proportion of viable, mature and reproducing grass, forbs and shrubs immediately at the close of drilling operations, with stable or increasing populations present through the second growing season. Reclaimed cut and fill drill pads must effectively start from zero vegetative density and canopy cover (e.g. vegetation monitoring on cut and fill drill pads reclaimed and seeded in 2005 or later failed to detect a single forb in 2007). Examples of

these comparative oak mat advantages, with specific emphasis on sagebrush are provided in the following dialogue.

Several authors have reported major constraints to big sagebrush germination through direct seeding of mined lands because of direct competition for soil moisture by concurrently seeded grasses (Blaisdell 1949; Cook and Lewis 1973; Sturges 1977; Richardson et al. 1986; Eissenstat and Caldwell 1988; Jones 1991; Schuman and Booth 1998). Furthermore, sagebrush seed has a relatively short-lived viability (Young and Evans 1989), with some associated seed dormancy (McDonough and Harniss 1974; Booth et al. 1997). Plant competition for soil moisture in the Jonah Field may be exacerbated by the seasonal precipitation regime and low annual rainfall, effectively increasing the difficulty of sagebrush establishment at reclaimed cut and fill locations.

The oak mat construction technique had a reduced tendency for the proliferation of exotic, introduced or non-native forb species compared with reclaimed cut and fill locations, presumably because of the minimal aerial extent of unvegetated, broken and disturbed soil generated. Management methods involving external disturbance and/or widespread plant mortality often result in the establishment of exotic species (Larson 2003). Watts (1998) indicates disturbance as an important component of introduced plant establishment in sagebrush steppe environments in southern Idaho.

The development of location-specific cut and fill drill pad reclamation prescriptions based on measured soil and vegetation characteristics and region specific best management practices continues to improve the reclamation potential of cut and fill drill pads in the Jonah Field. However, as a result of the magnitude of soil and vegetation

disturbances associated with the cut and fill construction technique, and external climatic limitations inherent to the Jonah Field, the reclamation success and timeliness of oak mat drill pads appears to be greater than that obtained at reclaimed cut and fill locations.

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APPENDICES

APPENDIX A

STATISTICAL OUTPUT FOR VEGETATION ANALYSES

Paired t-test Results for Oak Mat Removal Area Grass Density versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, September 12, 2007, 1:07:30 PM

Data source: All sections data in Notebook 1

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Wednesday, September 12, 2007, 1:07:30 PM

Data source: All sections data in Notebook 1

Group	N	Missing	Median	25%	75%
Matted Grass Density	43	0	213.000	154.500	260.250
Reference Grass Density	43	0	150.000	127.500	211.500

W= -453.000 T+ = 246.500 T-= -699.500

Z-Statistic (based on positive ranks) = -2.735

(P = 0.006)

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant difference (P = 0.006).

Paired t-test Results for Oak Mat Removal Area Grass Canopy Cover versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, September 12, 2007, 1:11:42 PM

Data source: All sections data in Notebook 1

Normality Test: Failed ($P < 0.050$)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Wednesday, September 12, 2007, 1:11:42 PM

Data source: All sections data in Notebook 1

Group	N	Missing	Median	25%	75%
Matted Grass Cover	43	0	4.000	3.000	4.000
Reference Grass Cover	43	0	3.000	3.000	4.000

W= -80.000 T+ = 208.000 T- = -288.000

Z-Statistic (based on positive ranks) = -0.821

(P = 0.418)

The change that occurred with the treatment is not great enough to exclude the possibility that it is due to chance (P = 0.418).

Paired t-test Results for Oak Mat Removal Area Forb Density versus the Nearby Undisturbed Range**Paired t-test:**

Wednesday, September 12, 2007, 1:12:51 PM

Data source: All sections data in Notebook 1**Normality Test:** Failed (P < 0.050)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Wednesday, September 12, 2007, 1:12:51 PM

Data source: All sections data in Notebook 1

Group	N	Missing	Median	25%	75%
Matted Forb Density	43	0	4.000	3.000	8.000
Reference Forb Density	43	0	5.000	4.000	8.000

W= 102.000 T+ = 384.000 T- = -282.000

Z-Statistic (based on positive ranks) = 0.803

(P = 0.427)

The change that occurred with the treatment is not great enough to exclude the possibility that it is due to chance (P = 0.427).

Paired t-test Results for Oak Mat Removal Area Forb Canopy Cover versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, September 12, 2007, 1:13:11 PM

Data source: All sections data in Notebook 1

Normality Test: Failed ($P < 0.050$)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Wednesday, September 12, 2007, 1:13:11 PM

Data source: All sections data in Notebook 1

Group	N	Missing	Median	25%	75%
Matted Forb Cover	43	0	2.000	1.000	3.000
Reference Forb Cover	43	0	2.000	1.000	3.000

W= -24.000 T+ = 103.500 T-= -127.500

Z-Statistic (based on positive ranks) = -0.425

(P = 0.684)

The change that occurred with the treatment is not great enough to exclude the possibility that it is due to chance (P = 0.684).

Paired t-test Results for Oak Mat Removal Area Shrub Density versus the Nearby Undisturbed Range**Paired t-test:**

Wednesday, September 12, 2007, 1:15:07 PM

Data source: All sections data in Notebook 1**Normality Test:** Passed (P = 0.086)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Matted Shrub Density	43	0	3.930	2.444	0.373
Reference Shrub Density	43	0	7.209	3.342	0.510
Difference	43	0	-3.279	4.037	0.616

t = -5.326 with 42 degrees of freedom. (P = <0.001)

95 percent confidence interval for difference of means: -4.522 to -2.037

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant change (P = <0.001)

Power of performed test with alpha = 0.050: 1.000

Paired t-test Results for Oak Mat Removal Area Shrub Canopy Cover versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, September 12, 2007, 1:15:49 PM

Data source: All sections data in Notebook 1

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Wednesday, September 12, 2007, 1:15:49 PM

Data source: All sections data in Notebook 1

Group	N	Missing	Median	25%	75%
Matted Shrub Cover	43	0	2.000	2.000	4.000
Reference Shrub Cover	43	0	12.000	10.000	14.500

W= 886.000 T+ = 894.500 T- = -8.500

Z-Statistic (based on positive ranks) = 5.546

(P = <0.001)

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Paired t-test Results for Oak Mat Removal Area Wy. Big Sagebrush Density versus the Nearby Undisturbed Range

Paired t-test:

Thursday, October 11, 2007, 9:12:19 AM

Data source: Data 1 in Notebook 2

Normality Test: Failed ($P < 0.050$)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Thursday, October 11, 2007, 9:12:19 AM

Data source: Data 1 in Notebook 2

Group	N	Missing	Median	25%	75%
Reference	43	2	3.000	2.750	4.000
Matted	43	2	1.000	0.000	1.000

W= -691.000 T+ = 25.000 T- = -716.000

Z-Statistic (based on positive ranks) = -5.074

(P = <0.001)

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Paired t-test Results for Oak Mat Removal Area Wy. Big Sagebrush Canopy Cover versus the Nearby Undisturbed Range

Paired t-test:

Thursday, October 11, 2007, 9:07:59 AM

Data source: Data 1 in Big Sage & SDL Cover v. Undisturbed T-tests

Normality Test: Passed (P = 0.294)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Reference	43	2	9.268	3.606	0.563
Matted	43	2	1.220	2.092	0.327
Difference	43	2	8.049	4.248	0.663

t = 12.131 with 40 degrees of freedom. (P = <0.001)

95 percent confidence interval for difference of means: 6.708 to 9.390

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant change (P = <0.001)

Power of performed test with alpha = 0.050: 1.000

Paired t-test Results for Oak Mat Removal Area Wy. Big Sagebrush Seedling Density versus the Nearby Undisturbed Range

Paired t-test:

Thursday, October 11, 2007, 9:12:53 AM

Data source: Data 1 in Notebook 2

Normality Test: Failed ($P < 0.050$)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Thursday, October 11, 2007, 9:12:53 AM

Data source: Data 1 in Notebook 2

Group	N	Missing	Median	25%	75%
Reference	43	1	5.500	3.000	9.000
Matted	43	1	1.000	0.000	4.000

W= -374.000 T+ = 264.500 T-= -638.500
 Z-Statistic (based on positive ranks) = -2.345
 (P = 0.019)

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant difference (P = 0.019).

Paired t-test Results for Oak Mat Removal Area Wy. Big Sagebrush Seedling Canopy Cover versus the Nearby Undisturbed Range

Paired t-test:

Thursday, October 11, 2007, 9:08:54 AM

Data source: Data 1 in Big Sage & SDL Cover v. Undisturbed T-tests

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Thursday, October 11, 2007, 9:08:54 AM

Data source: Data 1 in Big Sage & SDL Cover v. Undisturbed T-tests

Group	N	Missing	Median	25%	75%
Reference	43	1	1.000	1.000	1.000
Matted	43	1	1.000	0.000	1.000

W= -78.000 T+ = 0.000 T-= -78.000

Z-Statistic (based on positive ranks) = -3.464

P(est.)= <0.001 P(exact)= <0.001

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Paired t-test Results for Oak Mat Removal Area Grass Density versus the Nearby Undisturbed Range**Paired t-test:**

Wednesday, September 12, 2007, 1:22:13 PM

Data source: Data 2 in Notebook 1**Normality Test:** Passed (P = 0.535)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Matted Grass Density	7	0	179.571	67.312	25.442
Reference Grass Density	7	0	133.714	42.676	16.130
Difference	7	0	45.857	70.528	26.657

t = 1.720 with 6 degrees of freedom. (P = 0.136)

95 percent confidence interval for difference of means: -19.370 to 111.084

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.136)

Power of performed test with alpha = 0.050: 0.212

The power of the performed test (0.212) is below the desired power of 0.800.
 Less than desired power indicates you are less likely to detect a difference when one actually exists.
 Negative results should be interpreted cautiously.

Paired t-test Results for Oak Mat Removal Area Grass Canopy Cover versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, September 12, 2007, 1:23:01 PM

Data source: Data 2 in Notebook 1

Normality Test: Passed (P = 0.139)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Matted Grass Cover	7	0	3.857	1.069	0.404
Reference Grass Cover	7	0	3.714	1.113	0.421
Difference	7	0	0.143	1.676	0.634

t = 0.225 with 6 degrees of freedom. (P = 0.829)

95 percent confidence interval for difference of means: -1.407 to 1.693

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.829)

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Paired t-test Results for Oak Mat Removal Area Forb Density versus the Nearby Undisturbed Range**Paired t-test:**

Wednesday, September 12, 2007, 1:23:31 PM

Data source: Data 2 in Notebook 1**Normality Test:** Passed (P = 0.391)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Matted Forb Density	7	0	4.571	2.699	1.020
Reference Forb Density	7	0	3.571	1.272	0.481
Difference	7	0	1.000	3.651	1.380

t = 0.725 with 6 degrees of freedom. (P = 0.496)

95 percent confidence interval for difference of means: -2.377 to 4.377

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.496)

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.
 Less than desired power indicates you are less likely to detect a difference when one actually exists.
 Negative results should be interpreted cautiously.

Paired t-test Results for Oak Mat Removal Area Forb Canopy Cover versus the Nearby Undisturbed Range**Paired t-test:**

Wednesday, September 12, 2007, 1:23:58 PM

Data source: Data 2 in Notebook 1**Normality Test:** Passed (P = 0.759)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Matted Forb Cover	7	0	3.857	1.464	0.553
Reference Forb Cover	7	0	3.000	1.000	0.378
Difference	7	0	0.857	2.035	0.769

t = 1.114 with 6 degrees of freedom. (P = 0.308)

95 percent confidence interval for difference of means: -1.025 to 2.740

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.308)

Power of performed test with alpha = 0.050: 0.068

The power of the performed test (0.068) is below the desired power of 0.800.
 Less than desired power indicates you are less likely to detect a difference when one actually exists.
 Negative results should be interpreted cautiously.

Paired t-test Results for Oak Mat Removal Area Shrub Density versus the Nearby Undisturbed Range**Paired t-test:**

Wednesday, September 12, 2007, 1:26:00 PM

Data source: Data 2 in Oak mat veg data MDM 9.12.07**Normality Test:** Failed (P < 0.050)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Wednesday, September 12, 2007, 1:26:00 PM

Data source: Data 2 in Oak mat veg data MDM 9.12.07

Group	N	Missing	Median	25%	75%
Matted Shrub Density	7	0	2.000	2.000	4.500
Reference Shrub Density	7	0	5.000	5.000	10.000

W= 28.000 T+ = 28.000 T- = 0.000

Z-Statistic (based on positive ranks) = 2.375

P(est.)= 0.022 P(exact)= 0.016

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant difference (P = 0.016).

Paired t-test Results for Oak Mat Removal Area Shrub Canopy Cover versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, September 12, 2007, 1:27:15 PM

Data source: Data 2 in Oak mat veg data MDM 9.12.07

Normality Test: Passed (P = 0.678)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Matted Shrub Cover	7	0	1.571	0.535	0.202
Reference Shrub Cover	7	0	11.714	3.684	1.392
Difference	7	0	-10.143	4.140	1.565

t = -6.481 with 6 degrees of freedom. (P = <0.001)

95 percent confidence interval for difference of means: -13.972 to -6.314

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant change (P = <0.001)

Power of performed test with alpha = 0.050: 1.000

Paired t-test Results for Oak Mat Removal Area Grass Density versus the Nearby Undisturbed Range**Paired t-test:**

Wednesday, September 12, 2007, 1:32:20 PM

Data source: Data 3 in Oak mat veg data MDM 9.12.07**Normality Test:** Passed (P = 0.059)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Matted Grass Density	17	0	259.471	99.766	24.197
Reference Grass Density	17	0	170.588	45.303	10.988
Difference	17	0	88.882	98.491	23.888

t = 3.721 with 16 degrees of freedom. (P = 0.002)

95 percent confidence interval for difference of means: 38.243 to 139.522

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant change (P = 0.002)

Power of performed test with alpha = 0.050: 0.934

Paired t-test Results for Oak Mat Removal Area Grass Canopy Cover versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, September 12, 2007, 1:33:09 PM

Data source: Data 3 in Oak mat veg data MDM 9.12.07

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Wednesday, September 12, 2007, 1:33:09 PM

Data source: Data 3 in Oak mat veg data MDM 9.12.07

Group	N	Missing	Median	25%	75%
Matted Grass Cover	17	0	3.000	3.000	4.000
Reference Grass Cover	17	0	3.000	2.000	3.000

W= -42.000 T+ = 12.000 T- = -54.000

Z-Statistic (based on positive ranks) = -2.111

P(est.)= 0.039 P(exact)= 0.067

The change that occurred with the treatment is not great enough to exclude the possibility that it is due to chance (P = 0.067).

Paired t-test Results for Oak Mat Removal Area Forb Density versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, September 12, 2007, 1:33:33 PM

Data source: Data 3 in Oak mat veg data MDM 9.12.07

Normality Test: Passed (P = 0.068)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Matted Forb Density	17	0	3.765	2.862	0.694
Reference Forb Density	17	0	5.706	4.058	0.984
Difference	17	0	-1.941	4.437	1.076

t = -1.804 with 16 degrees of freedom. (P = 0.090)

95 percent confidence interval for difference of means: -4.222 to 0.340

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.090)

Power of performed test with alpha = 0.050: 0.279

The power of the performed test (0.279) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Paired t-test Results for Oak Mat Removal Area Forb Canopy Cover versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, September 12, 2007, 1:34:13 PM

Data source: Data 3 in Oak mat veg data MDM 9.12.07

Normality Test: Failed ($P < 0.050$)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Wednesday, September 12, 2007, 1:34:13 PM

Data source: Data 3 in Oak mat veg data MDM 9.12.07

Group	N	Missing	Median	25%	75%
Matted Forb Cover	17	0	1.000	1.000	1.000
Reference Forb Cover	17	0	1.000	1.000	1.000

W= -2.000 T+ = 2.000 T- = -4.000

Z-Statistic (based on positive ranks) = -0.577

P(est.)= 0.773 P(exact)= 0.750

The change that occurred with the treatment is not great enough to exclude the possibility that it is due to chance ($P = 0.750$).

Paired t-test Results for Oak Mat Removal Area ShrubDensity versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, September 12, 2007, 1:34:46 PM

Data source: Data 3 in Oak mat veg data MDM 9.12.07

Normality Test: Passed (P = 0.324)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Matted Shrub Density	17	0	4.824	3.005	0.729
Reference Shrub Density	17	0	7.235	3.419	0.829
Difference	17	0	-2.412	4.403	1.068

t = -2.259 with 16 degrees of freedom. (P = 0.038)

95 percent confidence interval for difference of means: -4.675 to -0.148

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant change (P = 0.038)

Power of performed test with alpha = 0.050: 0.469

Paired t-test Results for Oak Mat Removal Area Shrub Canopy Cover versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, September 12, 2007, 1:35:23 PM

Data source: Data 3 in Oak mat veg data MDM 9.12.07

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Wednesday, September 12, 2007, 1:35:23 PM

Data source: Data 3 in Oak mat veg data MDM 9.12.07

Group	N	Missing	Median	25%	75%
Matted Shrub Cover	17	0	3.000	2.000	4.000
Reference Shrub Cover	17	0	11.000	10.000	12.250

W= 153.000 T+ = 153.000 T- = 0.000

Z-Statistic (based on positive ranks) = 3.645

P(est.)= <0.001 P(exact)= <0.001

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Paired t-test Results for Oak Mat Removal Area Grass Density versus the Nearby Undisturbed Range**Paired t-test:**

Wednesday, September 12, 2007, 1:38:23 PM

Data source: Data 4 in Oak mat veg data MDM 9.12.07**Normality Test:** Passed (P = 0.266)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Matted Grass Density	4	0	263.250	69.048	34.524
Reference Grass Density	4	0	348.750	151.784	75.892
Difference	4	0	-85.500	106.629	53.314

t = -1.604 with 3 degrees of freedom. (P = 0.207)

95 percent confidence interval for difference of means: -255.169 to 84.169

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.207)

Power of performed test with alpha = 0.050: 0.145

The power of the performed test (0.145) is below the desired power of 0.800.
 Less than desired power indicates you are less likely to detect a difference when one actually exists.
 Negative results should be interpreted cautiously.

Paired t-test Results for Oak Mat Removal Area Grass Canopy Cover versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, September 12, 2007, 1:39:00 PM

Data source: Data 4 in Oak mat veg data MDM 9.12.07

Normality Test: Passed (P = 0.432)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Matted Grass Cover	4	0	5.250	1.500	0.750
Reference Grass Cover	4	0	5.250	2.217	1.109
Difference	4	0	0.000	1.633	0.816

t = 0.000 with 3 degrees of freedom. (P = 1.000)

95 percent confidence interval for difference of means: -2.598 to 2.598

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 1.000)

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Paired t-test Results for Oak Mat Removal Area Forb Density versus the Nearby Undisturbed Range**Paired t-test:**

Wednesday, September 12, 2007, 1:39:40 PM

Data source: Data 4 in Oak mat veg data MDM 9.12.07**Normality Test:** Passed (P = 0.411)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Matted Forb Density	4	0	17.500	7.853	3.926
Reference Forb Density	4	0	6.750	1.500	0.750
Difference	4	0	10.750	8.342	4.171

t = 2.577 with 3 degrees of freedom. (P = 0.082)

95 percent confidence interval for difference of means: -2.523 to 24.023

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.082)

Power of performed test with alpha = 0.050: 0.375

The power of the performed test (0.375) is below the desired power of 0.800.
 Less than desired power indicates you are less likely to detect a difference when one actually exists.
 Negative results should be interpreted cautiously.

Paired t-test Results for Oak Mat Removal Area Forb Canopr Cover versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, September 12, 2007, 1:40:35 PM

Data source: Data 4 in Oak mat veg data MDM 9.12.07

Normality Test: Passed (P = 0.138)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Matted Forb Cover	4	0	4.250	1.258	0.629
Reference Forb Cover	4	0	3.000	0.000	0.000
Difference	4	0	1.250	1.258	0.629

t = 1.987 with 3 degrees of freedom. (P = 0.141)

95 percent confidence interval for difference of means: -0.752 to 3.252

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.141)

Power of performed test with alpha = 0.050: 0.226

The power of the performed test (0.226) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Paired t-test Results for Oak Mat Removal Area Shrub Density versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, September 12, 2007, 1:40:57 PM

Data source: Data 4 in Oak mat veg data MDM 9.12.07

Normality Test: Passed (P = 0.699)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Matted Shrub Density	4	0	5.000	2.449	1.225
Reference Shrub Density	4	0	6.250	1.708	0.854
Difference	4	0	-1.250	3.775	1.887

t = -0.662 with 3 degrees of freedom. (P = 0.555)

95 percent confidence interval for difference of means: -7.257 to 4.757

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.555)

Power of performed test with alpha = 0.050: 0.052

The power of the performed test (0.052) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Paired t-test Results for Oak Mat Removal Area Shrub Canopy Cover versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, September 12, 2007, 1:41:17 PM

Data source: Data 4 in Oak mat veg data MDM 9.12.07

Normality Test: Passed (P = 0.440)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Matted Shrub Cover	4	0	6.500	4.123	2.062
Reference Shrub Cover	4	0	11.000	5.033	2.517
Difference	4	0	-4.500	8.226	4.113

t = -1.094 with 3 degrees of freedom. (P = 0.354)

95 percent confidence interval for difference of means: -17.589 to 8.589

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.354)

Power of performed test with alpha = 0.050: 0.064

The power of the performed test (0.064) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Paired t-test Results for Oak Mat Removal Area Grass Density versus the Nearby Undisturbed Range**Paired t-test:**

Wednesday, September 12, 2007, 1:45:24 PM

Data source: Data 5 in Oak mat veg data MDM 9.12.07**Normality Test:** Passed (P = 0.208)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Matted Grass Density	9	0	184.444	36.719	12.240
Reference Grass Density	9	0	196.000	119.785	39.928
Difference	9	0	-11.556	133.245	44.415

t = -0.260 with 8 degrees of freedom. (P = 0.801)

95 percent confidence interval for difference of means: -113.977 to 90.866

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.801)

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.
 Less than desired power indicates you are less likely to detect a difference when one actually exists.
 Negative results should be interpreted cautiously.

Paired t-test Results for Oak Mat Removal Area Grass Canopy Cover versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, September 12, 2007, 1:45:54 PM

Data source: Data 5 in Oak mat veg data MDM 9.12.07

Normality Test: Passed (P = 0.797)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Matted Grass Cover	9	0	3.667	1.118	0.373
Reference Grass Cover	9	0	3.889	1.269	0.423
Difference	9	0	-0.222	1.716	0.572

t = -0.389 with 8 degrees of freedom. (P = 0.708)

95 percent confidence interval for difference of means: -1.541 to 1.097

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.708)

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Paired t-test Results for Oak Mat Removal Area Forb Density versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, September 12, 2007, 1:46:58 PM

Data source: Data 5 in Oak mat veg data MDM 9.12.07

Normality Test: Passed (P = 0.351)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Matted Forb Density	9	0	8.889	5.326	1.775
Reference Forb Density	9	0	10.333	4.924	1.641
Difference	9	0	-1.444	6.616	2.205

t = -0.655 with 8 degrees of freedom. (P = 0.531)

95 percent confidence interval for difference of means: -6.530 to 3.641

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.531)

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Paired t-test Results for Oak Mat Removal Area Forb Canopy Cover versus the Nearby Undisturbed Range**Paired t-test:**

Wednesday, September 12, 2007, 1:47:16 PM

Data source: Data 5 in Oak mat veg data MDM 9.12.07**Normality Test:** Passed (P = 0.191)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Matted Forb Cover	9	0	2.444	1.130	0.377
Reference Forb Cover	9	0	2.667	1.118	0.373
Difference	9	0	-0.222	1.787	0.596

t = -0.373 with 8 degrees of freedom. (P = 0.719)

95 percent confidence interval for difference of means: -1.596 to 1.152

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.719)

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.
 Less than desired power indicates you are less likely to detect a difference when one actually exists.
 Negative results should be interpreted cautiously.

Paired t-test Results for Oak Mat Removal Area Shrub Density versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, September 12, 2007, 1:47:33 PM

Data source: Data 5 in Oak mat veg data MDM 9.12.07

Normality Test: Passed (P = 0.194)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Matted Shrub Density	9	0	3.111	1.616	0.539
Reference Shrub Density	9	0	6.778	2.048	0.683
Difference	9	0	-3.667	2.646	0.882

t = -4.158 with 8 degrees of freedom. (P = 0.003)

95 percent confidence interval for difference of means: -5.700 to -1.633

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant change (P = 0.003)

Power of performed test with alpha = 0.050: 0.950

Paired t-test Results for Oak Mat Removal Area Shrub Canopy Cover versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, September 12, 2007, 1:47:56 PM

Data source: Data 5 in Oak mat veg data MDM 9.12.07

Normality Test: Passed (P = 0.105)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Matted Shrub Cover	9	0	3.000	1.803	0.601
Reference Shrub Cover	9	0	13.333	3.391	1.130
Difference	9	0	-10.333	4.873	1.624

t = -6.361 with 8 degrees of freedom. (P = <0.001)

95 percent confidence interval for difference of means: -14.079 to -6.587

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant change (P = <0.001)

Power of performed test with alpha = 0.050: 1.000

Paired t-test Results for Forb Frequency Measured at Cut and Fill Locations Reclaimed in 2005 or later versus the Nearby Undisturbed Range

Paired t-test:

Monday, November 05, 2007, 4:00:27 PM

Data source: Data 1 in Notebook 1

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Monday, November 05, 2007, 4:00:27 PM

Data source: Data 1 in Notebook 1

Group	N	Missing	Median	25%	75%
Col 4	84	1	0.600	0.300	1.000
Col 5	84	1	0.000	0.000	0.000

W= -3321.000 T+ = 0.000 T-= -3321.000
 Z-Statistic (based on positive ranks) = -7.826
 (P = <0.001)

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Paired t-test Results for Shrub Frequency Measured at Cut and Fill Locations Reclaimed in 2005 or later versus the Nearby Undisturbed Range

Paired t-test:

Monday, November 05, 2007, 4:00:58 PM

Data source: Data 1 in Notebook 1

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Monday, November 05, 2007, 4:00:58 PM

Data source: Data 1 in Notebook 1

Group	N	Missing	Median	25%	75%
Col 6	84	1	1.800	1.400	2.200
Col 7	84	1	0.000	0.000	0.000

W= -3486.000 T+ = 0.000 T-= -3486.000
 Z-Statistic (based on positive ranks) = -7.918
 (P = <0.001)

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Paired t-test Results for the Number of Forb Species Measured at Cut and Fill Locations Reclaimed in 2005 or later versus the Nearby Undisturbed Range

Paired t-test:

Monday, November 05, 2007, 4:01:58 PM

Data source: Data 1 in Notebook 1

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Monday, November 05, 2007, 4:01:58 PM

Data source: Data 1 in Notebook 1

Group	N	Missing	Median	25%	75%
Col 8	84	1	2.000	1.000	3.000
Col 9	84	1	0.000	0.000	0.000

W= -3321.000 T+ = 0.000 T-= -3321.000
 Z-Statistic (based on positive ranks) = -7.910
 (P = <0.001)

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Paired t-test Results for the Number of Shrub Species Measured at Cut and Fill Locations Reclaimed in 2005 or later versus the Nearby Undisturbed Range

Paired t-test:

Monday, November 05, 2007, 4:02:25 PM

Data source: Data 1 in Notebook 1

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Monday, November 05, 2007, 4:02:25 PM

Data source: Data 1 in Notebook 1

Group	N	Missing	Median	25%	75%
Col 10	84	1	3.000	2.000	4.000
Col 11	84	1	0.000	0.000	0.000

W= -3486.000 T+ = 0.000 T-= -3486.000

Z-Statistic (based on positive ranks) = -8.007

(P = <0.001)

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Paired t-test Results for % Bare Ground Measured at Cut and Fill Locations Reclaimed in 2005 or later versus the Nearby Undisturbed Range

Paired t-test:

Monday, November 05, 2007, 3:59:45 PM

Data source: Data 1 in Notebook 1

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Monday, November 05, 2007, 3:59:45 PM

Data source: Data 1 in Notebook 1

Group	N	Missing	Median	25%	75%
Col 2	84	1	68.200	62.500	74.000
Col 3	84	1	88.900	82.000	94.175

W= 2926.000 T+ = 3206.000 T-= -280.000

Z-Statistic (based on positive ranks) = 6.642

(P = <0.001)

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Paired t-test Results for Reclaimed Cut and Fill Location Grass Density versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, October 10, 2007, 7:36:24 PM

Data source: Data 1 in Plant density v. REF T-tests

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Wednesday, October 10, 2007, 7:36:24 PM

Data source: Data 1 in Plant density v. REF T-tests

Group	N	Missing	Median	25%	75%
TOTAL GRASS	66	0	134.500	66.000	256.000
TOTAL GRASS undist	66	0	135.000	95.000	194.000

W= 65.000 T+ = 1105.000 T- = -1040.000

Z-Statistic (based on positive ranks) = 0.212

(P = 0.834)

The change that occurred with the treatment is not great enough to exclude the possibility that it is due to chance (P = 0.834).

Paired t-test Results for Reclaimed Cut and Fill Location Grass Canopy Cover versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, October 10, 2007, 7:45:36 PM

Data source: Data 1 in Plant cover v. REF T-tests

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Wednesday, October 10, 2007, 7:45:36 PM

Data source: Data 1 in Plant cover v. REF T-tests

Group	N	Missing	Median	25%	75%
TOTAL GRASS	66	0	5.000	4.000	9.000
TOTAL GRASS undist	66	0	4.000	3.000	5.000

W= -975.000 T+ = 255.000 T-= -1230.000

Z-Statistic (based on positive ranks) = -4.217

(P = <0.001)

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Paired t-test Results for Reclaimed Cut and Fill Location Forb Density versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, October 10, 2007, 7:38:17 PM

Data source: Data 1 in Plant density v. REF T-tests

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Wednesday, October 10, 2007, 7:38:17 PM

Data source: Data 1 in Plant density v. REF T-tests

Group	N	Missing	Median	25%	75%
TOTAL FORB	66	0	0.000	0.000	1.000
TOTAL FORB undist	66	0	8.000	4.000	11.000

W= 2001.000 T+ = 2008.500 T- = -7.500

Z-Statistic (based on positive ranks) = 6.854

(P = <0.001)

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Paired t-test Results for Reclaimed Cut and Fill Location Forb Canopy Cover versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, October 10, 2007, 7:47:23 PM

Data source: Data 1 in Plant cover v. REF T-tests

Normality Test: Failed ($P < 0.050$)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Wednesday, October 10, 2007, 7:47:23 PM

Data source: Data 1 in Plant cover v. REF T-tests

Group	N	Missing	Median	25%	75%
TOTAL FORB	66	0	0.000	0.000	1.000
TOTAL FORB undist	66	0	3.000	2.000	5.000

W= 1818.000 T+ = 1824.000 T- = -6.000

Z-Statistic (based on positive ranks) = 6.726

($P = < 0.001$)

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant difference ($P = < 0.001$).

Paired t-test Results for Reclaimed Cut and Fill Location Shrub Density versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, October 10, 2007, 7:40:20 PM

Data source: Data 1 in Plant density v. REF T-tests

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Wednesday, October 10, 2007, 7:40:20 PM

Data source: Data 1 in Plant density v. REF T-tests

Group	N	Missing	Median	25%	75%
TOTAL SHRUB	66	0	1.000	0.000	2.000
TOTAL SHRUB undist	66	0	14.000	9.000	27.000

W= 2189.000 T+ = 2200.000 T- = -11.000

Z-Statistic (based on positive ranks) = 6.994

(P = <0.001)

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Paired t-test Results for Reclaimed Cut and Fill Location Shrub Canopy Cover versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, October 10, 2007, 7:49:01 PM

Data source: Data 1 in Plant cover v. REF T-tests

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Wednesday, October 10, 2007, 7:49:01 PM

Data source: Data 1 in Plant cover v. REF T-tests

Group	N	Missing	Median	25%	75%
TOTAL SHRUB	66	0	1.000	0.000	2.000
TOTAL SHRUB undist	66	0	16.000	12.000	20.000

W= 2200.000 T+ = 2205.500 T- = -5.500

Z-Statistic (based on positive ranks) = 7.031

(P = <0.001)

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Paired t-test Results for Reclaimed Cut and Fill Location Weedy Forb Density versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, October 10, 2007, 7:42:21 PM

Data source: Data 1 in Plant density v. REF T-tests

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Wednesday, October 10, 2007, 7:42:21 PM

Data source: Data 1 in Plant density v. REF T-tests

Group	N	Missing	Median	25%	75%
TOTAL WEEDY FORB	66	0	28.000	5.000	110.000
TOTAL WEEDY FORB undist66		0	0.000	0.000	0.000

W= -1596.000 T+ = 0.000 T-= -1596.000

Z-Statistic (based on positive ranks) = -6.510

(P = <0.001)

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Paired t-test Results for Reclaimed Cut and Fill Location Weedy Forb Canopy Cover versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, October 10, 2007, 7:49:34 PM

Data source: Data 1 in Plant cover v. REF T-tests

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Wednesday, October 10, 2007, 7:49:34 PM

Data source: Data 1 in Plant cover v. REF T-tests

Group	N	Missing	Median	25%	75%
TOTAL WEEDY FORB	66	0	2.000	1.000	3.000
TOTAL WEEDY FORB undist66		0	0.000	0.000	0.000

W= -1540.000 T+ = 0.000 T-= -1540.000

Z-Statistic (based on positive ranks) = -6.523

(P = <0.001)

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Paired t-test Results for Reclaimed Cut and Fill Location Wy. Big Sagebrush Density versus the Nearby Undisturbed Range

Paired t-test:

Thursday, October 11, 2007, 8:35:07 AM

Data source: Data 1 in Notebook 3

Normality Test: Failed ($P < 0.050$)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Thursday, October 11, 2007, 8:35:07 AM

Data source: Data 1 in Notebook 3

Group	N	Missing	Median	25%	75%
Undisturbed	66	0	5.000	3.000	6.000
Disturbed	66	0	0.000	0.000	0.000

W= -2016.000 T+ = 0.000 T-= -2016.000
 Z-Statistic (based on positive ranks) = -6.920
 (P = <0.001)

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant difference ($P = <0.001$).

Paired t-test Results for Reclaimed Cut and Fill Location Wy. Big Sagebrush Canopy Cover versus the Nearby Undisturbed Range

Paired t-test:

Thursday, October 11, 2007, 8:30:28 AM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.051)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Disturbed	66	0	0.121	0.448	0.0551
Undisturbed	66	0	12.591	6.283	0.773
Difference	66	0	-12.470	6.381	0.785

t = -15.876 with 65 degrees of freedom. (P = <0.001)

95 percent confidence interval for difference of means: -14.038 to -10.901

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant change (P = <0.001)

Power of performed test with alpha = 0.050: 1.000

Paired t-test Results for Reclaimed Cut and Fill Location Wy. Big Sagebrush Seedling Density versus the Nearby Undisturbed Range

Paired t-test:

Thursday, October 11, 2007, 8:36:03 AM

Data source: Data 1 in Notebook 3

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Thursday, October 11, 2007, 8:36:03 AM

Data source: Data 1 in Notebook 3

Group	N	Missing	Median	25%	75%
Undisturbed	66	0	4.000	1.000	12.000
Disturbed	66	0	0.000	0.000	0.000

W= -1298.000 T+ = 14.000 T-= -1312.000
 Z-Statistic (based on positive ranks) = -6.088
 (P = <0.001)

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Paired t-test Results for Reclaimed Cut and Fill Location Wy. Big Sagebrush Seedling Canopy Cover versus the Nearby Undisturbed Range

Paired t-test:

Thursday, October 11, 2007, 8:31:25 AM

Data source: Data 1 in Notebook 1

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Thursday, October 11, 2007, 8:31:25 AM

Data source: Data 1 in Notebook 1

Group	N	Missing	Median	25%	75%
Undisturbed	66	0	1.000	1.000	1.000
Disturbed	66	0	0.000	0.000	0.000

W= -780.000 T+ = 20.000 T-= -800.000

Z-Statistic (based on positive ranks) = -5.947

(P = <0.001)

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

T-test Results for Oak Mat Removal Area Percent Change in Grass Density versus Reclaimed Cut and Fill Locations

t-test

Thursday, October 11, 2007, 3:17:04 PM

Data source: Data 1 in Oak v. Cut 1 way ANOVA for Veg Characteristics

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Rank Sum Test begun

Mann-Whitney Rank Sum Test

Thursday, October 11, 2007, 3:17:04 PM

Data source: Data 1 in Oak v. Cut 1 way ANOVA for Veg Characteristics

Group	N	Missing	Median	25%	75%
% change Grass Den	43	0	24.742	-6.686	53.331
% Change grass Density	66	0	-8.951	-40.000	53.333

Mann-Whitney U Statistic= 1023.000

T = 2761.000 n(small)= 43 n(big)= 66 (P = 0.014)

The difference in the median values between the two groups is greater than would be expected by chance; there is a statistically significant difference (P = 0.014)

T-test Results for Oak Mat Removal Area Percent Change in Grass Canopy Cover versus Reclaimed Cut and Fill Locations

t-test

Thursday, October 11, 2007, 3:19:40 PM

Data source: Data 1 in Oak v. Cut 1 way ANOVA for Veg Characteristics

Normality Test: Failed ($P < 0.050$)

Test execution ended by user request, Rank Sum Test begun

Mann-Whitney Rank Sum Test

Thursday, October 11, 2007, 3:19:40 PM

Data source: Data 1 in Oak v. Cut 1 way ANOVA for Veg Characteristics

Group	N	Missing	Median	25%	75%
% Change Grass Cover	66	0	33.333	0.000	100.000
% change Grass Cov	43	0	0.000	-15.000	33.333

Mann-Whitney U Statistic= 1809.000

T = 1975.000 n(small)= 43 n(big)= 66 ($P = 0.015$)

The difference in the median values between the two groups is greater than would be expected by chance; there is a statistically significant difference ($P = 0.015$)

T-test Results for Oak Mat Removal Area Percent Change in Forb Density versus Reclaimed Cut and Fill Locations

t-test

Thursday, October 11, 2007, 3:18:25 PM

Data source: Data 1 in Oak v. Cut 1 way ANOVA for Veg Characteristics

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Rank Sum Test begun

Mann-Whitney Rank Sum Test

Thursday, October 11, 2007, 3:18:25 PM

Data source: Data 1 in Oak v. Cut 1 way ANOVA for Veg Characteristics

Group	N	Missing	Median	25%	75%
% change Forb Den	43	0	-17.647	-50.000	46.591
% Change forb Density	66	0	-100.000	-100.000	-90.000

Mann-Whitney U Statistic= 190.500

T = 3593.500 n(small)= 43 n(big)= 66 (P = <0.001)

The difference in the median values between the two groups is greater than would be expected by chance; there is a statistically significant difference (P = <0.001)

T-test Results for Oak Mat Removal Area Percent Change in Forb Canopy Cover versus Reclaimed Cut and Fill Locations

t-test

Thursday, October 11, 2007, 3:20:17 PM

Data source: Data 1 in Oak v. Cut 1 way ANOVA for Veg Characteristics

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Rank Sum Test begun

Mann-Whitney Rank Sum Test

Thursday, October 11, 2007, 3:20:17 PM

Data source: Data 1 in Oak v. Cut 1 way ANOVA for Veg Characteristics

Group	N	Missing	Median	25%	75%
% Change Forb Cover	66	0	-100.000	-100.000	-75.000
% change Forb Cov	43	0	0.000	0.000	18.750

Mann-Whitney U Statistic= 179.500

T = 3604.500 n(small)= 43 n(big)= 66 (P = <0.001)

The difference in the median values between the two groups is greater than would be expected by chance; there is a statistically significant difference (P = <0.001)

T-test Results for Oak Mat Removal Area Percent Change in Shrub Density versus Reclaimed Cut and Fill Locations

t-test

Thursday, October 11, 2007, 3:19:07 PM

Data source: Data 1 in Oak v. Cut 1 way ANOVA for Veg Characteristics

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Rank Sum Test begun

Mann-Whitney Rank Sum Test

Thursday, October 11, 2007, 3:19:07 PM

Data source: Data 1 in Oak v. Cut 1 way ANOVA for Veg Characteristics

Group	N	Missing	Median	25%	75%
% change Shrub Den	43	0	-50.000	-70.238	-14.560
% Change Shrub Density	66	0	-94.281	-100.000	-84.211

Mann-Whitney U Statistic= 275.500

T = 3508.500 n(small)= 43 n(big)= 66 (P = <0.001)

The difference in the median values between the two groups is greater than would be expected by chance; there is a statistically significant difference (P = <0.001)

T-test Results for Oak Mat Removal Area Percent Change in Shrub Canopy Cover versus Reclaimed Cut and Fill Locations

t-test

Thursday, October 11, 2007, 3:20:55 PM

Data source: Data 1 in Oak v. Cut 1 way ANOVA for Veg Characteristics

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Rank Sum Test begun

Mann-Whitney Rank Sum Test

Thursday, October 11, 2007, 3:20:55 PM

Data source: Data 1 in Oak v. Cut 1 way ANOVA for Veg Characteristics

Group	N	Missing	Median	25%	75%
% Change Shrub Cover	66	0	-93.095	-100.000	-87.500
% change Shrub Cov	43	0	-77.778	-83.333	-64.394

Mann-Whitney U Statistic= 427.500

T = 3356.500 n(small)= 43 n(big)= 66 (P = <0.001)

The difference in the median values between the two groups is greater than would be expected by chance; there is a statistically significant difference (P = <0.001)

APPENDIX B

STATISTICAL OUTPUT FOR SOIL BULK DENSITY ANALYSIS

Linear Regression Results for Troxler Gauge and Laboratory Determined Dry Soil Bulk Density Using all Depth Increment Data

Linear Regression

Tuesday, September 18, 2007, 11:10:11 AM

Data source: Data 1 in Notebook1

Col 2 = -0.163 + (1.109 * Col 3)

N = 41

R = 0.911 Rsqr = 0.829 Adj Rsqr = 0.825

Standard Error of Estimate = 0.080

	Coefficient	Std. Error	t	P
Constant	-0.163	0.114	-1.431	0.160
Col 3	1.109	0.0806	13.767	<0.001

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	1.225	1.225	189.534	<0.001
Residual	39	0.252	0.00646		
Total	40	1.477	0.0369		

Normality Test: Passed (P = 0.212)

Constant Variance Test: Passed (P = 0.142)

Power of performed test with alpha = 0.050: 1.000

Linear Regression Results for Troxler Gauge and Laboratory Determined Dry Soil Bulk Density Using 0-5.1 cm Depth Increment Data

Linear Regression

Tuesday, September 18, 2007, 11:15:05 AM

Data source: Data 1 in Notebook1

Col 6 = $-0.311 + (1.181 * \text{Col 7})$

N = 12

R = 0.895 Rsqr = 0.800 Adj Rsqr = 0.780

Standard Error of Estimate = 0.071

	Coefficient	Std. Error	t	P
Constant	-0.311	0.245	-1.271	0.233
Col 7	1.181	0.187	6.329	<0.001

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	0.200	0.200	40.055	<0.001
Residual	10	0.0499	0.00499		
Total	11	0.250	0.0227		

Normality Test: Passed (P = 0.651)

Constant Variance Test: Passed (P = 0.852)

Power of performed test with alpha = 0.050: 0.991

Linear Regression Results for Troxler Gauge and Laboratory Determined Dry Soil Bulk Density Using 0-15.2 cm Depth Increment Data

Linear Regression

Tuesday, September 18, 2007, 11:24:59 AM

Data source: Data 1 in Notebook1

Col 10 = 0.0487 + (0.967 * Col 11)

N = 14

R = 0.906 Rsqr = 0.820 Adj Rsqr = 0.805

Standard Error of Estimate = 0.084

	Coefficient	Std. Error	t	P
Constant	0.0487	0.189	0.258	0.801
Col 11	0.967	0.131	7.396	<0.001

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	0.386	0.386	54.698	<0.001
Residual	12	0.0846	0.00705		
Total	13	0.470	0.0362		

Normality Test: Passed (P = 0.299)

Constant Variance Test: Passed (P = 0.101)

Power of performed test with alpha = 0.050: 0.999

Linear Regression Results for Troxler Gauge and Laboratory Determined Dry Soil Bulk Density Using 0-30.5 cm Depth Increment Data

Linear Regression

Tuesday, September 18, 2007, 11:28:41 AM

Data source: Data 1 in Notebook1

Col 14 = 0.134 + (0.929 * Col 15)

N = 15

R = 0.912 Rsqr = 0.831 Adj Rsqr = 0.818

Standard Error of Estimate = 0.060

	Coefficient	Std. Error	t	P
Constant	0.134	0.170	0.790	0.444
Col 15	0.929	0.116	7.995	<0.001

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	0.229	0.229	63.917	<0.001
Residual	13	0.0465	0.00358		
Total	14	0.275	0.0197		

Normality Test: Passed (P = 0.502)

Constant Variance Test: Passed (P = 0.230)

Power of performed test with alpha = 0.050: 1.000

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site JF 7-7X

Two Way Analysis of Variance

Monday, September 24, 2007, 2:23:52 PM

Data source: JF 7-7X data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.493)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0202	0.00404	0.609	0.700
Treatment	1	0.0289	0.0289	4.348	0.091
Residual	5	0.0332	0.00664		
Total	11	0.0823	0.00748		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.700).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.091).

Power of performed test with alpha = 0.0500: for Replication : 0.0512

Power of performed test with alpha = 0.0500: for Treatment : 0.312

Least square means for Replication :

Group	Mean
1.000	1.345
2.000	1.347
3.000	1.322
4.000	1.362
5.000	1.411
6.000	1.440

Std Err of LS Mean = 0.0576

Least square means for Treatment :

Group	Mean
Before	1.420
After	1.322

Std Err of LS Mean = 0.0333

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site JF 7-7X

Two Way Analysis of Variance

Monday, September 24, 2007, 2:24:03 PM

Data source: JF 7-7X data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.453)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0162	0.00324	1.402	0.360
Treatment	1	0.00825	0.00825	3.572	0.117
Residual	5	0.0115	0.00231		
Total	11	0.0360	0.00327		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.360).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.117).

Power of performed test with alpha = 0.0500: for Replication : 0.0923

Power of performed test with alpha = 0.0500: for Treatment : 0.251

Least square means for Replication :

Group	Mean
1.000	1.459
2.000	1.420
3.000	1.422
4.000	1.420
5.000	1.414
6.000	1.517

Std Err of LS Mean = 0.0340

Least square means for Treatment :

Group	Mean
Before	1.468
After	1.416

Std Err of LS Mean = 0.0196

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site JF 7-7X

Two Way Analysis of Variance

Monday, September 24, 2007, 2:24:13 PM

Data source: JF 7-7X data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.483)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0266	0.00533	2.010	0.231
Treatment	1	0.00691	0.00691	2.607	0.167
Residual	5	0.0133	0.00265		
Total	11	0.0468	0.00425		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.231).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.167).

Power of performed test with alpha = 0.0500: for Replication : 0.164

Power of performed test with alpha = 0.0500: for Treatment : 0.174

Least square means for Replication :

Group	Mean
1.000	1.516
2.000	1.489
3.000	1.432
4.000	1.505
5.000	1.390
6.000	1.513

Std Err of LS Mean = 0.0364

Least square means for Treatment :

Group	Mean
Before	1.498
After	1.450

Std Err of LS Mean = 0.0210

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site JF 19-7X

Two Way Analysis of Variance

Monday, September 24, 2007, 2:27:39 PM

Data source: JF 19-7X data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.311)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.00610	0.00122	2.292	0.192
Treatment	1	0.000817	0.000817	1.534	0.270
Residual	5	0.00266	0.000532		
Total	11	0.00958	0.000871		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.192).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.270).

Power of performed test with alpha = 0.0500: for Replication : 0.200

Power of performed test with alpha = 0.0500: for Treatment : 0.0900

Least square means for Replication :

Group	Mean
1.000	1.354
2.000	1.331
3.000	1.311
4.000	1.352
5.000	1.383
6.000	1.336

Std Err of LS Mean = 0.0163

Least square means for Treatment :

Group	Mean
Before	1.353
After	1.336

Std Err of LS Mean = 0.00942

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site JF 19-7X

Two Way Analysis of Variance

Monday, September 24, 2007, 2:27:48 PM

Data source: JF 19-7X data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.646)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.00299	0.000598	0.218	0.940
Treatment	1	0.00549	0.00549	1.998	0.217
Residual	5	0.0137	0.00275		
Total	11	0.0222	0.00202		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.940).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.217).

Power of performed test with alpha = 0.0500: for Replication : 0.0512

Power of performed test with alpha = 0.0500: for Treatment : 0.126

Least square means for Replication :

Group	Mean
1.000	1.382
2.000	1.419
3.000	1.366
4.000	1.386
5.000	1.392
6.000	1.392

Std Err of LS Mean = 0.0371

Least square means for Treatment :

Group	Mean
Before	1.368
After	1.411

Std Err of LS Mean = 0.0214

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site JF 19-7X

Two Way Analysis of Variance

Monday, September 24, 2007, 2:27:56 PM

Data source: JF 19-7X data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.295)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0179	0.00359	2.093	0.218
Treatment	1	0.00785	0.00785	4.581	0.085
Residual	5	0.00857	0.00171		
Total	11	0.0344	0.00312		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.218).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.085).

Power of performed test with alpha = 0.0500: for Replication : 0.174

Power of performed test with alpha = 0.0500: for Treatment : 0.330

Least square means for Replication :

Group	Mean
1.000	1.469
2.000	1.499
3.000	1.439
4.000	1.382
5.000	1.412
6.000	1.417

Std Err of LS Mean = 0.0293

Least square means for Treatment :

Group	Mean
Before	1.411
After	1.462

Std Err of LS Mean = 0.0169

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site JF 27-7X

Two Way Analysis of Variance

Monday, September 24, 2007, 2:31:55 PM

Data source: JF 27-7X data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.463)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0250	0.00500	0.892	0.560
Treatment	1	0.00142	0.00142	0.254	0.641
Residual	4	0.0224	0.00560		
Total	10	0.0515	0.00515		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.560).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.641).

Power of performed test with alpha = 0.0500: for Replication : 0.0520

Power of performed test with alpha = 0.0500: for Treatment : 0.0503

Least square means for Replication :

Group	Mean	SEM
1.000	1.326	0.0529
2.000	1.306	0.0529
3.000	1.353	0.0529
4.000	1.225	0.0529
5.000	1.301	0.0529
6.000	1.213	0.0785

Least square means for Treatment :

Group	Mean	SEM
Before	1.275	0.0306
After	1.299	0.0362

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site JF 27-7X

Two Way Analysis of Variance

Monday, September 24, 2007, 2:32:11 PM

Data source: JF 27-7X data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.317)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0442	0.00884	3.067	0.150
Treatment	1	0.00507	0.00507	1.759	0.255
Residual	4	0.0115	0.00288		
Total	10	0.0622	0.00622		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.150).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.255).

Power of performed test with alpha = 0.0500: for Replication : 0.255

Power of performed test with alpha = 0.0500: for Treatment : 0.103

Least square means for Replication :

Group	Mean	SEM
1.000	1.322	0.0380
2.000	1.348	0.0380
3.000	1.412	0.0380
4.000	1.208	0.0380
5.000	1.338	0.0380
6.000	1.304	0.0563

Least square means for Treatment :

Group	Mean	SEM
Before	1.300	0.0219
After	1.345	0.0259

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site JF 27-7X

Two Way Analysis of Variance

Monday, September 24, 2007, 2:32:20 PM

Data source: JF 27-7X data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.051)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0517	0.0103	1.223	0.435
Treatment	1	0.0338	0.0338	3.993	0.116
Residual	4	0.0338	0.00846		
Total	10	0.125	0.0125		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.435).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.116).

Power of performed test with alpha = 0.0500: for Replication : 0.0708

Power of performed test with alpha = 0.0500: for Treatment : 0.262

Least square means for Replication :

Group	Mean	SEM
1.000	1.479	0.0650
2.000	1.374	0.0650
3.000	1.473	0.0650
4.000	1.296	0.0650
5.000	1.348	0.0650
6.000	1.369	0.0964

Least square means for Treatment :

Group	Mean	SEM
Before	1.332	0.0375
After	1.448	0.0444

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site JF 39-7X

Two Way Analysis of Variance

Monday, September 24, 2007, 2:36:00 PM

Data source: JF 39-7X data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.278)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0336	0.00672	2.566	0.191
Treatment	1	0.0497	0.0497	18.979	0.012
Residual	4	0.0105	0.00262		
Total	10	0.0978	0.00978		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.191).

The difference in the mean values among the different levels of Treatment is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.012). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.202

Power of performed test with alpha = 0.0500: for Treatment : 0.886

Least square means for Replication :

Group	Mean	SEM
1.000	1.241	0.0362
2.000	1.388	0.0362
3.000	1.291	0.0362
4.000	1.308	0.0362
5.000	1.223	0.0362
6.000	1.286	0.0537

Least square means for Treatment :

Group	Mean	SEM
Before	1.360	0.0209
After	1.219	0.0247

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Treatment**

Comparison	Diff of Means	p	q	P	P<0.050
Before vs. After	0.141	2	6.161	0.012	Yes

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site JF 39-7X

Two Way Analysis of Variance

Monday, September 24, 2007, 2:36:25 PM

Data source: JF 39-7X data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.224)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0227	0.00454	1.253	0.426
Treatment	1	0.00227	0.00227	0.626	0.473
Residual	4	0.0145	0.00363		
Total	10	0.0381	0.00381		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.426).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.473).

Power of performed test with alpha = 0.0500: for Replication : 0.0734

Power of performed test with alpha = 0.0500: for Treatment : 0.0503

Least square means for Replication :

Group	Mean	SEM
1.000	1.399	0.0426
2.000	1.459	0.0426
3.000	1.380	0.0426
4.000	1.391	0.0426
5.000	1.327	0.0426
6.000	1.316	0.0632

Least square means for Treatment :

Group	Mean	SEM
Before	1.394	0.0246
After	1.364	0.0291

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site JF 39-7X

Two Way Analysis of Variance

Monday, September 24, 2007, 2:36:37 PM

Data source: JF 39-7X data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.058)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0177	0.00354	0.731	0.637
Treatment	1	0.000804	0.000804	0.166	0.704
Residual	4	0.0194	0.00484		
Total	10	0.0383	0.00383		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.637).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.704).

Power of performed test with alpha = 0.0500: for Replication : 0.0520

Power of performed test with alpha = 0.0500: for Treatment : 0.0503

Least square means for Replication :

Group	Mean	SEM
1.000	1.373	0.0492
2.000	1.496	0.0492
3.000	1.398	0.0492
4.000	1.411	0.0492
5.000	1.424	0.0492
6.000	1.397	0.0729

Least square means for Treatment :

Group	Mean	SEM
Before	1.407	0.0284
After	1.425	0.0336

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site JF 67-7

Two Way Analysis of Variance

Monday, September 24, 2007, 2:39:35 PM

Data source: JF 67-7 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.417)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0150	0.00299	0.384	0.836
Treatment	1	0.0721	0.0721	9.255	0.056
Residual	3	0.0234	0.00779		
Total	9	0.107	0.0119		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.836).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.056).

Power of performed test with alpha = 0.0500: for Replication : 0.0540

Power of performed test with alpha = 0.0500: for Treatment : 0.500

Least square means for Replication :

Group	Mean	SEM
1.000	1.278	0.0624
2.000	1.345	0.0624
3.000	1.275	0.0624
4.000	1.313	0.0624
5.000	1.283	0.0936
6.000	1.200	0.0936

Least square means for Treatment :

Group	Mean	SEM
Before	1.377	0.0360
After	1.188	0.0510

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site JF 67-7

Two Way Analysis of Variance

Monday, September 24, 2007, 2:40:08 PM

Data source: JF 67-7 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.208)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0130	0.00260	0.708	0.658
Treatment	1	0.0156	0.0156	4.237	0.132
Residual	3	0.0110	0.00367		
Total	9	0.0407	0.00452		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.658).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.132).

Power of performed test with alpha = 0.0500: for Replication : 0.0540

Power of performed test with alpha = 0.0500: for Treatment : 0.243

Least square means for Replication :

Group	Mean	SEM
1.000	1.341	0.0428
2.000	1.402	0.0428
3.000	1.370	0.0428
4.000	1.447	0.0428
5.000	1.388	0.0643
6.000	1.363	0.0643

Least square means for Treatment :

Group	Mean	SEM
Before	1.429	0.0247
After	1.341	0.0350

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site JF 67-7

Two Way Analysis of Variance

Monday, September 24, 2007, 2:40:20 PM

Data source: JF 67-7 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.129)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0235	0.00469	4.760	0.115
Treatment	1	0.00112	0.00112	1.141	0.364
Residual	3	0.00296	0.000985		
Total	9	0.0315	0.00351		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.115).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.364).

Power of performed test with alpha = 0.0500: for Replication : 0.326

Power of performed test with alpha = 0.0500: for Treatment : 0.0604

Least square means for Replication :

Group	Mean	SEM
1.000	1.344	0.0222
2.000	1.397	0.0222
3.000	1.397	0.0222
4.000	1.435	0.0222
5.000	1.528	0.0333
6.000	1.393	0.0333

Least square means for Treatment :

Group	Mean	SEM
Before	1.427	0.0128
After	1.404	0.0181

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site JF 120-7

Two Way Analysis of Variance

Monday, September 24, 2007, 2:43:26 PM

Data source: Data 7 in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.305)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0348	0.00697	1.879	0.320
Treatment	1	0.000000920	0.000000920	0.000248	0.988
Residual	3	0.0111	0.00371		
Total	9	0.0474	0.00526		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.320).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.988).

Power of performed test with alpha = 0.0500: for Replication : 0.114

Power of performed test with alpha = 0.0500: for Treatment : 0.0521

Least square means for Replication :

Group	Mean	SEM
1.000	1.345	0.0431
2.000	1.367	0.0431
3.000	1.358	0.0431
4.000	1.330	0.0431
5.000	1.310	0.0646
6.000	1.538	0.0646

Least square means for Treatment :

Group	Mean	SEM
Before	1.374	0.0249
After	1.375	0.0352

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site JF 120-7

Two Way Analysis of Variance

Monday, September 24, 2007, 2:43:34 PM

Data source: Data 7 in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.326)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0302	0.00604	1.815	0.331
Treatment	1	0.0000123	0.0000123	0.00371	0.955
Residual	3	0.00999	0.00333		
Total	9	0.0414	0.00460		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.331).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.955).

Power of performed test with alpha = 0.0500: for Replication : 0.110

Power of performed test with alpha = 0.0500: for Treatment : 0.0521

Least square means for Replication :

Group	Mean	SEM
1.000	1.364	0.0408
2.000	1.440	0.0408
3.000	1.367	0.0408
4.000	1.397	0.0408
5.000	1.378	0.0612
6.000	1.554	0.0612

Least square means for Treatment :

Group	Mean	SEM
Before	1.415	0.0236
After	1.418	0.0333

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site JF 120-7

Two Way Analysis of Variance

Monday, September 24, 2007, 2:43:43 PM

Data source: Data 7 in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.254)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0214	0.00428	1.506	0.391
Treatment	1	0.000565	0.000565	0.199	0.686
Residual	3	0.00852	0.00284		
Total	9	0.0330	0.00366		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.391).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.686).

Power of performed test with alpha = 0.0500: for Replication : 0.0880

Power of performed test with alpha = 0.0500: for Treatment : 0.0521

Least square means for Replication :

Group	Mean	SEM
1.000	1.439	0.0377
2.000	1.449	0.0377
3.000	1.394	0.0377
4.000	1.466	0.0377
5.000	1.418	0.0565
6.000	1.569	0.0565

Least square means for Treatment :

Group	Mean	SEM
Before	1.464	0.0218
After	1.447	0.0308

Paired t-test Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal in Section 7

Paired t-test:

Wednesday, September 26, 2007, 12:18:36 PM

Data source: Data 39 in drill pad density stats

Normality Test: Passed (P = 0.493)

Treatment Name	N	Missing	Mean	Std Dev	SEM
0-2 before	6	0	1.360	0.0476	0.0195
0-2 after	6	0	1.292	0.0617	0.0252
Difference	6	0	0.0683	0.0805	0.0328

t = 2.079 with 5 degrees of freedom. (P = 0.092)

95 percent confidence interval for difference of means: -0.0162 to 0.153

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.092)

Power of performed test with alpha = 0.050: 0.310

The power of the performed test (0.310) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Paired t-test Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal in Section 7

Paired t-test:

Wednesday, September 26, 2007, 12:20:30 PM

Data source: Data 39 in drill pad density stats

Normality Test: Passed (P = 0.565)

Treatment Name	N	Missing	Mean	Std Dev	SEM
0-6 before	6	0	1.396	0.0579	0.0236
0-6 after	6	0	1.382	0.0303	0.0124
Difference	6	0	0.0140	0.0520	0.0212

t = 0.660 with 5 degrees of freedom. (P = 0.539)

95 percent confidence interval for difference of means: -0.0406 to 0.0686

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.539)

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Paired t-test ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal in Section 7

Paired t-test:

Wednesday, September 26, 2007, 12:21:03 PM

Data source: Data 39 in drill pad density stats

Normality Test: Passed (P = 0.253)

Treatment Name	N	Missing	Mean	Std Dev	SEM
0-12 before	6	0	1.423	0.0567	0.0232
0-12 after	6	0	1.434	0.0290	0.0119
Difference	6	0	-0.0106	0.0673	0.0275

t = -0.385 with 5 degrees of freedom. (P = 0.716)

95 percent confidence interval for difference of means: -0.0812 to 0.0600

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.716)

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 53-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:28:34 AM

Data source: Data 30 in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.052)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.00308	0.000617	0.273	0.910
Treatment	1	0.00783	0.00783	3.463	0.122
Residual	5	0.0113	0.00226		
Total	11	0.0222	0.00202		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.910).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.122).

Power of performed test with alpha = 0.0500: for Replication : 0.0512

Power of performed test with alpha = 0.0500: for Treatment : 0.242

Least square means for Replication :

Group	Mean
1.000	1.309
2.000	1.311
3.000	1.353
4.000	1.336
5.000	1.319
6.000	1.312

Std Err of LS Mean = 0.0336

Least square means for Treatment :

Group	Mean
Before	1.349
After	1.298

Std Err of LS Mean = 0.0194

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 53-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:28:45 AM

Data source: Data 30 in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.638)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0102	0.00205	0.533	0.747
Treatment	1	0.00774	0.00774	2.014	0.215
Residual	5	0.0192	0.00384		
Total	11	0.0372	0.00338		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.747).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.215).

Power of performed test with alpha = 0.0500: for Replication : 0.0512

Power of performed test with alpha = 0.0500: for Treatment : 0.127

Least square means for Replication :

Group	Mean
1.000	1.266
2.000	1.270
3.000	1.313
4.000	1.289
5.000	1.346
6.000	1.268

Std Err of LS Mean = 0.0438

Least square means for Treatment :

Group	Mean
Before	1.267
After	1.318

Std Err of LS Mean = 0.0253

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 53-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:28:56 AM

Data source: Data 30 in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.288)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0138	0.00277	1.271	0.400
Treatment	1	0.0454	0.0454	20.828	0.006
Residual	5	0.0109	0.00218		
Total	11	0.0701	0.00638		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.400).

The difference in the mean values among the different levels of Treatment is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.006). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.0782

Power of performed test with alpha = 0.0500: for Treatment : 0.946

Least square means for Replication :

Group Mean

1.000 1.254
2.000 1.301
3.000 1.332
4.000 1.284
5.000 1.360
6.000 1.295

Std Err of LS Mean = 0.0330

Least square means for Treatment :

Group Mean

Before 1.243
After 1.366

Std Err of LS Mean = 0.0191

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Treatment**

Comparison	Diff of Means	p	q	P	P<0.050
After vs. Before	0.123	2	6.454	0.006	Yes

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 54-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:31:55 AM

Data source: SHB 54-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.150)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0508	0.0102	0.985	0.506
Treatment	1	0.000981	0.000981	0.0951	0.770
Residual	5	0.0516	0.0103		
Total	11	0.103	0.00939		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.506).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.770).

Power of performed test with alpha = 0.0500: for Replication : 0.0512

Power of performed test with alpha = 0.0500: for Treatment : 0.0500

Least square means for Replication :

Group	Mean
1.000	1.404
2.000	1.355
3.000	1.271
4.000	1.408
5.000	1.429
6.000	1.480

Std Err of LS Mean = 0.0718

Least square means for Treatment :

Group	Mean
Before	1.400
After	1.382

Std Err of LS Mean = 0.0415

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 54-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:32:02 AM

Data source: SHB 54-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.250)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0293	0.00585	1.209	0.420
Treatment	1	0.0165	0.0165	3.418	0.124
Residual	5	0.0242	0.00484		
Total	11	0.0700	0.00636		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.420).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.124).

Power of performed test with alpha = 0.0500: for Replication : 0.0718

Power of performed test with alpha = 0.0500: for Treatment : 0.239

Least square means for Replication :

Group	Mean
1.000	1.387
2.000	1.317
3.000	1.313
4.000	1.388
5.000	1.413
6.000	1.451

Std Err of LS Mean = 0.0492

Least square means for Treatment :

Group	Mean
Before	1.341
After	1.415

Std Err of LS Mean = 0.0284

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 54-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:32:10 AM

Data source: SHB 54-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.670)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0134	0.00267	1.886	0.252
Treatment	1	0.0484	0.0484	34.150	0.002
Residual	5	0.00709	0.00142		
Total	11	0.0689	0.00626		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.252).

The difference in the mean values among the different levels of Treatment is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.002). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.149

Power of performed test with alpha = 0.0500: for Treatment : 0.995

Least square means for Replication :

Group Mean

1.000 1.348
2.000 1.343
3.000 1.338
4.000 1.389
5.000 1.375
6.000 1.434

Std Err of LS Mean = 0.0266

Least square means for Treatment :

Group Mean

Before 1.308
After 1.435

Std Err of LS Mean = 0.0154

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Treatment**

Comparison	Diff of Means	p	q	P	P<0.050
After vs. Before	0.127	2	8.264	0.002	Yes

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 58-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:34:16 AM

Data source: Data 32 in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.371)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0329	0.00659	5.263	0.101
Treatment	1	0.00966	0.00966	7.720	0.069
Residual	3	0.00375	0.00125		
Total	9	0.0428	0.00476		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.101).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.069).

Power of performed test with alpha = 0.0500: for Replication : 0.362

Power of performed test with alpha = 0.0500: for Treatment : 0.429

Least square means for Replication :

Group	Mean	SEM
1.000	1.233	0.0250
2.000	1.415	0.0375
3.000	1.344	0.0250
4.000	1.390	0.0250
5.000	1.328	0.0250
6.000	1.346	0.0375

Least square means for Treatment :

Group	Mean	SEM
Before	1.308	0.0144
After	1.378	0.0204

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 58-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:34:53 AM

Data source: SHB 58-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.271)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0196	0.00393	2.756	0.217
Treatment	1	0.0141	0.0141	9.916	0.051
Residual	3	0.00427	0.00142		
Total	9	0.0375	0.00417		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.217).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.051).

Power of performed test with alpha = 0.0500: for Replication : 0.179

Power of performed test with alpha = 0.0500: for Treatment : 0.529

Least square means for Replication :

Group	Mean	SEM
1.000	1.240	0.0267
2.000	1.351	0.0400
3.000	1.337	0.0267
4.000	1.366	0.0267
5.000	1.289	0.0267
6.000	1.316	0.0400

Least square means for Treatment :

Group	Mean	SEM
Before	1.274	0.0154
After	1.358	0.0218

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 58-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:35:03 AM

Data source: SHB 58-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.407)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.00838	0.00168	0.991	0.538
Treatment	1	0.0275	0.0275	16.253	0.027
Residual	3	0.00508	0.00169		
Total	9	0.0450	0.00500		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.538).

The difference in the mean values among the different levels of Treatment is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.027). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.0540

Power of performed test with alpha = 0.0500: for Treatment : 0.740

Least square means for Replication :

Group	Mean	SEM
1.000	1.298	0.0291
2.000	1.348	0.0436
3.000	1.311	0.0291
4.000	1.367	0.0291
5.000	1.290	0.0291
6.000	1.300	0.0436

Least square means for Treatment :

Group	Mean	SEM
Before	1.260	0.0168
After	1.378	0.0237

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Treatment**

Comparison	Diff of Means	p	q	P	P<0.050
After vs. Before	0.117	2	5.701	0.028	Yes

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 59-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:37:57 AM

Data source: SHB 59-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.425)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0331	0.00662	5.225	0.067
Treatment	1	0.0187	0.0187	14.778	0.018
Residual	4	0.00507	0.00127		
Total	10	0.0574	0.00574		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.067).

The difference in the mean values among the different levels of Treatment is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.018). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.474

Power of performed test with alpha = 0.0500: for Treatment : 0.796

Least square means for Replication :

Group	Mean	SEM
1.000	1.478	0.0252
2.000	1.423	0.0252
3.000	1.421	0.0373
4.000	1.368	0.0252
5.000	1.444	0.0252
6.000	1.316	0.0252

Least square means for Treatment :

Group	Mean	SEM
Before	1.365	0.0145
After	1.452	0.0172

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Treatment**

Comparison	Diff of Means	p	q	P	P<0.050
After vs. Before	0.0865	2	5.437	0.019	Yes

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 59-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:38:21 AM

Data source: SHB 59-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.401)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0304	0.00607	1.532	0.350
Treatment	1	0.0308	0.0308	7.766	0.049
Residual	4	0.0159	0.00396		
Total	10	0.0913	0.00913		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.350).

The difference in the mean values among the different levels of Treatment is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.049). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.0986

Power of performed test with alpha = 0.0500: for Treatment : 0.505

Least square means for Replication :

Group	Mean	SEM
1.000	1.454	0.0445
2.000	1.370	0.0445
3.000	1.307	0.0660
4.000	1.347	0.0445
5.000	1.463	0.0445
6.000	1.427	0.0445

Least square means for Treatment :

Group	Mean	SEM
Before	1.339	0.0257
After	1.450	0.0304

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Treatment**

Comparison	Diff of Means	p	q	P	P<0.050
After vs. Before	0.111	2	3.941	0.050	Yes

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 59-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:38:32 AM

Data source: SHB 59-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.209)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0389	0.00778	4.390	0.088
Treatment	1	0.0685	0.0685	38.674	0.003
Residual	4	0.00708	0.00177		
Total	10	0.148	0.0148		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.088).

The difference in the mean values among the different levels of Treatment is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.003). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.393

Power of performed test with alpha = 0.0500: for Treatment : 0.994

Least square means for Replication :

Group	Mean	SEM
1.000	1.455	0.0298
2.000	1.386	0.0298
3.000	1.233	0.0441
4.000	1.355	0.0298
5.000	1.437	0.0298
6.000	1.366	0.0298

Least square means for Treatment :

Group	Mean	SEM
Before	1.289	0.0172
After	1.455	0.0203

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Treatment**

Comparison	Diff of Means	p	q	P	P<0.050
After vs. Before	0.166	2	8.795	0.004	Yes

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site JF 114/60-20

Two Way Analysis of Variance

Monday, September 24, 2007, 2:48:53 PM

Data source: SHB 114/60-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.226)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0209	0.00418	2.306	0.219
Treatment	1	0.0219	0.0219	12.072	0.025
Residual	4	0.00725	0.00181		
Total	10	0.0466	0.00466		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.219).

The difference in the mean values among the different levels of Treatment is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.025). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.175

Power of performed test with alpha = 0.0500: for Treatment : 0.708

Least square means for Replication :

Group	Mean	SEM
1.000	1.256	0.0301
2.000	1.354	0.0301
3.000	1.380	0.0301
4.000	1.330	0.0301
5.000	1.326	0.0301
6.000	1.261	0.0447

Least square means for Treatment :

Group	Mean	SEM
Before	1.365	0.0174
After	1.271	0.0206

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Treatment**

Comparison	Diff of Means	p	q	P	P<0.050
Before vs. After	0.0936	2	4.914	0.026	Yes

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site JF 114/60-20

Two Way Analysis of Variance

Monday, September 24, 2007, 2:49:49 PM

Data source: SHB 114/60-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.366)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0315	0.00629	1.125	0.467
Treatment	1	0.000439	0.000439	0.0785	0.793
Residual	4	0.0224	0.00559		
Total	10	0.0539	0.00539		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.467).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.793).

Power of performed test with alpha = 0.0500: for Replication : 0.0624

Power of performed test with alpha = 0.0500: for Treatment : 0.0503

Least square means for Replication :

Group	Mean	SEM
1.000	1.231	0.0529
2.000	1.333	0.0529
3.000	1.399	0.0529
4.000	1.343	0.0529
5.000	1.329	0.0529
6.000	1.274	0.0784

Least square means for Treatment :

Group	Mean	SEM
Before	1.325	0.0305
After	1.312	0.0361

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site JF 114/60-20

Two Way Analysis of Variance

Monday, September 24, 2007, 2:49:58 PM

Data source: SHB 114/60-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.447)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.00475	0.000949	0.214	0.939
Treatment	1	0.00550	0.00550	1.238	0.328
Residual	4	0.0178	0.00444		
Total	10	0.0304	0.00304		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.939).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.328).

Power of performed test with alpha = 0.0500: for Replication : 0.0520

Power of performed test with alpha = 0.0500: for Treatment : 0.0667

Least square means for Replication :

Group	Mean	SEM
1.000	1.310	0.0471
2.000	1.299	0.0471
3.000	1.351	0.0471
4.000	1.323	0.0471
5.000	1.335	0.0471
6.000	1.282	0.0699

Least square means for Treatment :

Group	Mean	SEM
Before	1.293	0.0272
After	1.340	0.0322

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 69-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:43:51 AM

Data source: SHB 69-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.260)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0877	0.0175	9.044	0.050
Treatment	1	0.00464	0.00464	2.391	0.220
Residual	3	0.00582	0.00194		
Total	9	0.100	0.0111		

The difference in the mean values among the different levels of Replication is greater than would be expected by chance after allowing for effects of differences in Treatment. There is a statistically significant difference (P = 0.050). To isolate which group(s) differ from the others use a multiple comparison procedure.

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.220).

Power of performed test with alpha = 0.0500: for Replication : 0.590

Power of performed test with alpha = 0.0500: for Treatment : 0.135

Least square means for Replication :

Group	Mean	SEM
1.000	1.281	0.0467
2.000	1.187	0.0311
3.000	1.424	0.0311
4.000	1.400	0.0311
5.000	1.395	0.0311
6.000	1.451	0.0467

Least square means for Treatment :

Group	Mean	SEM
Before	1.380	0.0180
After	1.332	0.0254

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Replication**

Comparison	Diff of Means	p	q	P	P<0.050
6.000 vs. 2.000	0.264	6	6.654	0.082	No

6.000 vs. 1.000	0.171	6	3.659	0.319	Do Not Test
6.000 vs. 5.000	0.0566	6	1.427	0.890	Do Not Test
6.000 vs. 4.000	0.0519	6	1.307	0.917	Do Not Test
6.000 vs. 3.000	0.0275	6	0.692	0.993	Do Not Test
3.000 vs. 2.000	0.237	6	7.601	0.058	Do Not Test
3.000 vs. 1.000	0.143	6	3.613	0.327	Do Not Test
3.000 vs. 5.000	0.0292	6	0.936	0.975	Do Not Test
3.000 vs. 4.000	0.0244	6	0.784	0.988	Do Not Test
4.000 vs. 2.000	0.212	6	6.817	0.077	Do Not Test
4.000 vs. 1.000	0.119	6	2.998	0.449	Do Not Test
4.000 vs. 5.000	0.00475	6	0.152	1.000	Do Not Test
5.000 vs. 2.000	0.207	6	6.664	0.082	Do Not Test
5.000 vs. 1.000	0.114	6	2.879	0.478	Do Not Test
1.000 vs. 2.000	0.0932	6	2.349	0.622	Do Not Test

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 69-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:48:25 AM

Data source: SHB 69-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.347)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0353	0.00706	6.990	0.070
Treatment	1	3.944E-031	3.944E-031	3.905E-028	1.000
Residual	3	0.00303	0.00101		
Total	9	0.0386	0.00428		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.070).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 1.000).

Power of performed test with alpha = 0.0500: for Replication : 0.475

Power of performed test with alpha = 0.0500: for Treatment : 0.0521

Least square means for Replication :

Group	Mean	SEM
1.000	1.324	0.0337
2.000	1.224	0.0225
3.000	1.349	0.0225
4.000	1.380	0.0225
5.000	1.372	0.0225
6.000	1.395	0.0337

Least square means for Treatment :

Group	Mean	SEM
Before	1.341	0.0130
After	1.341	0.0183

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 69-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:48:35 AM

Data source: SHB 69-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.344)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0200	0.00401	30.075	0.009
Treatment	1	0.0172	0.0172	129.000	0.001
Residual	3	0.000400	0.000133		
Total	9	0.0320	0.00356		

The difference in the mean values among the different levels of Replication is greater than would be expected by chance after allowing for effects of differences in Treatment. There is a statistically significant difference (P = 0.009). To isolate which group(s) differ from the others use a multiple comparison procedure.

The difference in the mean values among the different levels of Treatment is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.001). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.977

Power of performed test with alpha = 0.0500: for Treatment : 1.000

Least square means for Replication :

Group	Mean	SEM
1.000	1.296	0.0122
2.000	1.226	0.00816
3.000	1.271	0.00816
4.000	1.308	0.00816
5.000	1.304	0.00816
6.000	1.396	0.0122

Least square means for Treatment :

Group	Mean	SEM
Before	1.254	0.00471
After	1.347	0.00666

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Replication**

Comparison	Diff of Means	p	q	P	P<0.050
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6.000 vs. 2.000	0.170	6	16.390	0.007	Yes
6.000 vs. 3.000	0.126	6	12.080	0.016	Yes
6.000 vs. 1.000	0.100	6	8.171	0.048	Yes
6.000 vs. 5.000	0.0929	6	8.931	0.038	Yes
6.000 vs. 4.000	0.0886	6	8.516	0.043	Yes
4.000 vs. 2.000	0.0819	6	10.037	0.027	Yes
4.000 vs. 3.000	0.0371	6	4.543	0.205	No
4.000 vs. 1.000	0.0114	6	1.098	0.955	Do Not Test
4.000 vs. 5.000	0.00431	6	0.528	0.998	Do Not Test
5.000 vs. 2.000	0.0776	6	9.509	0.032	Yes
5.000 vs. 3.000	0.0328	6	4.015	0.266	Do Not Test
5.000 vs. 1.000	0.00711	6	0.684	0.993	Do Not Test
1.000 vs. 2.000	0.0705	6	6.776	0.079	No
1.000 vs. 3.000	0.0256	6	2.466	0.588	Do Not Test
3.000 vs. 2.000	0.0448	6	5.494	0.133	Do Not Test

Comparisons for factor: **Treatment**

Comparison	Diff of Means	p	q	P	P<0.050
After vs. Before	0.0927	2	16.062	0.002	Yes

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 70-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:58:16 AM

Data source: SHB 70-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.151)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.00144	0.000287	0.0636	0.996
Treatment	1	0.00313	0.00313	0.694	0.443
Residual	5	0.0226	0.00452		
Total	11	0.0271	0.00247		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.996).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.443).

Power of performed test with alpha = 0.0500: for Replication : 0.0512

Power of performed test with alpha = 0.0500: for Treatment : 0.0500

Least square means for Replication :

Group	Mean
1.000	1.284
2.000	1.313
3.000	1.312
4.000	1.299
5.000	1.306
6.000	1.315

Std Err of LS Mean = 0.0475

Least square means for Treatment :

Group	Mean
Before	1.321
After	1.289

Std Err of LS Mean = 0.0274

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 70-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:58:23 AM

Data source: SHB 70-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.608)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.00416	0.000832	0.648	0.677
Treatment	1	0.000000914	0.000000914	0.000712	0.980
Residual	5	0.00642	0.00128		
Total	11	0.0106	0.000962		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.677).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.980).

Power of performed test with alpha = 0.0500: for Replication : 0.0512

Power of performed test with alpha = 0.0500: for Treatment : 0.0500

Least square means for Replication :

Group	Mean
1.000	1.261
2.000	1.291
3.000	1.253
4.000	1.272
5.000	1.284
6.000	1.308

Std Err of LS Mean = 0.0253

Least square means for Treatment :

Group	Mean
Before	1.278
After	1.279

Std Err of LS Mean = 0.0146

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 70-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:58:30 AM

Data source: SHB 70-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.531)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.00919	0.00184	2.626	0.156
Treatment	1	0.00658	0.00658	9.402	0.028
Residual	5	0.00350	0.000700		
Total	11	0.0193	0.00175		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.156).

The difference in the mean values among the different levels of Treatment is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.028). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.243

Power of performed test with alpha = 0.0500: for Treatment : 0.646

Least square means for Replication :

Group Mean

1.000 1.237
2.000 1.267
3.000 1.238
4.000 1.317
5.000 1.272
6.000 1.288

Std Err of LS Mean = 0.0187

Least square means for Treatment :

Group Mean

Before 1.246
After 1.293

Std Err of LS Mean = 0.0108

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Treatment**

Comparison	Diff of Means	p	q	P	P<0.050
After vs. Before	0.0468	2	4.336	0.028	Yes

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 71-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 11:02:21 AM

Data source: SHB 71-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.528)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0109	0.00218	2.147	0.239
Treatment	1	0.0000311	0.0000311	0.0306	0.870
Residual	4	0.00406	0.00102		
Total	10	0.0150	0.00150		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.239).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.870).

Power of performed test with alpha = 0.0500: for Replication : 0.159

Power of performed test with alpha = 0.0500: for Treatment : 0.0503

Least square means for Replication :

Group	Mean	SEM
1.000	1.328	0.0225
2.000	1.402	0.0225
3.000	1.319	0.0225
4.000	1.383	0.0225
5.000	1.336	0.0225
6.000	1.358	0.0334

Least square means for Treatment :

Group	Mean	SEM
Before	1.356	0.0130
After	1.353	0.0154

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 71-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 11:02:33 AM

Data source: SHB 71-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.291)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0559	0.0112	7.325	0.038
Treatment	1	0.000555	0.000555	0.364	0.579
Residual	4	0.00610	0.00153		
Total	10	0.0624	0.00624		

The difference in the mean values among the different levels of Replication is greater than would be expected by chance after allowing for effects of differences in Treatment. There is a statistically significant difference (P = 0.038). To isolate which group(s) differ from the others use a multiple comparison procedure.

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.579).

Power of performed test with alpha = 0.0500: for Replication : 0.646

Power of performed test with alpha = 0.0500: for Treatment : 0.0503

Least square means for Replication :

Group	Mean	SEM
1.000	1.318	0.0276
2.000	1.438	0.0276
3.000	1.203	0.0276
4.000	1.321	0.0276
5.000	1.332	0.0276
6.000	1.343	0.0410

Least square means for Treatment :

Group	Mean	SEM
Before	1.318	0.0159
After	1.333	0.0189

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Replication**

Comparison	Diff of Means	p	q	P	P<0.050
2.000 vs. 3.000	0.235	6	8.513	0.022	Yes

2.000 vs. 1.000	0.121	6	4.376	0.180	No
2.000 vs. 4.000	0.118	6	4.256	0.194	Do Not Test
2.000 vs. 5.000	0.107	6	3.867	0.246	Do Not Test
2.000 vs. 6.000	0.0952	6	2.725	0.494	Do Not Test
6.000 vs. 3.000	0.140	6	4.005	0.226	No
6.000 vs. 1.000	0.0257	6	0.735	0.992	Do Not Test
6.000 vs. 4.000	0.0224	6	0.640	0.996	Do Not Test
6.000 vs. 5.000	0.0116	6	0.332	1.000	Do Not Test
5.000 vs. 3.000	0.128	6	4.646	0.153	Do Not Test
5.000 vs. 1.000	0.0141	6	0.510	0.999	Do Not Test
5.000 vs. 4.000	0.0108	6	0.390	1.000	Do Not Test
4.000 vs. 3.000	0.118	6	4.256	0.194	Do Not Test
4.000 vs. 1.000	0.00331	6	0.120	1.000	Do Not Test
1.000 vs. 3.000	0.114	6	4.136	0.209	Do Not Test

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 71-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 11:03:33 AM

Data source: SHB 71-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.429)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0257	0.00514	4.707	0.079
Treatment	1	0.0124	0.0124	11.336	0.028
Residual	4	0.00437	0.00109		
Total	10	0.0461	0.00461		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.079).

The difference in the mean values among the different levels of Treatment is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.028). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.424

Power of performed test with alpha = 0.0500: for Treatment : 0.679

Least square means for Replication :

Group	Mean	SEM
1.000	1.401	0.0234
2.000	1.401	0.0234
3.000	1.285	0.0234
4.000	1.302	0.0234
5.000	1.320	0.0234
6.000	1.304	0.0346

Least square means for Treatment :

Group	Mean	SEM
Before	1.300	0.0135
After	1.371	0.0160

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Treatment**

Comparison	Diff of Means	p	q	P	P<0.050
After vs. Before	0.0703	2	4.762	0.028	Yes

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 75-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 11:13:58 AM

Data source: SHB 75-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.102)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0183	0.00366	19.497	0.017
Treatment	1	0.00103	0.00103	5.494	0.101
Residual	3	0.000563	0.000188		
Total	9	0.0218	0.00243		

The difference in the mean values among the different levels of Replication is greater than would be expected by chance after allowing for effects of differences in Treatment. There is a statistically significant difference (P = 0.017). To isolate which group(s) differ from the others use a multiple comparison procedure.

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.101).

Power of performed test with alpha = 0.0500: for Replication : 0.897

Power of performed test with alpha = 0.0500: for Treatment : 0.314

Least square means for Replication :

Group	Mean	SEM
1.000	1.372	0.00969
2.000	1.319	0.0145
3.000	1.376	0.0145
4.000	1.320	0.00969
5.000	1.296	0.00969
6.000	1.252	0.00969

Least square means for Treatment :

Group	Mean	SEM
Before	1.334	0.00559
After	1.311	0.00791

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Replication**

Comparison	Diff of Means	p	q	P	P<0.050
3.000 vs. 6.000	0.124	6	10.004	0.027	Yes

3.000 vs. 5.000	0.0795	6	6.436	0.090	No
3.000 vs. 2.000	0.0570	6	3.918	0.280	Do Not Test
3.000 vs. 4.000	0.0558	6	4.515	0.208	Do Not Test
3.000 vs. 1.000	0.00424	6	0.343	1.000	Do Not Test
1.000 vs. 6.000	0.119	6	12.315	0.015	Yes
1.000 vs. 5.000	0.0753	6	7.767	0.055	Do Not Test
1.000 vs. 2.000	0.0527	6	4.268	0.235	Do Not Test
1.000 vs. 4.000	0.0515	6	5.318	0.143	Do Not Test
4.000 vs. 6.000	0.0678	6	6.997	0.072	No
4.000 vs. 5.000	0.0237	6	2.449	0.592	Do Not Test
4.000 vs. 2.000	0.00119	6	0.0961	1.000	Do Not Test
2.000 vs. 6.000	0.0666	6	5.393	0.139	Do Not Test
2.000 vs. 5.000	0.0225	6	1.825	0.780	Do Not Test
5.000 vs. 6.000	0.0441	6	4.548	0.205	Do Not Test

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 75-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 11:15:00 AM

Data source: SHB 75-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.163)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0191	0.00381	2.028	0.297
Treatment	1	9.861E-030	9.861E-030	5.244E-027	1.000
Residual	3	0.00564	0.00188		
Total	9	0.0248	0.00275		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.297).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 1.000).

Power of performed test with alpha = 0.0500: for Replication : 0.125

Power of performed test with alpha = 0.0500: for Treatment : 0.0521

Least square means for Replication :

Group	Mean	SEM
1.000	1.385	0.0307
2.000	1.303	0.0460
3.000	1.349	0.0460
4.000	1.287	0.0307
5.000	1.308	0.0307
6.000	1.258	0.0307

Least square means for Treatment :

Group	Mean	SEM
Before	1.315	0.0177
After	1.315	0.0250

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 75-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 11:15:10 AM

Data source: SHB 75-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.089)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0177	0.00353	4.997	0.108
Treatment	1	0.0104	0.0104	14.660	0.031
Residual	3	0.00212	0.000707		
Total	9	0.0329	0.00366		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.108).

The difference in the mean values among the different levels of Treatment is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.031). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.343

Power of performed test with alpha = 0.0500: for Treatment : 0.697

Least square means for Replication :

Group	Mean	SEM
1.000	1.369	0.0188
2.000	1.257	0.0282
3.000	1.319	0.0282
4.000	1.258	0.0188
5.000	1.282	0.0188
6.000	1.267	0.0188

Least square means for Treatment :

Group	Mean	SEM
Before	1.256	0.0109
After	1.328	0.0154

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Treatment**

Comparison	Diff of Means	p	q	P	P<0.050
After vs. Before	0.0720	2	5.415	0.032	Yes

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 76-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 11:17:12 AM

Data source: SHB 76-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.589)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0709	0.0142	2.631	0.156
Treatment	1	0.000533	0.000533	0.0989	0.766
Residual	5	0.0270	0.00539		
Total	11	0.0984	0.00895		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.156).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.766).

Power of performed test with alpha = 0.0500: for Replication : 0.244

Power of performed test with alpha = 0.0500: for Treatment : 0.0500

Least square means for Replication :

Group	Mean
1.000	1.471
2.000	1.344
3.000	1.328
4.000	1.398
5.000	1.317
6.000	1.219

Std Err of LS Mean = 0.0519

Least square means for Treatment :

Group	Mean
Before	1.353
After	1.339

Std Err of LS Mean = 0.0300

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 76-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 11:17:20 AM

Data source: SHB 76-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.345)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0412	0.00825	2.363	0.183
Treatment	1	0.00198	0.00198	0.566	0.486
Residual	5	0.0174	0.00349		
Total	11	0.0607	0.00551		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.183).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.486).

Power of performed test with alpha = 0.0500: for Replication : 0.209

Power of performed test with alpha = 0.0500: for Treatment : 0.0500

Least square means for Replication :

Group	Mean
1.000	1.368
2.000	1.335
3.000	1.333
4.000	1.374
5.000	1.325
6.000	1.197

Std Err of LS Mean = 0.0418

Least square means for Treatment :

Group	Mean
Before	1.309
After	1.335

Std Err of LS Mean = 0.0241

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 76-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 11:17:29 AM

Data source: SHB 76-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.323)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0223	0.00446	1.331	0.381
Treatment	1	0.0334	0.0334	9.966	0.025
Residual	5	0.0167	0.00335		
Total	11	0.0724	0.00658		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.381).

The difference in the mean values among the different levels of Treatment is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.025). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.0846

Power of performed test with alpha = 0.0500: for Treatment : 0.674

Least square means for Replication :

Group	Mean
1.000	1.377
2.000	1.272
3.000	1.302
4.000	1.341
5.000	1.309
6.000	1.245

Std Err of LS Mean = 0.0409

Least square means for Treatment :

Group	Mean
Before	1.255
After	1.360

Std Err of LS Mean = 0.0236

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Treatment**

Comparison	Diff of Means	p	q	P	P<0.050
After vs. Before	0.105	2	4.464	0.025	Yes

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 111-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 9:30:53 AM

Data source: SHB 111-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.107)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0247	0.00494	1.482	0.338
Treatment	1	0.0616	0.0616	18.480	0.008
Residual	5	0.0167	0.00333		
Total	11	0.103	0.00936		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.338).

The difference in the mean values among the different levels of Treatment is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.008). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.101

Power of performed test with alpha = 0.0500: for Treatment : 0.918

Least square means for Replication :

Group Mean

1.000 1.407
2.000 1.402
3.000 1.273
4.000 1.359
5.000 1.392
6.000 1.375

Std Err of LS Mean = 0.0408

Least square means for Treatment :

Group Mean

Before 1.440
After 1.296

Std Err of LS Mean = 0.0236

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Treatment**

Comparison	Diff of Means	p	q	P	P<0.050
Before vs. After	0.143	2	6.080	0.008	Yes

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 111-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 9:31:17 AM

Data source: SHB 111-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.623)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0538	0.0108	5.612	0.041
Treatment	1	0.00242	0.00242	1.264	0.312
Residual	5	0.00959	0.00192		
Total	11	0.0658	0.00598		

The difference in the mean values among the different levels of Replication is greater than would be expected by chance after allowing for effects of differences in Treatment. There is a statistically significant difference (P = 0.041). To isolate which group(s) differ from the others use a multiple comparison procedure.

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.312).

Power of performed test with alpha = 0.0500: for Replication : 0.605

Power of performed test with alpha = 0.0500: for Treatment : 0.0695

Least square means for Replication :

Group Mean

1.000 1.473

2.000 1.353

3.000 1.284

4.000 1.279

5.000 1.402

6.000 1.369

Std Err of LS Mean = 0.0310

Least square means for Treatment :

Group Mean

Before 1.346

After 1.374

Std Err of LS Mean = 0.0179

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Replication**

Comparison	Diff of Means	p	q	P	P<0.050
1.000 vs. 4.000	0.194	6	6.257	0.044	Yes

1.000 vs. 3.000	0.189	6	6.097	0.048	Yes
1.000 vs. 2.000	0.120	6	3.877	0.216	No
1.000 vs. 6.000	0.104	6	3.369	0.310	Do Not Test
1.000 vs. 5.000	0.0712	6	2.300	0.618	Do Not Test
5.000 vs. 4.000	0.123	6	3.957	0.204	No
5.000 vs. 3.000	0.118	6	3.797	0.229	Do Not Test
5.000 vs. 2.000	0.0489	6	1.578	0.857	Do Not Test
5.000 vs. 6.000	0.0331	6	1.070	0.964	Do Not Test
6.000 vs. 4.000	0.0894	6	2.888	0.430	Do Not Test
6.000 vs. 3.000	0.0845	6	2.727	0.478	Do Not Test
6.000 vs. 2.000	0.0157	6	0.508	0.999	Do Not Test
2.000 vs. 4.000	0.0737	6	2.380	0.591	Do Not Test
2.000 vs. 3.000	0.0687	6	2.219	0.646	Do Not Test
3.000 vs. 4.000	0.00497	6	0.160	1.000	Do Not Test

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 111-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 9:34:12 AM

Data source: SHB 111-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.202)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0317	0.00634	11.397	0.009
Treatment	1	0.0293	0.0293	52.697	<0.001
Residual	5	0.00278	0.000556		
Total	11	0.0638	0.00580		

The difference in the mean values among the different levels of Replication is greater than would be expected by chance after allowing for effects of differences in Treatment. There is a statistically significant difference (P = 0.009). To isolate which group(s) differ from the others use a multiple comparison procedure.

The difference in the mean values among the different levels of Treatment is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = <0.001). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.926

Power of performed test with alpha = 0.0500: for Treatment : 1.000

Least square means for Replication :

Group Mean

1.000 1.395

2.000 1.371

3.000 1.319

4.000 1.246

5.000 1.369

6.000 1.386

Std Err of LS Mean = 0.0167

Least square means for Treatment :

Group Mean

Before 1.298

After 1.397

Std Err of LS Mean = 0.00963

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Replication**

Comparison	Diff of Means	p	q	P	P<0.050
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1.000 vs. 4.000	0.149	6	8.942	0.010	Yes
1.000 vs. 3.000	0.0759	6	4.549	0.135	No
1.000 vs. 5.000	0.0259	6	1.551	0.865	Do Not Test
1.000 vs. 2.000	0.0241	6	1.447	0.892	Do Not Test
1.000 vs. 6.000	0.00948	6	0.569	0.998	Do Not Test
6.000 vs. 4.000	0.140	6	8.374	0.013	Yes
6.000 vs. 3.000	0.0664	6	3.980	0.201	Do Not Test
6.000 vs. 5.000	0.0164	6	0.982	0.975	Do Not Test
6.000 vs. 2.000	0.0147	6	0.879	0.984	Do Not Test
2.000 vs. 4.000	0.125	6	7.495	0.021	Yes
2.000 vs. 3.000	0.0517	6	3.101	0.373	Do Not Test
2.000 vs. 5.000	0.00172	6	0.103	1.000	Do Not Test
5.000 vs. 4.000	0.123	6	7.392	0.022	Yes
5.000 vs. 3.000	0.0500	6	2.998	0.400	Do Not Test
3.000 vs. 4.000	0.0733	6	4.394	0.150	No

Comparisons for factor: **Treatment**

Comparison	Diff of Means	p	q	P	P<0.050
After vs. Before	0.0989	2	10.266	<0.001	Yes

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 112-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 9:36:29 AM

Data source: SHB 112-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.248)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0142	0.00284	2.307	0.219
Treatment	1	0.00431	0.00431	3.498	0.135
Residual	4	0.00492	0.00123		
Total	10	0.0233	0.00233		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.219).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.135).

Power of performed test with alpha = 0.0500: for Replication : 0.175

Power of performed test with alpha = 0.0500: for Treatment : 0.227

Least square means for Replication :

Group	Mean	SEM
1.000	1.332	0.0248
2.000	1.391	0.0248
3.000	1.440	0.0248
4.000	1.361	0.0368
5.000	1.355	0.0248
6.000	1.356	0.0248

Least square means for Treatment :

Group	Mean	SEM
Before	1.393	0.0143
After	1.352	0.0169

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 112-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 9:36:39 AM

Data source: SHB 112-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.169)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0162	0.00324	8.196	0.032
Treatment	1	0.00242	0.00242	6.121	0.069
Residual	4	0.00158	0.000396		
Total	10	0.0189	0.00189		

The difference in the mean values among the different levels of Replication is greater than would be expected by chance after allowing for effects of differences in Treatment. There is a statistically significant difference (P = 0.032). To isolate which group(s) differ from the others use a multiple comparison procedure.

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.069).

Power of performed test with alpha = 0.0500: for Replication : 0.703

Power of performed test with alpha = 0.0500: for Treatment : 0.406

Least square means for Replication :

Group	Mean	SEM
1.000	1.361	0.0141
2.000	1.407	0.0141
3.000	1.445	0.0141
4.000	1.452	0.0209
5.000	1.366	0.0141
6.000	1.350	0.0141

Least square means for Treatment :

Group	Mean	SEM
Before	1.381	0.00812
After	1.412	0.00961

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Replication**

Comparison	Diff of Means	p	q	P	P<0.050
4.000 vs. 6.000	0.103	6	5.760	0.082	No

4.000 vs. 1.000	0.0917	6	5.155	0.114	Do Not Test
4.000 vs. 5.000	0.0859	6	4.830	0.138	Do Not Test
4.000 vs. 2.000	0.0454	6	2.550	0.546	Do Not Test
4.000 vs. 3.000	0.00729	6	0.409	0.999	Do Not Test
3.000 vs. 6.000	0.0952	6	6.768	0.049	Do Not Test
3.000 vs. 1.000	0.0845	6	6.003	0.072	Do Not Test
3.000 vs. 5.000	0.0787	6	5.591	0.089	Do Not Test
3.000 vs. 2.000	0.0381	6	2.707	0.499	Do Not Test
2.000 vs. 6.000	0.0571	6	4.061	0.218	Do Not Test
2.000 vs. 1.000	0.0464	6	3.296	0.350	Do Not Test
2.000 vs. 5.000	0.0406	6	2.884	0.450	Do Not Test
5.000 vs. 6.000	0.0166	6	1.177	0.946	Do Not Test
5.000 vs. 1.000	0.00580	6	0.412	0.999	Do Not Test
1.000 vs. 6.000	0.0108	6	0.765	0.991	Do Not Test

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 112-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 9:37:32 AM

Data source: SHB 112-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.414)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0423	0.00847	2.731	0.176
Treatment	1	0.0252	0.0252	8.122	0.046
Residual	4	0.0124	0.00310		
Total	10	0.0809	0.00809		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.176).

The difference in the mean values among the different levels of Treatment is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.046). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.219

Power of performed test with alpha = 0.0500: for Treatment : 0.525

Least square means for Replication :

Group	Mean	SEM
1.000	1.387	0.0394
2.000	1.411	0.0394
3.000	1.445	0.0394
4.000	1.378	0.0584
5.000	1.300	0.0394
6.000	1.276	0.0394

Least square means for Treatment :

Group	Mean	SEM
Before	1.316	0.0227
After	1.416	0.0269

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Treatment**

Comparison	Diff of Means	p	q	P	P<0.050
After vs. Before	0.100	2	4.030	0.047	Yes

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 112X-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 9:39:21 AM

Data source: Data 24 in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.288)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0468	0.00936	0.554	0.735
Treatment	1	0.000980	0.000980	0.0580	0.822
Residual	4	0.0676	0.0169		
Total	10	0.115	0.0115		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.735).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.822).

Power of performed test with alpha = 0.0500: for Replication : 0.0520

Power of performed test with alpha = 0.0500: for Treatment : 0.0503

Least square means for Replication :

Group	Mean	SEM
1.000	1.465	0.0919
2.000	1.401	0.0919
3.000	1.397	0.136
4.000	1.266	0.0919
5.000	1.339	0.0919
6.000	1.332	0.0919

Least square means for Treatment :

Group	Mean	SEM
Before	1.357	0.0531
After	1.377	0.0628

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 112X-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 9:39:30 AM

Data source: Data 24 in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.346)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0320	0.00640	1.457	0.369
Treatment	1	0.0325	0.0325	7.392	0.053
Residual	4	0.0176	0.00439		
Total	10	0.0862	0.00862		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.369).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.053).

Power of performed test with alpha = 0.0500: for Replication : 0.0916

Power of performed test with alpha = 0.0500: for Treatment : 0.484

Least square means for Replication :

Group	Mean	SEM
1.000	1.441	0.0469
2.000	1.384	0.0469
3.000	1.346	0.0695
4.000	1.267	0.0469
5.000	1.349	0.0469
6.000	1.352	0.0469

Least square means for Treatment :

Group	Mean	SEM
Before	1.300	0.0270
After	1.413	0.0320

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 112X-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 9:39:42 AM

Data source: Data 24 in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.179)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0157	0.00314	3.793	0.110
Treatment	1	0.0728	0.0728	87.901	<0.001
Residual	4	0.00331	0.000829		
Total	10	0.0916	0.00916		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.110).

The difference in the mean values among the different levels of Treatment is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = <0.001). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.332

Power of performed test with alpha = 0.0500: for Treatment : 1.000

Least square means for Replication :

Group	Mean	SEM
1.000	1.376	0.0204
2.000	1.321	0.0204
3.000	1.380	0.0302
4.000	1.279	0.0204
5.000	1.322	0.0204
6.000	1.377	0.0204

Least square means for Treatment :

Group	Mean	SEM
Before	1.257	0.0118
After	1.428	0.0139

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Treatment**

Comparison	Diff of Means	p	q	P	P<0.050
After vs. Before	0.171	2	13.259	<0.001	Yes

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 122-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 9:42:44 AM

Data source: SHB 122-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.538)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0898	0.0180	18.090	0.003
Treatment	1	0.000104	0.000104	0.104	0.760
Residual	5	0.00497	0.000993		
Total	11	0.0949	0.00863		

The difference in the mean values among the different levels of Replication is greater than would be expected by chance after allowing for effects of differences in Treatment. There is a statistically significant difference (P = 0.003). To isolate which group(s) differ from the others use a multiple comparison procedure.

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.760).

Power of performed test with alpha = 0.0500: for Replication : 0.992

Power of performed test with alpha = 0.0500: for Treatment : 0.0500

Least square means for Replication :

Group Mean

1.000 1.406

2.000 1.406

3.000 1.266

4.000 1.480

5.000 1.227

6.000 1.356

Std Err of LS Mean = 0.0223

Least square means for Treatment :

Group Mean

Before 1.360

After 1.354

Std Err of LS Mean = 0.0129

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Replication**

Comparison	Diff of Means	p	q	P	P<0.050
4.000 vs. 5.000	0.252	6	11.318	0.004	Yes

4.000 vs. 3.000	0.214	6	9.584	0.007	Yes
4.000 vs. 6.000	0.123	6	5.537	0.069	No
4.000 vs. 2.000	0.0739	6	3.316	0.321	Do Not Test
4.000 vs. 1.000	0.0732	6	3.286	0.328	Do Not Test
1.000 vs. 5.000	0.179	6	8.032	0.016	Yes
1.000 vs. 3.000	0.140	6	6.298	0.042	Yes
1.000 vs. 6.000	0.0502	6	2.251	0.635	Do Not Test
1.000 vs. 2.000	0.000678	6	0.0304	1.000	Do Not Test
2.000 vs. 5.000	0.178	6	8.002	0.016	Yes
2.000 vs. 3.000	0.140	6	6.268	0.043	Yes
2.000 vs. 6.000	0.0495	6	2.221	0.645	Do Not Test
6.000 vs. 5.000	0.129	6	5.781	0.059	No
6.000 vs. 3.000	0.0902	6	4.047	0.192	Do Not Test
3.000 vs. 5.000	0.0386	6	1.734	0.810	Do Not Test

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 122-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 9:43:29 AM

Data source: SHB 122-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.429)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.122	0.0244	9.670	0.013
Treatment	1	0.00556	0.00556	2.203	0.198
Residual	5	0.0126	0.00252		
Total	11	0.140	0.0127		

The difference in the mean values among the different levels of Replication is greater than would be expected by chance after allowing for effects of differences in Treatment. There is a statistically significant difference (P = 0.013). To isolate which group(s) differ from the others use a multiple comparison procedure.

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.198).

Power of performed test with alpha = 0.0500: for Replication : 0.874

Power of performed test with alpha = 0.0500: for Treatment : 0.142

Least square means for Replication :

Group Mean

1.000 1.462

2.000 1.372

3.000 1.284

4.000 1.458

5.000 1.192

6.000 1.262

Std Err of LS Mean = 0.0355

Least square means for Treatment :

Group Mean

Before 1.317

After 1.360

Std Err of LS Mean = 0.0205

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Replication**

Comparison	Diff of Means	p	q	P	P<0.050
1.000 vs. 5.000	0.270	6	7.598	0.020	Yes

1.000 vs. 6.000	0.200	6	5.640	0.064	No
1.000 vs. 3.000	0.179	6	5.034	0.096	Do Not Test
1.000 vs. 2.000	0.0903	6	2.541	0.537	Do Not Test
1.000 vs. 4.000	0.00414	6	0.117	1.000	Do Not Test
4.000 vs. 5.000	0.266	6	7.482	0.021	Yes
4.000 vs. 6.000	0.196	6	5.524	0.069	Do Not Test
4.000 vs. 3.000	0.175	6	4.918	0.104	Do Not Test
4.000 vs. 2.000	0.0861	6	2.424	0.576	Do Not Test
2.000 vs. 5.000	0.180	6	5.058	0.095	No
2.000 vs. 6.000	0.110	6	3.100	0.373	Do Not Test
2.000 vs. 3.000	0.0886	6	2.494	0.552	Do Not Test
3.000 vs. 5.000	0.0911	6	2.564	0.529	Do Not Test
3.000 vs. 6.000	0.0215	6	0.606	0.997	Do Not Test
6.000 vs. 5.000	0.0696	6	1.958	0.737	Do Not Test

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 122-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 9:43:50 AM

Data source: SHB 122-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.587)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0651	0.0130	5.473	0.043
Treatment	1	0.0316	0.0316	13.270	0.015
Residual	5	0.0119	0.00238		
Total	11	0.109	0.00987		

The difference in the mean values among the different levels of Replication is greater than would be expected by chance after allowing for effects of differences in Treatment. There is a statistically significant difference (P = 0.043). To isolate which group(s) differ from the others use a multiple comparison procedure.

The difference in the mean values among the different levels of Treatment is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.015). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.591

Power of performed test with alpha = 0.0500: for Treatment : 0.804

Least square means for Replication :

Group Mean

1.000 1.378

2.000 1.306

3.000 1.293

4.000 1.423

5.000 1.219

6.000 1.228

Std Err of LS Mean = 0.0345

Least square means for Treatment :

Group Mean

Before 1.256

After 1.359

Std Err of LS Mean = 0.0199

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Replication**

Comparison	Diff of Means	p	q	P	P<0.050
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4.000 vs. 5.000	0.203	6	5.899	0.055	No
4.000 vs. 6.000	0.195	6	5.649	0.064	Do Not Test
4.000 vs. 3.000	0.129	6	3.749	0.237	Do Not Test
4.000 vs. 2.000	0.116	6	3.374	0.309	Do Not Test
4.000 vs. 1.000	0.0448	6	1.300	0.926	Do Not Test
1.000 vs. 5.000	0.159	6	4.599	0.130	Do Not Test
1.000 vs. 6.000	0.150	6	4.349	0.155	Do Not Test
1.000 vs. 3.000	0.0845	6	2.449	0.567	Do Not Test
1.000 vs. 2.000	0.0716	6	2.075	0.696	Do Not Test
2.000 vs. 5.000	0.0871	6	2.524	0.542	Do Not Test
2.000 vs. 6.000	0.0785	6	2.275	0.627	Do Not Test
2.000 vs. 3.000	0.0129	6	0.375	1.000	Do Not Test
3.000 vs. 5.000	0.0741	6	2.150	0.670	Do Not Test
3.000 vs. 6.000	0.0655	6	1.900	0.756	Do Not Test
6.000 vs. 5.000	0.00862	6	0.250	1.000	Do Not Test

Comparisons for factor: **Treatment**

Comparison	Diff of Means	p	q	P	P<0.050
After vs. Before	0.103	2	5.152	0.015	Yes

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 123-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:04:48 AM

Data source: Data 26 in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.432)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0304	0.00608	2.182	0.206
Treatment	1	0.000147	0.000147	0.0529	0.827
Residual	5	0.0139	0.00279		
Total	11	0.0445	0.00404		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.206).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.827).

Power of performed test with alpha = 0.0500: for Replication : 0.186

Power of performed test with alpha = 0.0500: for Treatment : 0.0500

Least square means for Replication :

Group	Mean
1.000	1.345
2.000	1.214
3.000	1.358
4.000	1.328
5.000	1.299
6.000	1.358

Std Err of LS Mean = 0.0373

Least square means for Treatment :

Group	Mean
Before	1.320
After	1.313

Std Err of LS Mean = 0.0215

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 123-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:04:56 AM

Data source: Data 26 in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.485)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0415	0.00831	3.504	0.098
Treatment	1	0.00308	0.00308	1.297	0.306
Residual	5	0.0119	0.00237		
Total	11	0.0565	0.00513		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.098).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.306).

Power of performed test with alpha = 0.0500: for Replication : 0.359

Power of performed test with alpha = 0.0500: for Treatment : 0.0720

Least square means for Replication :

Group Mean

1.000 1.348
2.000 1.206
3.000 1.398
4.000 1.287
5.000 1.295
6.000 1.312

Std Err of LS Mean = 0.0344

Least square means for Treatment :

Group Mean

Before 1.292
After 1.324

Std Err of LS Mean = 0.0199

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 123-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:05:06 AM

Data source: Data 26 in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.073)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0234	0.00468	2.014	0.230
Treatment	1	0.0121	0.0121	5.213	0.071
Residual	5	0.0116	0.00232		
Total	11	0.0471	0.00428		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.230).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.071).

Power of performed test with alpha = 0.0500: for Replication : 0.165

Power of performed test with alpha = 0.0500: for Treatment : 0.379

Least square means for Replication :

Group	Mean
1.000	1.378
2.000	1.259
3.000	1.365
4.000	1.299
5.000	1.366
6.000	1.299

Std Err of LS Mean = 0.0341

Least square means for Treatment :

Group	Mean
Before	1.296
After	1.359

Std Err of LS Mean = 0.0197

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 124-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:08:21 AM

Data source: SHB 124-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.537)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0160	0.00320	1.180	0.430
Treatment	1	0.000188	0.000188	0.0692	0.803
Residual	5	0.0136	0.00271		
Total	11	0.0297	0.00270		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.430).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.803).

Power of performed test with alpha = 0.0500: for Replication : 0.0688

Power of performed test with alpha = 0.0500: for Treatment : 0.0500

Least square means for Replication :

Group	Mean
1.000	1.346
2.000	1.385
3.000	1.336
4.000	1.398
5.000	1.431
6.000	1.330

Std Err of LS Mean = 0.0368

Least square means for Treatment :

Group	Mean
Before	1.367
After	1.375

Std Err of LS Mean = 0.0213

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 124-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:08:29 AM

Data source: SHB 124-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.560)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.00813	0.00163	0.242	0.927
Treatment	1	0.00782	0.00782	1.167	0.329
Residual	5	0.0335	0.00670		
Total	11	0.0495	0.00450		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.927).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.329).

Power of performed test with alpha = 0.0500: for Replication : 0.0512

Power of performed test with alpha = 0.0500: for Treatment : 0.0621

Least square means for Replication :

Group	Mean
1.000	1.335
2.000	1.357
3.000	1.322
4.000	1.359
5.000	1.372
6.000	1.295

Std Err of LS Mean = 0.0579

Least square means for Treatment :

Group	Mean
Before	1.314
After	1.366

Std Err of LS Mean = 0.0334

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 124-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:09:38 AM

Data source: SHB 124-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.290)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.00835	0.00167	0.258	0.918
Treatment	1	0.00634	0.00634	0.981	0.367
Residual	5	0.0323	0.00647		
Total	11	0.0470	0.00427		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.918).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.367).

Power of performed test with alpha = 0.0500: for Replication : 0.0512

Power of performed test with alpha = 0.0500: for Treatment : 0.0500

Least square means for Replication :

Group	Mean
1.000	1.316
2.000	1.357
3.000	1.358
4.000	1.372
5.000	1.366
6.000	1.302

Std Err of LS Mean = 0.0569

Least square means for Treatment :

Group	Mean
Before	1.322
After	1.368

Std Err of LS Mean = 0.0328

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 124X-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:12:59 AM

Data source: SHB 124X-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.441)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0319	0.00637	0.408	0.824
Treatment	1	0.000980	0.000980	0.0627	0.815
Residual	4	0.0625	0.0156		
Total	10	0.0948	0.00948		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.824).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.815).

Power of performed test with alpha = 0.0500: for Replication : 0.0520

Power of performed test with alpha = 0.0500: for Treatment : 0.0503

Least square means for Replication :

Group	Mean	SEM
1.000	1.411	0.0884
2.000	1.378	0.131
3.000	1.372	0.0884
4.000	1.313	0.0884
5.000	1.321	0.0884
6.000	1.250	0.0884

Least square means for Treatment :

Group	Mean	SEM
Before	1.331	0.0510
After	1.351	0.0604

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 124X-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:14:31 AM

Data source: SHB 124X-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.441)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0319	0.00637	0.408	0.824
Treatment	1	0.000980	0.000980	0.0627	0.815
Residual	4	0.0625	0.0156		
Total	10	0.0948	0.00948		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.824).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.815).

Power of performed test with alpha = 0.0500: for Replication : 0.0520

Power of performed test with alpha = 0.0500: for Treatment : 0.0503

Least square means for Replication :

Group	Mean	SEM
1.000	1.411	0.0884
2.000	1.378	0.131
3.000	1.372	0.0884
4.000	1.313	0.0884
5.000	1.321	0.0884
6.000	1.250	0.0884

Least square means for Treatment :

Group	Mean	SEM
Before	1.331	0.0510
After	1.351	0.0604

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 124X-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:21:21 AM

Data source: SHB 124X-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.576)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.00871	0.00174	0.231	0.930
Treatment	1	0.00172	0.00172	0.228	0.658
Residual	4	0.0302	0.00754		
Total	10	0.0411	0.00411		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.930).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.658).

Power of performed test with alpha = 0.0500: for Replication : 0.0520

Power of performed test with alpha = 0.0500: for Treatment : 0.0503

Least square means for Replication :

Group	Mean	SEM
1.000	1.329	0.0614
2.000	1.334	0.0911
3.000	1.367	0.0614
4.000	1.281	0.0614
5.000	1.320	0.0614
6.000	1.299	0.0614

Least square means for Treatment :

Group	Mean	SEM
Before	1.335	0.0354
After	1.309	0.0419

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 125-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:24:59 AM

Data source: SHB 125-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.105)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0503	0.0101	1.581	0.339
Treatment	1	0.000124	0.000124	0.0196	0.896
Residual	4	0.0254	0.00636		
Total	10	0.0759	0.00759		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.339).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.896).

Power of performed test with alpha = 0.0500: for Replication : 0.103

Power of performed test with alpha = 0.0500: for Treatment : 0.0503

Least square means for Replication :

Group	Mean	SEM
1.000	1.355	0.0836
2.000	1.209	0.0564
3.000	1.360	0.0564
4.000	1.351	0.0564
5.000	1.349	0.0564
6.000	1.425	0.0564

Least square means for Treatment :

Group	Mean	SEM
Before	1.345	0.0325
After	1.338	0.0385

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 125-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:25:09 AM

Data source: SHB 125-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.401)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0284	0.00568	2.328	0.217
Treatment	1	0.00949	0.00949	3.890	0.120
Residual	4	0.00976	0.00244		
Total	10	0.0498	0.00498		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.217).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.120).

Power of performed test with alpha = 0.0500: for Replication : 0.177

Power of performed test with alpha = 0.0500: for Treatment : 0.254

Least square means for Replication :

Group	Mean	SEM
1.000	1.299	0.0518
2.000	1.221	0.0349
3.000	1.339	0.0349
4.000	1.327	0.0349
5.000	1.375	0.0349
6.000	1.348	0.0349

Least square means for Treatment :

Group	Mean	SEM
Before	1.287	0.0202
After	1.349	0.0239

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 125-20

Two Way Analysis of Variance

Tuesday, September 25, 2007, 10:25:18 AM

Data source: SHB 125-20 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.368)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0195	0.00390	2.311	0.219
Treatment	1	0.0235	0.0235	13.924	0.020
Residual	4	0.00674	0.00169		
Total	10	0.0563	0.00563		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.219).

The difference in the mean values among the different levels of Treatment is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.020). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.176

Power of performed test with alpha = 0.0500: for Treatment : 0.771

Least square means for Replication :

Group	Mean	SEM
1.000	1.252	0.0431
2.000	1.255	0.0290
3.000	1.329	0.0290
4.000	1.304	0.0290
5.000	1.361	0.0290
6.000	1.253	0.0290

Least square means for Treatment :

Group	Mean	SEM
Before	1.244	0.0168
After	1.341	0.0198

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Treatment**

Comparison	Diff of Means	p	q	P	P<0.050
After vs. Before	0.0969	2	5.277	0.020	Yes

Paired t-test Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal in Section 20

Paired t-test:

Thursday, September 27, 2007, 2:24:51 PM

Data source: Data 40 in drill pad density stats

Normality Test: Passed (P = 0.302)

Treatment Name	N	Missing	Mean	Std Dev	SEM
0-2 before	17	0	1.359	0.0328	0.00795
0-2 after	17	0	1.342	0.0411	0.00998
Difference	17	0	0.0162	0.0501	0.0122

t = 1.332 with 16 degrees of freedom. (P = 0.202)

95 percent confidence interval for difference of means: -0.00957 to 0.0419

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.202)

Power of performed test with alpha = 0.050: 0.124

The power of the performed test (0.124) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Paired t-test Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal in Section 20

Paired t-test:

Thursday, September 27, 2007, 2:25:08 PM

Data source: Data 40 in drill pad density stats

Normality Test: Passed (P = 0.366)

Treatment Name	N	Missing	Mean	Std Dev	SEM
0-6 before	17	0	1.317	0.0273	0.00662
0-6 after	17	0	1.356	0.0474	0.0115
Difference	17	0	-0.0385	0.0417	0.0101

t = -3.810 with 16 degrees of freedom. (P = 0.002)

95 percent confidence interval for difference of means: -0.0600 to -0.0171

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant change (P = 0.002)

Power of performed test with alpha = 0.050: 0.945

Paired t-test Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal in Section 20

Paired t-test:

Thursday, September 27, 2007, 2:26:15 PM

Data source: Data 40 in drill pad density stats

Normality Test: Passed (P = 0.511)

Treatment Name	N	Missing	Mean	Std Dev	SEM
0-12 before	17	0	1.282	0.0294	0.00714
0-12 after	17	0	1.370	0.0482	0.0117
Difference	17	0	-0.0888	0.0497	0.0120

t = -7.372 with 16 degrees of freedom. (P = <0.001)

95 percent confidence interval for difference of means: -0.114 to -0.0633

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant change (P = <0.001)

Power of performed test with alpha = 0.050: 1.000

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 51-28

Two Way Analysis of Variance

Monday, September 24, 2007, 2:53:37 PM

Data source: SHB 51-28 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.309)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.108	0.0216	4.082	0.099
Treatment	1	0.00465	0.00465	0.878	0.402
Residual	4	0.0212	0.00530		
Total	10	0.132	0.0132		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.099).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.402).

Power of performed test with alpha = 0.0500: for Replication : 0.362

Power of performed test with alpha = 0.0500: for Treatment : 0.0503

Least square means for Replication :

Group	Mean	SEM
1.000	1.496	0.0515
2.000	1.263	0.0515
3.000	1.329	0.0515
4.000	1.230	0.0515
5.000	1.297	0.0763
6.000	1.446	0.0515

Least square means for Treatment :

Group	Mean	SEM
Before	1.365	0.0297
After	1.322	0.0352

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 51-28

Two Way Analysis of Variance

Monday, September 24, 2007, 2:53:50 PM

Data source: SHB 51-28 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.396)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.130	0.0260	5.393	0.064
Treatment	1	0.00320	0.00320	0.664	0.461
Residual	4	0.0193	0.00482		
Total	10	0.157	0.0157		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.064).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.461).

Power of performed test with alpha = 0.0500: for Replication : 0.489

Power of performed test with alpha = 0.0500: for Treatment : 0.0503

Least square means for Replication :

Group	Mean	SEM
1.000	1.599	0.0491
2.000	1.341	0.0491
3.000	1.373	0.0491
4.000	1.271	0.0491
5.000	1.306	0.0728
6.000	1.426	0.0491

Least square means for Treatment :

Group	Mean	SEM
Before	1.368	0.0283
After	1.404	0.0335

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 51-28

Two Way Analysis of Variance

Monday, September 24, 2007, 2:54:08 PM

Data source: SHB 51-28 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.080)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0921	0.0184	24.321	0.004
Treatment	1	0.00642	0.00642	8.486	0.044
Residual	4	0.00303	0.000757		
Total	10	0.106	0.0106		

The difference in the mean values among the different levels of Replication is greater than would be expected by chance after allowing for effects of differences in Treatment. There is a statistically significant difference (P = 0.004). To isolate which group(s) differ from the others use a multiple comparison procedure.

The difference in the mean values among the different levels of Treatment is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.044). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.993

Power of performed test with alpha = 0.0500: for Treatment : 0.545

Least square means for Replication :

Group	Mean	SEM
1.000	1.642	0.0195
2.000	1.417	0.0195
3.000	1.405	0.0195
4.000	1.387	0.0195
5.000	1.391	0.0289
6.000	1.487	0.0195

Least square means for Treatment :

Group	Mean	SEM
Before	1.429	0.0112
After	1.480	0.0133

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Replication**

Comparison	Diff of Means	p	q	P	P<0.050
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1.000 vs. 4.000	0.254	6	13.072	0.005	Yes
1.000 vs. 5.000	0.251	6	10.180	0.012	Yes
1.000 vs. 3.000	0.236	6	12.141	0.006	Yes
1.000 vs. 2.000	0.225	6	11.565	0.007	Yes
1.000 vs. 6.000	0.154	6	7.932	0.028	Yes
6.000 vs. 4.000	0.100	6	5.140	0.115	No
6.000 vs. 5.000	0.0962	6	3.909	0.240	Do Not Test
6.000 vs. 3.000	0.0819	6	4.210	0.199	Do Not Test
6.000 vs. 2.000	0.0707	6	3.634	0.284	Do Not Test
2.000 vs. 4.000	0.0293	6	1.507	0.874	Do Not Test
2.000 vs. 5.000	0.0255	6	1.037	0.967	Do Not Test
2.000 vs. 3.000	0.0112	6	0.576	0.997	Do Not Test
3.000 vs. 4.000	0.0181	6	0.931	0.978	Do Not Test
3.000 vs. 5.000	0.0143	6	0.582	0.997	Do Not Test
5.000 vs. 4.000	0.00379	6	0.154	1.000	Do Not Test

Comparisons for factor: **Treatment**

Comparison	Diff of Means	p	q	P	P<0.050
After vs. Before	0.0507	2	4.120	0.044	Yes

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 52-28

Two Way Analysis of Variance

Monday, September 24, 2007, 3:01:37 PM

Data source: SHB 52-28 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.315)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.00239	0.000478	0.0633	0.994
Treatment	1	0.0146	0.0146	1.934	0.259
Residual	3	0.0226	0.00755		
Total	9	0.0418	0.00465		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.994).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.259).

Power of performed test with alpha = 0.0500: for Replication : 0.0540

Power of performed test with alpha = 0.0500: for Treatment : 0.107

Least square means for Replication :

Group	Mean	SEM
1.000	1.427	0.0614
2.000	1.450	0.0921
3.000	1.446	0.0614
4.000	1.422	0.0614
5.000	1.396	0.0921
6.000	1.420	0.0614

Least square means for Treatment :

Group	Mean	SEM
Before	1.470	0.0355
After	1.384	0.0502

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 52-28

Two Way Analysis of Variance

Monday, September 24, 2007, 3:01:45 PM

Data source: SHB 52-28 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.185)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.00565	0.00113	0.215	0.935
Treatment	1	0.00136	0.00136	0.259	0.646
Residual	3	0.0158	0.00526		
Total	9	0.0225	0.00250		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.935).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.646).

Power of performed test with alpha = 0.0500: for Replication : 0.0540

Power of performed test with alpha = 0.0500: for Treatment : 0.0521

Least square means for Replication :

Group	Mean	SEM
1.000	1.558	0.0513
2.000	1.546	0.0769
3.000	1.571	0.0513
4.000	1.563	0.0513
5.000	1.525	0.0769
6.000	1.506	0.0513

Least square means for Treatment :

Group	Mean	SEM
Before	1.558	0.0296
After	1.532	0.0419

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 52-28

Two Way Analysis of Variance

Monday, September 24, 2007, 3:02:01 PM

Data source: SHB 52-28 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.451)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0283	0.00567	2.217	0.272
Treatment	1	0.0000836	0.0000836	0.0327	0.868
Residual	3	0.00767	0.00256		
Total	9	0.0364	0.00404		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.272).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.868).

Power of performed test with alpha = 0.0500: for Replication : 0.139

Power of performed test with alpha = 0.0500: for Treatment : 0.0521

Least square means for Replication :

Group	Mean	SEM
1.000	1.528	0.0357
2.000	1.593	0.0536
3.000	1.659	0.0357
4.000	1.577	0.0357
5.000	1.512	0.0536
6.000	1.519	0.0357

Least square means for Treatment :

Group	Mean	SEM
Before	1.561	0.0206
After	1.568	0.0292

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 61-28

Two Way Analysis of Variance

Monday, September 24, 2007, 3:05:10 PM

Data source: SHB 61-28 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.644)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0134	0.00267	0.664	0.668
Treatment	1	0.0161	0.0161	3.998	0.102
Residual	5	0.0201	0.00402		
Total	11	0.0496	0.00451		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.668).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.102).

Power of performed test with alpha = 0.0500: for Replication : 0.0512

Power of performed test with alpha = 0.0500: for Treatment : 0.285

Least square means for Replication :

Group	Mean
1.000	1.442
2.000	1.520
3.000	1.446
4.000	1.525
5.000	1.459
6.000	1.471

Std Err of LS Mean = 0.0449

Least square means for Treatment :

Group	Mean
Before	1.514
After	1.440

Std Err of LS Mean = 0.0259

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 61-28

Two Way Analysis of Variance

Monday, September 24, 2007, 3:05:19 PM

Data source: SHB 61-28 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.118)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.00833	0.00167	2.568	0.162
Treatment	1	0.00329	0.00329	5.072	0.074
Residual	5	0.00324	0.000649		
Total	11	0.0149	0.00135		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.162).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.074).

Power of performed test with alpha = 0.0500: for Replication : 0.236

Power of performed test with alpha = 0.0500: for Treatment : 0.368

Least square means for Replication :

Group	Mean
1.000	1.571
2.000	1.601
3.000	1.565
4.000	1.577
5.000	1.573
6.000	1.641

Std Err of LS Mean = 0.0180

Least square means for Treatment :

Group	Mean
Before	1.605
After	1.571

Std Err of LS Mean = 0.0104

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 61-28

Two Way Analysis of Variance

Monday, September 24, 2007, 3:05:27 PM

Data source: SHB 61-28 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.326)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.00609	0.00122	1.332	0.380
Treatment	1	0.000892	0.000892	0.976	0.369
Residual	5	0.00457	0.000914		
Total	11	0.0115	0.00105		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.380).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.369).

Power of performed test with alpha = 0.0500: for Replication : 0.0847

Power of performed test with alpha = 0.0500: for Treatment : 0.0500

Least square means for Replication :

Group	Mean
1.000	1.567
2.000	1.598
3.000	1.569
4.000	1.595
5.000	1.583
6.000	1.634

Std Err of LS Mean = 0.0214

Least square means for Treatment :

Group	Mean
Before	1.582
After	1.600

Std Err of LS Mean = 0.0123

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 68-28

Two Way Analysis of Variance

Monday, September 24, 2007, 3:14:11 PM

Data source: SHB 68-28 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.513)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0893	0.0179	3.167	0.143
Treatment	1	0.00623	0.00623	1.104	0.353
Residual	4	0.0226	0.00564		
Total	10	0.117	0.0117		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.143).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.353).

Power of performed test with alpha = 0.0500: for Replication : 0.266

Power of performed test with alpha = 0.0500: for Treatment : 0.0575

Least square means for Replication :

Group	Mean	SEM
1.000	1.392	0.0531
2.000	1.518	0.0531
3.000	1.371	0.0788
4.000	1.337	0.0531
5.000	1.541	0.0531
6.000	1.311	0.0531

Least square means for Treatment :

Group	Mean	SEM
Before	1.436	0.0307
After	1.386	0.0363

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 68-28

Two Way Analysis of Variance

Monday, September 24, 2007, 3:14:23 PM

Data source: SHB 68-28 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.310)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.136	0.0272	11.540	0.017
Treatment	1	0.00471	0.00471	1.996	0.231
Residual	4	0.00943	0.00236		
Total	10	0.152	0.0152		

The difference in the mean values among the different levels of Replication is greater than would be expected by chance after allowing for effects of differences in Treatment. There is a statistically significant difference (P = 0.017). To isolate which group(s) differ from the others use a multiple comparison procedure.

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.231).

Power of performed test with alpha = 0.0500: for Replication : 0.855

Power of performed test with alpha = 0.0500: for Treatment : 0.120

Least square means for Replication :

Group	Mean	SEM
1.000	1.537	0.0343
2.000	1.606	0.0343
3.000	1.470	0.0509
4.000	1.353	0.0343
5.000	1.658	0.0343
6.000	1.406	0.0343

Least square means for Treatment :

Group	Mean	SEM
Before	1.483	0.0198
After	1.527	0.0235

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Replication**

Comparison	Diff of Means	p	q	P	P<0.050
5.000 vs. 4.000	0.305	6	8.875	0.019	Yes

5.000 vs. 6.000	0.252	6	7.332	0.037	Yes
5.000 vs. 3.000	0.188	6	4.324	0.186	No
5.000 vs. 1.000	0.121	6	3.521	0.305	Do Not Test
5.000 vs. 2.000	0.0513	6	1.495	0.877	Do Not Test
2.000 vs. 4.000	0.253	6	7.380	0.036	Yes
2.000 vs. 6.000	0.200	6	5.836	0.078	No
2.000 vs. 3.000	0.136	6	3.142	0.385	Do Not Test
2.000 vs. 1.000	0.0696	6	2.026	0.715	Do Not Test
1.000 vs. 4.000	0.184	6	5.354	0.102	No
1.000 vs. 6.000	0.131	6	3.811	0.255	Do Not Test
1.000 vs. 3.000	0.0669	6	1.541	0.865	Do Not Test
3.000 vs. 4.000	0.117	6	2.692	0.503	Do Not Test
3.000 vs. 6.000	0.0639	6	1.472	0.883	Do Not Test
6.000 vs. 4.000	0.0530	6	1.544	0.864	Do Not Test

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 68-28

Two Way Analysis of Variance

Monday, September 24, 2007, 3:15:28 PM

Data source: SHB 68-28 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.323)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0364	0.00728	1.056	0.493
Treatment	1	0.000602	0.000602	0.0873	0.782
Residual	4	0.0276	0.00690		
Total	10	0.0646	0.00646		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.493).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.782).

Power of performed test with alpha = 0.0500: for Replication : 0.0566

Power of performed test with alpha = 0.0500: for Treatment : 0.0503

Least square means for Replication :

Group	Mean	SEM
1.000	1.467	0.0587
2.000	1.593	0.0587
3.000	1.508	0.0871
4.000	1.445	0.0587
5.000	1.554	0.0587
6.000	1.451	0.0587

Least square means for Treatment :

Group	Mean	SEM
Before	1.495	0.0339
After	1.511	0.0401

Paired t-test Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal in Section 28

Paired t-test:

Wednesday, September 26, 2007, 12:26:00 PM

Data source: Data 41 in drill pad density stats

Normality Test: Passed (P = 0.425)

Treatment Name	N	Missing	Mean	Std Dev	SEM
0-2 before	4	0	1.446	0.0627	0.0314
0-2 after	4	0	1.388	0.0448	0.0224
Difference	4	0	0.0581	0.0241	0.0120

t = 4.823 with 3 degrees of freedom. (P = 0.017)

95 percent confidence interval for difference of means: 0.0198 to 0.0964

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant change (P = 0.017)

Power of performed test with alpha = 0.050: 0.871

Paired t-test Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal in Section 28

Paired t-test:

Wednesday, September 26, 2007, 12:26:35 PM

Data source: Data 41 in drill pad density stats

Normality Test: Passed (P = 0.222)

Treatment Name	N	Missing	Mean	Std Dev	SEM
0-6 before	4	0	1.503	0.103	0.0516
0-6 after	4	0	1.515	0.0660	0.0330
Difference	4	0	-0.0119	0.0455	0.0228

t = -0.524 with 3 degrees of freedom. (P = 0.636)

95 percent confidence interval for difference of means: -0.0843 to 0.0605

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.636)

Power of performed test with alpha = 0.050: 0.052

The power of the performed test (0.052) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Paired t-test Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal in Section 28

Paired t-test:

Wednesday, September 26, 2007, 12:27:07 PM

Data source: Data 41 in drill pad density stats

Normality Test: Failed ($P < 0.050$)

Test execution ended by user request, Signed Rank Test begun

Wilcoxon Signed Rank Test

Wednesday, September 26, 2007, 12:27:07 PM

Data source: Data 41 in drill pad density stats

Group	N	Missing	Median	25%	75%
0-12 before	4	0	1.528	1.462	1.572
0-12 after	4	0	1.542	1.501	1.587

W= 10.000 T+ = 10.000 T- = 0.000

Z-Statistic (based on positive ranks) = 1.826

P(est.)= 0.100 P(exact)= 0.125

The change that occurred with the treatment is not great enough to exclude the possibility that it is due to chance ($P = 0.125$).

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 19-34

Two Way Analysis of Variance

Monday, September 24, 2007, 3:21:18 PM

Data source: SHB 19-34 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.363)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0211	0.00422	6.148	0.051
Treatment	1	0.00223	0.00223	3.244	0.146
Residual	4	0.00274	0.000686		
Total	10	0.0260	0.00260		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.051).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.146).

Power of performed test with alpha = 0.0500: for Replication : 0.555

Power of performed test with alpha = 0.0500: for Treatment : 0.208

Least square means for Replication :

Group	Mean	SEM
1.000	1.249	0.0275
2.000	1.255	0.0185
3.000	1.185	0.0185
4.000	1.304	0.0185
5.000	1.235	0.0185
6.000	1.308	0.0185

Least square means for Treatment :

Group	Mean	SEM
Before	1.271	0.0107
After	1.241	0.0127

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 19-34

Two Way Analysis of Variance

Monday, September 24, 2007, 3:21:29 PM

Data source: SHB 19-34 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.254)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0132	0.00265	0.437	0.806
Treatment	1	0.0286	0.0286	4.729	0.095
Residual	4	0.0242	0.00605		
Total	10	0.0684	0.00684		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.806).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.095).

Power of performed test with alpha = 0.0500: for Replication : 0.0520

Power of performed test with alpha = 0.0500: for Treatment : 0.313

Least square means for Replication :

Group	Mean	SEM
1.000	1.306	0.0816
2.000	1.257	0.0550
3.000	1.266	0.0550
4.000	1.338	0.0550
5.000	1.316	0.0550
6.000	1.345	0.0550

Least square means for Treatment :

Group	Mean	SEM
Before	1.251	0.0318
After	1.358	0.0376

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 19-34

Two Way Analysis of Variance

Monday, September 24, 2007, 3:21:37 PM

Data source: SHB 19-34 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.192)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0495	0.00989	0.955	0.533
Treatment	1	0.0000428	0.0000428	0.00413	0.952
Residual	4	0.0415	0.0104		
Total	10	0.0909	0.00909		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.533).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.952).

Power of performed test with alpha = 0.0500: for Replication : 0.0520

Power of performed test with alpha = 0.0500: for Treatment : 0.0503

Least square means for Replication :

Group	Mean	SEM
1.000	1.349	0.107
2.000	1.306	0.0720
3.000	1.355	0.0720
4.000	1.387	0.0720
5.000	1.203	0.0720
6.000	1.392	0.0720

Least square means for Treatment :

Group	Mean	SEM
Before	1.330	0.0416
After	1.334	0.0492

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 30-34

Two Way Analysis of Variance

Monday, September 24, 2007, 3:27:41 PM

Data source: SHB 30-34 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.466)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.00557	0.00111	0.810	0.598
Treatment	1	0.0203	0.0203	14.743	0.018
Residual	4	0.00550	0.00137		
Total	10	0.0306	0.00306		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.598).

The difference in the mean values among the different levels of Treatment is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.018). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.0520

Power of performed test with alpha = 0.0500: for Treatment : 0.795

Least square means for Replication :

Group	Mean	SEM
1.000	1.330	0.0262
2.000	1.283	0.0389
3.000	1.290	0.0262
4.000	1.313	0.0262
5.000	1.294	0.0262
6.000	1.347	0.0262

Least square means for Treatment :

Group	Mean	SEM
Before	1.355	0.0151
After	1.265	0.0179

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Treatment**

Comparison	Diff of Means	p	q	P	P<0.050
Before vs. After	0.0900	2	5.430	0.019	Yes

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 30-34

Two Way Analysis of Variance

Monday, September 24, 2007, 3:28:01 PM

Data source: SHB 30-34 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.558)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0290	0.00580	7.667	0.035
Treatment	1	0.0000463	0.0000463	0.0613	0.817
Residual	4	0.00303	0.000757		
Total	10	0.0324	0.00324		

The difference in the mean values among the different levels of Replication is greater than would be expected by chance after allowing for effects of differences in Treatment. There is a statistically significant difference (P = 0.035). To isolate which group(s) differ from the others use a multiple comparison procedure.

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.817).

Power of performed test with alpha = 0.0500: for Replication : 0.669

Power of performed test with alpha = 0.0500: for Treatment : 0.0503

Least square means for Replication :

Group	Mean	SEM
1.000	1.339	0.0194
2.000	1.479	0.0288
3.000	1.317	0.0194
4.000	1.415	0.0194
5.000	1.438	0.0194
6.000	1.385	0.0194

Least square means for Treatment :

Group	Mean	SEM
Before	1.393	0.0112
After	1.398	0.0133

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Replication**

Comparison	Diff of Means	p	q	P	P<0.050
2.000 vs. 3.000	0.162	6	6.583	0.053	No

2.000 vs. 1.000	0.140	6	5.674	0.085	Do Not Test
2.000 vs. 6.000	0.0932	6	3.790	0.258	Do Not Test
2.000 vs. 4.000	0.0634	6	2.578	0.537	Do Not Test
2.000 vs. 5.000	0.0402	6	1.636	0.838	Do Not Test
5.000 vs. 3.000	0.122	6	6.258	0.063	Do Not Test
5.000 vs. 1.000	0.0994	6	5.108	0.117	Do Not Test
5.000 vs. 6.000	0.0530	6	2.725	0.494	Do Not Test
5.000 vs. 4.000	0.0232	6	1.192	0.943	Do Not Test
4.000 vs. 3.000	0.0985	6	5.066	0.120	Do Not Test
4.000 vs. 1.000	0.0762	6	3.916	0.239	Do Not Test
4.000 vs. 6.000	0.0298	6	1.533	0.867	Do Not Test
6.000 vs. 3.000	0.0687	6	3.533	0.303	Do Not Test
6.000 vs. 1.000	0.0464	6	2.384	0.598	Do Not Test
1.000 vs. 3.000	0.0224	6	1.149	0.950	Do Not Test

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 30-34

Two Way Analysis of Variance

Monday, September 24, 2007, 3:29:04 PM

Data source: SHB 30-34 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.153)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0387	0.00773	0.255	0.912
Treatment	1	0.00893	0.00893	0.294	0.625
Residual	3	0.0911	0.0304		
Total	9	0.145	0.0161		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.912).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.625).

Power of performed test with alpha = 0.0500: for Replication : 0.0540

Power of performed test with alpha = 0.0500: for Treatment : 0.0521

Least square means for Replication :

Group	Mean	SEM
1.000	1.291	0.185
2.000	1.501	0.185
3.000	1.346	0.123
4.000	1.402	0.123
5.000	1.297	0.123
6.000	1.398	0.123

Least square means for Treatment :

Group	Mean	SEM
Before	1.406	0.0711
After	1.339	0.101

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 31-34

Two Way Analysis of Variance

Monday, September 24, 2007, 3:31:52 PM

Data source: SHB 31-34 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.359)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.00506	0.00101	0.520	0.755
Treatment	1	0.0237	0.0237	12.186	0.025
Residual	4	0.00778	0.00194		
Total	10	0.0400	0.00400		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.755).

The difference in the mean values among the different levels of Treatment is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.025). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.0520

Power of performed test with alpha = 0.0500: for Treatment : 0.712

Least square means for Replication :

Group	Mean	SEM
1.000	1.261	0.0312
2.000	1.293	0.0463
3.000	1.294	0.0312
4.000	1.256	0.0312
5.000	1.313	0.0312
6.000	1.265	0.0312

Least square means for Treatment :

Group	Mean	SEM
Before	1.329	0.0180
After	1.232	0.0213

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Treatment**

Comparison	Diff of Means	p	q	P	P<0.050
Before vs. After	0.0974	2	4.937	0.025	Yes

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 31-34

Two Way Analysis of Variance

Monday, September 24, 2007, 3:33:03 PM

Data source: SHB 31-34 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.375)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0226	0.00453	1.033	0.502
Treatment	1	0.00291	0.00291	0.664	0.461
Residual	4	0.0175	0.00438		
Total	10	0.0455	0.00455		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.502).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.461).

Power of performed test with alpha = 0.0500: for Replication : 0.0547

Power of performed test with alpha = 0.0500: for Treatment : 0.0503

Least square means for Replication :

Group	Mean	SEM
1.000	1.259	0.0468
2.000	1.375	0.0694
3.000	1.375	0.0468
4.000	1.274	0.0468
5.000	1.314	0.0468
6.000	1.353	0.0468

Least square means for Treatment :

Group	Mean	SEM
Before	1.342	0.0270
After	1.308	0.0320

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 31-34

Two Way Analysis of Variance

Monday, September 24, 2007, 3:33:29 PM

Data source: SHB 31-34 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.460)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0305	0.00611	6.883	0.043
Treatment	1	0.00809	0.00809	9.121	0.039
Residual	4	0.00355	0.000887		
Total	10	0.0438	0.00438		

The difference in the mean values among the different levels of Replication is greater than would be expected by chance after allowing for effects of differences in Treatment. There is a statistically significant difference (P = 0.043). To isolate which group(s) differ from the others use a multiple comparison procedure.

The difference in the mean values among the different levels of Treatment is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.039). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.614

Power of performed test with alpha = 0.0500: for Treatment : 0.578

Least square means for Replication :

Group	Mean	SEM
1.000	1.355	0.0211
2.000	1.380	0.0312
3.000	1.451	0.0211
4.000	1.359	0.0211
5.000	1.342	0.0211
6.000	1.474	0.0211

Least square means for Treatment :

Group	Mean	SEM
Before	1.365	0.0122
After	1.422	0.0144

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Replication**

Comparison	Diff of Means	p	q	P	P<0.050
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6.000 vs. 5.000	0.133	6	6.303	0.061	No
6.000 vs. 1.000	0.119	6	5.648	0.087	Do Not Test
6.000 vs. 4.000	0.116	6	5.484	0.095	Do Not Test
6.000 vs. 2.000	0.0940	6	3.527	0.304	Do Not Test
6.000 vs. 3.000	0.0233	6	1.105	0.957	Do Not Test
3.000 vs. 5.000	0.109	6	5.198	0.111	Do Not Test
3.000 vs. 1.000	0.0957	6	4.543	0.163	Do Not Test
3.000 vs. 4.000	0.0922	6	4.379	0.180	Do Not Test
3.000 vs. 2.000	0.0707	6	2.653	0.515	Do Not Test
2.000 vs. 5.000	0.0388	6	1.456	0.887	Do Not Test
2.000 vs. 1.000	0.0250	6	0.938	0.978	Do Not Test
2.000 vs. 4.000	0.0216	6	0.809	0.988	Do Not Test
4.000 vs. 5.000	0.0172	6	0.819	0.987	Do Not Test
4.000 vs. 1.000	0.00345	6	0.164	1.000	Do Not Test
1.000 vs. 5.000	0.0138	6	0.655	0.995	Do Not Test

Comparisons for factor: **Treatment**

Comparison	Diff of Means	p	q	P	P<0.050
After vs. Before	0.0569	2	4.271	0.039	Yes

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 42-34

Two Way Analysis of Variance

Monday, September 24, 2007, 3:36:46 PM

Data source: SHB 42-34 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Failed (P < 0.050)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0137	0.00274	6.861	0.072
Treatment	1	0.0343	0.0343	85.893	0.003
Residual	3	0.00120	0.000399		
Total	9	0.0626	0.00696		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.072).

The difference in the mean values among the different levels of Treatment is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.003). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.467

Power of performed test with alpha = 0.0500: for Treatment : 1.000

Least square means for Replication :

Group	Mean	SEM
1.000	1.320	0.0141
2.000	1.238	0.0141
3.000	1.269	0.0212
4.000	1.286	0.0141
5.000	1.231	0.0141
6.000	1.330	0.0212

Least square means for Treatment :

Group	Mean	SEM
Before	1.345	0.00815
After	1.214	0.0115

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Treatment**

Comparison	Diff of Means	p	q	P	P<0.050
Before vs. After	0.131	2	13.107	0.003	Yes

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 42-34

Two Way Analysis of Variance

Monday, September 24, 2007, 3:37:08 PM

Data source: SHB 42-34 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.198)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0245	0.00490	10.416	0.041
Treatment	1	0.00477	0.00477	10.149	0.050
Residual	3	0.00141	0.000470		
Total	9	0.0315	0.00350		

The difference in the mean values among the different levels of Replication is greater than would be expected by chance after allowing for effects of differences in Treatment. There is a statistically significant difference (P = 0.041). To isolate which group(s) differ from the others use a multiple comparison procedure.

The difference in the mean values among the different levels of Treatment is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.050). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.655

Power of performed test with alpha = 0.0500: for Treatment : 0.539

Least square means for Replication :

Group	Mean	SEM
1.000	1.338	0.0153
2.000	1.231	0.0153
3.000	1.272	0.0230
4.000	1.352	0.0153
5.000	1.243	0.0153
6.000	1.306	0.0230

Least square means for Treatment :

Group	Mean	SEM
Before	1.315	0.00885
After	1.266	0.0125

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Replication**

Comparison	Diff of Means	p	q	P	P<0.050
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4.000 vs. 2.000	0.122	6	7.937	0.052	No
4.000 vs. 5.000	0.109	6	7.127	0.069	Do Not Test
4.000 vs. 3.000	0.0807	6	4.130	0.251	Do Not Test
4.000 vs. 6.000	0.0460	6	2.351	0.621	Do Not Test
4.000 vs. 1.000	0.0141	6	0.918	0.977	Do Not Test
1.000 vs. 2.000	0.108	6	7.019	0.072	Do Not Test
1.000 vs. 5.000	0.0952	6	6.209	0.098	Do Not Test
1.000 vs. 3.000	0.0667	6	3.410	0.363	Do Not Test
1.000 vs. 6.000	0.0319	6	1.631	0.837	Do Not Test
6.000 vs. 2.000	0.0758	6	3.876	0.286	Do Not Test
6.000 vs. 5.000	0.0633	6	3.240	0.396	Do Not Test
6.000 vs. 3.000	0.0348	6	1.512	0.869	Do Not Test
3.000 vs. 2.000	0.0410	6	2.097	0.698	Do Not Test
3.000 vs. 5.000	0.0286	6	1.461	0.881	Do Not Test
5.000 vs. 2.000	0.0124	6	0.810	0.986	Do Not Test

Comparisons for factor: **Treatment**

Comparison	Diff of Means	p	q	P	P<0.050
Before vs. After	0.0489	2	4.505	0.050	No

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 42-34

Two Way Analysis of Variance

Monday, September 24, 2007, 3:37:30 PM

Data source: SHB 42-34 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.393)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.103	0.0206	10.382	0.041
Treatment	1	0.0000951	0.0000951	0.0480	0.841
Residual	3	0.00594	0.00198		
Total	9	0.110	0.0122		

The difference in the mean values among the different levels of Replication is greater than would be expected by chance after allowing for effects of differences in Treatment. There is a statistically significant difference (P = 0.041). To isolate which group(s) differ from the others use a multiple comparison procedure.

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.841).

Power of performed test with alpha = 0.0500: for Replication : 0.654

Power of performed test with alpha = 0.0500: for Treatment : 0.0521

Least square means for Replication :

Group	Mean	SEM
1.000	1.322	0.0315
2.000	1.433	0.0315
3.000	1.293	0.0472
4.000	1.521	0.0315
5.000	1.239	0.0315
6.000	1.283	0.0472

Least square means for Treatment :

Group	Mean	SEM
Before	1.352	0.0182
After	1.345	0.0257

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Replication**

Comparison	Diff of Means	p	q	P	P<0.050
4.000 vs. 5.000	0.282	6	8.958	0.037	Yes

4.000 vs. 6.000	0.238	6	5.931	0.110	No
4.000 vs. 3.000	0.228	6	5.673	0.123	Do Not Test
4.000 vs. 1.000	0.199	6	6.328	0.094	Do Not Test
4.000 vs. 2.000	0.0879	6	2.794	0.499	Do Not Test
2.000 vs. 5.000	0.194	6	6.163	0.100	No
2.000 vs. 6.000	0.150	6	3.739	0.306	Do Not Test
2.000 vs. 3.000	0.140	6	3.481	0.350	Do Not Test
2.000 vs. 1.000	0.111	6	3.534	0.340	Do Not Test
1.000 vs. 5.000	0.0828	6	2.630	0.542	Do Not Test
1.000 vs. 6.000	0.0388	6	0.967	0.972	Do Not Test
1.000 vs. 3.000	0.0285	6	0.709	0.992	Do Not Test
3.000 vs. 5.000	0.0543	6	1.354	0.907	Do Not Test
3.000 vs. 6.000	0.0103	6	0.219	1.000	Do Not Test
6.000 vs. 5.000	0.0440	6	1.096	0.955	Do Not Test

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 43-34

Two Way Analysis of Variance

Monday, September 24, 2007, 3:44:07 PM

Data source: SHB 43-34 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.457)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0108	0.00216	1.277	0.418
Treatment	1	0.0121	0.0121	7.136	0.056
Residual	4	0.00676	0.00169		
Total	10	0.0292	0.00292		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.418).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.056).

Power of performed test with alpha = 0.0500: for Replication : 0.0755

Power of performed test with alpha = 0.0500: for Treatment : 0.469

Least square means for Replication :

Group	Mean	SEM
1.000	1.261	0.0291
2.000	1.237	0.0291
3.000	1.240	0.0291
4.000	1.225	0.0431
5.000	1.303	0.0291
6.000	1.206	0.0291

Least square means for Treatment :

Group	Mean	SEM
Before	1.280	0.0168
After	1.211	0.0199

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 43-34

Two Way Analysis of Variance

Monday, September 24, 2007, 3:44:17 PM

Data source: SHB 43-34 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.390)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.00677	0.00135	1.008	0.511
Treatment	1	0.00297	0.00297	2.207	0.212
Residual	4	0.00538	0.00134		
Total	10	0.0155	0.00155		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.511).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.212).

Power of performed test with alpha = 0.0500: for Replication : 0.0527

Power of performed test with alpha = 0.0500: for Treatment : 0.134

Least square means for Replication :

Group	Mean	SEM
1.000	1.293	0.0259
2.000	1.257	0.0259
3.000	1.275	0.0259
4.000	1.283	0.0385
5.000	1.335	0.0259
6.000	1.282	0.0259

Least square means for Treatment :

Group	Mean	SEM
Before	1.270	0.0150
After	1.305	0.0177

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 42-34

Two Way Analysis of Variance

Monday, September 24, 2007, 3:37:30 PM

Data source: SHB 42-34 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.393)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.103	0.0206	10.382	0.041
Treatment	1	0.0000951	0.0000951	0.0480	0.841
Residual	3	0.00594	0.00198		
Total	9	0.110	0.0122		

The difference in the mean values among the different levels of Replication is greater than would be expected by chance after allowing for effects of differences in Treatment. There is a statistically significant difference (P = 0.041). To isolate which group(s) differ from the others use a multiple comparison procedure.

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.841).

Power of performed test with alpha = 0.0500: for Replication : 0.654

Power of performed test with alpha = 0.0500: for Treatment : 0.0521

Least square means for Replication :

Group	Mean	SEM
1.000	1.322	0.0315
2.000	1.433	0.0315
3.000	1.293	0.0472
4.000	1.521	0.0315
5.000	1.239	0.0315
6.000	1.283	0.0472

Least square means for Treatment :

Group	Mean	SEM
Before	1.352	0.0182
After	1.345	0.0257

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Replication**

Comparison	Diff of Means	p	q	P	P<0.050
4.000 vs. 5.000	0.282	6	8.958	0.037	Yes

4.000 vs. 6.000	0.238	6	5.931	0.110	No
4.000 vs. 3.000	0.228	6	5.673	0.123	Do Not Test
4.000 vs. 1.000	0.199	6	6.328	0.094	Do Not Test
4.000 vs. 2.000	0.0879	6	2.794	0.499	Do Not Test
2.000 vs. 5.000	0.194	6	6.163	0.100	No
2.000 vs. 6.000	0.150	6	3.739	0.306	Do Not Test
2.000 vs. 3.000	0.140	6	3.481	0.350	Do Not Test
2.000 vs. 1.000	0.111	6	3.534	0.340	Do Not Test
1.000 vs. 5.000	0.0828	6	2.630	0.542	Do Not Test
1.000 vs. 6.000	0.0388	6	0.967	0.972	Do Not Test
1.000 vs. 3.000	0.0285	6	0.709	0.992	Do Not Test
3.000 vs. 5.000	0.0543	6	1.354	0.907	Do Not Test
3.000 vs. 6.000	0.0103	6	0.219	1.000	Do Not Test
6.000 vs. 5.000	0.0440	6	1.096	0.955	Do Not Test

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 43-34

Two Way Analysis of Variance

Monday, September 24, 2007, 3:44:07 PM

Data source: SHB 43-34 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.457)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0108	0.00216	1.277	0.418
Treatment	1	0.0121	0.0121	7.136	0.056
Residual	4	0.00676	0.00169		
Total	10	0.0292	0.00292		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.418).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.056).

Power of performed test with alpha = 0.0500: for Replication : 0.0755

Power of performed test with alpha = 0.0500: for Treatment : 0.469

Least square means for Replication :

Group	Mean	SEM
1.000	1.261	0.0291
2.000	1.237	0.0291
3.000	1.240	0.0291
4.000	1.225	0.0431
5.000	1.303	0.0291
6.000	1.206	0.0291

Least square means for Treatment :

Group	Mean	SEM
Before	1.280	0.0168
After	1.211	0.0199

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 43-34

Two Way Analysis of Variance

Monday, September 24, 2007, 3:44:17 PM

Data source: SHB 43-34 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.390)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.00677	0.00135	1.008	0.511
Treatment	1	0.00297	0.00297	2.207	0.212
Residual	4	0.00538	0.00134		
Total	10	0.0155	0.00155		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.511).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.212).

Power of performed test with alpha = 0.0500: for Replication : 0.0527

Power of performed test with alpha = 0.0500: for Treatment : 0.134

Least square means for Replication :

Group	Mean	SEM
1.000	1.293	0.0259
2.000	1.257	0.0259
3.000	1.275	0.0259
4.000	1.283	0.0385
5.000	1.335	0.0259
6.000	1.282	0.0259

Least square means for Treatment :

Group	Mean	SEM
Before	1.270	0.0150
After	1.305	0.0177

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 43-34

Two Way Analysis of Variance

Monday, September 24, 2007, 3:44:25 PM

Data source: SHB 43-34 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.306)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.00765	0.00153	9.776	0.023
Treatment	1	0.00450	0.00450	28.735	0.006
Residual	4	0.000626	0.000157		
Total	10	0.0124	0.00124		

The difference in the mean values among the different levels of Replication is greater than would be expected by chance after allowing for effects of differences in Treatment. There is a statistically significant difference (P = 0.023). To isolate which group(s) differ from the others use a multiple comparison procedure.

The difference in the mean values among the different levels of Treatment is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.006). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.787

Power of performed test with alpha = 0.0500: for Treatment : 0.973

Least square means for Replication :

Group	Mean	SEM
1.000	1.269	0.00885
2.000	1.346	0.00885
3.000	1.315	0.00885
4.000	1.340	0.0131
5.000	1.337	0.00885
6.000	1.328	0.00885

Least square means for Treatment :

Group	Mean	SEM
Before	1.301	0.00511
After	1.344	0.00604

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Replication**

Comparison	Diff of Means	p	q	P	P<0.050
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2.000 vs. 1.000	0.0767	6	8.673	0.021	Yes
2.000 vs. 3.000	0.0310	6	3.508	0.307	No
2.000 vs. 6.000	0.0181	6	2.046	0.709	Do Not Test
2.000 vs. 5.000	0.00862	6	0.975	0.974	Do Not Test
2.000 vs. 4.000	0.00552	6	0.493	0.999	Do Not Test
4.000 vs. 1.000	0.0712	6	6.364	0.059	No
4.000 vs. 3.000	0.0255	6	2.280	0.632	Do Not Test
4.000 vs. 6.000	0.0126	6	1.125	0.954	Do Not Test
4.000 vs. 5.000	0.00310	6	0.277	1.000	Do Not Test
5.000 vs. 1.000	0.0681	6	7.699	0.031	Do Not Test
5.000 vs. 3.000	0.0224	6	2.534	0.551	Do Not Test
5.000 vs. 6.000	0.00948	6	1.072	0.962	Do Not Test
6.000 vs. 1.000	0.0586	6	6.627	0.052	Do Not Test
6.000 vs. 3.000	0.0129	6	1.462	0.885	Do Not Test
3.000 vs. 1.000	0.0457	6	5.165	0.113	Do Not Test

Comparisons for factor: **Treatment**

Comparison	Diff of Means	p	q	P	P<0.050
After vs. Before	0.0424	2	7.581	0.006	Yes

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 46-34X

Two Way Analysis of Variance

Monday, September 24, 2007, 3:47:51 PM

Data source: SHB 46-34X data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.408)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0231	0.00462	14.807	0.011
Treatment	1	0.00366	0.00366	11.722	0.027
Residual	4	0.00125	0.000312		
Total	10	0.0258	0.00258		

The difference in the mean values among the different levels of Replication is greater than would be expected by chance after allowing for effects of differences in Treatment. There is a statistically significant difference (P = 0.011). To isolate which group(s) differ from the others use a multiple comparison procedure.

The difference in the mean values among the different levels of Treatment is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.027). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.931

Power of performed test with alpha = 0.0500: for Treatment : 0.695

Least square means for Replication :

Group	Mean	SEM
1.000	1.330	0.0125
2.000	1.241	0.0185
3.000	1.381	0.0125
4.000	1.277	0.0125
5.000	1.368	0.0125
6.000	1.292	0.0125

Least square means for Treatment :

Group	Mean	SEM
Before	1.334	0.00721
After	1.296	0.00853

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Replication**

Comparison	Diff of Means	p	q	P	P<0.050
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3.000 vs. 2.000	0.140	6	8.851	0.019	Yes
3.000 vs. 4.000	0.103	6	8.253	0.025	Yes
3.000 vs. 6.000	0.0888	6	7.113	0.041	Yes
3.000 vs. 1.000	0.0502	6	4.018	0.224	No
3.000 vs. 5.000	0.0122	6	0.977	0.974	Do Not Test
5.000 vs. 2.000	0.128	6	8.079	0.027	Yes
5.000 vs. 4.000	0.0909	6	7.276	0.038	Yes
5.000 vs. 6.000	0.0766	6	6.136	0.067	No
5.000 vs. 1.000	0.0380	6	3.041	0.409	Do Not Test
1.000 vs. 2.000	0.0896	6	5.675	0.085	No
1.000 vs. 4.000	0.0529	6	4.235	0.196	Do Not Test
1.000 vs. 6.000	0.0386	6	3.095	0.396	Do Not Test
6.000 vs. 2.000	0.0510	6	3.228	0.365	Do Not Test
6.000 vs. 4.000	0.0142	6	1.140	0.952	Do Not Test
4.000 vs. 2.000	0.0368	6	2.327	0.617	Do Not Test

Comparisons for factor: **Treatment**

Comparison	Diff of Means	p	q	P	P<0.050
Before vs. After	0.0382	2	4.842	0.027	Yes

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 46-34X

Two Way Analysis of Variance

Monday, September 24, 2007, 3:49:06 PM

Data source: SHB 46-34X data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Failed (P < 0.050)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.112	0.0224	1.599	0.335
Treatment	1	0.0481	0.0481	3.436	0.137
Residual	4	0.0560	0.0140		
Total	10	0.269	0.0269		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.335).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.137).

Power of performed test with alpha = 0.0500: for Replication : 0.105

Power of performed test with alpha = 0.0500: for Treatment : 0.222

Least square means for Replication :

Group	Mean	SEM
1.000	1.404	0.0837
2.000	1.094	0.124
3.000	1.417	0.0837
4.000	1.379	0.0837
5.000	1.370	0.0837
6.000	1.511	0.0837

Least square means for Treatment :

Group	Mean	SEM
Before	1.293	0.0483
After	1.432	0.0572

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 46-34X

Two Way Analysis of Variance

Monday, September 24, 2007, 3:49:15 PM

Data source: SHB 46-34X data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.142)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0529	0.0106	0.702	0.652
Treatment	1	0.0432	0.0432	2.861	0.166
Residual	4	0.0603	0.0151		
Total	10	0.169	0.0169		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.652).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.166).

Power of performed test with alpha = 0.0500: for Replication : 0.0520

Power of performed test with alpha = 0.0500: for Treatment : 0.181

Least square means for Replication :

Group	Mean	SEM
1.000	1.379	0.0868
2.000	1.312	0.129
3.000	1.367	0.0868
4.000	1.388	0.0868
5.000	1.288	0.0868
6.000	1.505	0.0868

Least square means for Treatment :

Group	Mean	SEM
Before	1.308	0.0501
After	1.439	0.0593

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 47-34X

Two Way Analysis of Variance

Monday, September 24, 2007, 5:35:08 PM

Data source: SHB 47-34X data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.168)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0124	0.00247	19.074	0.018
Treatment	1	0.00174	0.00174	13.428	0.035
Residual	3	0.000389	0.000130		
Total	9	0.0136	0.00151		

The difference in the mean values among the different levels of Replication is greater than would be expected by chance after allowing for effects of differences in Treatment. There is a statistically significant difference (P = 0.018). To isolate which group(s) differ from the others use a multiple comparison procedure.

The difference in the mean values among the different levels of Treatment is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.035). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.891

Power of performed test with alpha = 0.0500: for Treatment : 0.659

Least square means for Replication :

Group	Mean	SEM
1.000	1.315	0.00805
2.000	1.317	0.0121
3.000	1.333	0.0121
4.000	1.375	0.00805
5.000	1.408	0.00805
6.000	1.331	0.00805

Least square means for Treatment :

Group	Mean	SEM
Before	1.361	0.00465
After	1.332	0.00657

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Replication**

Comparison	Diff of Means	p	q	P	P<0.050
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5.000 vs. 1.000	0.0936	6	11.625	0.018	Yes
5.000 vs. 2.000	0.0914	6	8.905	0.038	Yes
5.000 vs. 6.000	0.0773	6	9.603	0.031	Yes
5.000 vs. 3.000	0.0751	6	7.319	0.064	No
5.000 vs. 4.000	0.0332	6	4.128	0.252	Do Not Test
4.000 vs. 1.000	0.0603	6	7.497	0.060	No
4.000 vs. 2.000	0.0581	6	5.667	0.123	Do Not Test
4.000 vs. 6.000	0.0441	6	5.476	0.134	Do Not Test
4.000 vs. 3.000	0.0419	6	4.081	0.258	Do Not Test
3.000 vs. 1.000	0.0185	6	1.801	0.788	Do Not Test
3.000 vs. 2.000	0.0163	6	1.348	0.908	Do Not Test
3.000 vs. 6.000	0.00220	6	0.215	1.000	Do Not Test
6.000 vs. 1.000	0.0163	6	2.022	0.721	Do Not Test
6.000 vs. 2.000	0.0141	6	1.371	0.903	Do Not Test
2.000 vs. 1.000	0.00220	6	0.215	1.000	Do Not Test

Comparisons for factor: **Treatment**

Comparison	Diff of Means	p	q	P	P<0.050
Before vs. After	0.0295	2	5.182	0.035	Yes

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 47-34X

Two Way Analysis of Variance

Monday, September 24, 2007, 5:38:53 PM

Data source: SHB 47-34X data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.170)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0416	0.00832	3.981	0.142
Treatment	1	0.00111	0.00111	0.533	0.518
Residual	3	0.00627	0.00209		
Total	9	0.0525	0.00584		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.142).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.518).

Power of performed test with alpha = 0.0500: for Replication : 0.270

Power of performed test with alpha = 0.0500: for Treatment : 0.0521

Least square means for Replication :

Group	Mean	SEM
1.000	1.374	0.0323
2.000	1.329	0.0485
3.000	1.391	0.0485
4.000	1.380	0.0323
5.000	1.534	0.0323
6.000	1.396	0.0323

Least square means for Treatment :

Group	Mean	SEM
Before	1.389	0.0187
After	1.413	0.0264

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 47-34X

Two Way Analysis of Variance

Monday, September 24, 2007, 5:39:04 PM

Data source: SHB 47-34X data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.437)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0557	0.0111	4.471	0.124
Treatment	1	0.000509	0.000509	0.204	0.682
Residual	3	0.00748	0.00249		
Total	9	0.0663	0.00736		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.124).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.682).

Power of performed test with alpha = 0.0500: for Replication : 0.306

Power of performed test with alpha = 0.0500: for Treatment : 0.0521

Least square means for Replication :

Group	Mean	SEM
1.000	1.364	0.0353
2.000	1.337	0.0530
3.000	1.403	0.0530
4.000	1.357	0.0353
5.000	1.550	0.0353
6.000	1.448	0.0353

Least square means for Treatment :

Group	Mean	SEM
Before	1.402	0.0204
After	1.418	0.0288

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 48-34

Two Way Analysis of Variance

Monday, September 24, 2007, 5:47:51 PM

Data source: Data 20 in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.330)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0177	0.00355	6.444	0.078
Treatment	1	0.000971	0.000971	1.764	0.276
Residual	3	0.00165	0.000551		
Total	9	0.0210	0.00233		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.078).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.276).

Power of performed test with alpha = 0.0500: for Replication : 0.441

Power of performed test with alpha = 0.0500: for Treatment : 0.0973

Least square means for Replication :

Group	Mean	SEM
1.000	1.233	0.0166
2.000	1.348	0.0249
3.000	1.286	0.0166
4.000	1.227	0.0249
5.000	1.330	0.0166
6.000	1.259	0.0166

Least square means for Treatment :

Group	Mean	SEM
Before	1.291	0.00958
After	1.269	0.0135

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 48-34

Two Way Analysis of Variance

Monday, September 24, 2007, 5:48:02 PM

Data source: Data 20 in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.345)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0270	0.00541	2.446	0.246
Treatment	1	0.00991	0.00991	4.481	0.125
Residual	3	0.00663	0.00221		
Total	9	0.0417	0.00464		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.246).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.125).

Power of performed test with alpha = 0.0500: for Replication : 0.156

Power of performed test with alpha = 0.0500: for Treatment : 0.257

Least square means for Replication :

Group	Mean	SEM
1.000	1.265	0.0332
2.000	1.402	0.0499
3.000	1.298	0.0332
4.000	1.308	0.0499
5.000	1.402	0.0332
6.000	1.307	0.0332

Least square means for Treatment :

Group	Mean	SEM
Before	1.295	0.0192
After	1.366	0.0271

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 48-34

Two Way Analysis of Variance

Monday, September 24, 2007, 5:48:11 PM

Data source: Data 20 in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.179)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.00911	0.00182	0.349	0.857
Treatment	1	0.0114	0.0114	2.180	0.236
Residual	3	0.0157	0.00522		
Total	9	0.0358	0.00398		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.857).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.236).

Power of performed test with alpha = 0.0500: for Replication : 0.0540

Power of performed test with alpha = 0.0500: for Treatment : 0.122

Least square means for Replication :

Group	Mean	SEM
1.000	1.329	0.0511
2.000	1.391	0.0766
3.000	1.329	0.0511
4.000	1.364	0.0766
5.000	1.407	0.0511
6.000	1.353	0.0511

Least square means for Treatment :

Group	Mean	SEM
Before	1.325	0.0295
After	1.400	0.0417

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at Site SHB 96-34

Two Way Analysis of Variance

Monday, September 24, 2007, 5:53:26 PM

Data source: SHB 96-34 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.476)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.00381	0.000763	0.337	0.864
Treatment	1	0.00299	0.00299	1.319	0.334
Residual	3	0.00679	0.00226		
Total	9	0.0154	0.00171		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.864).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.334).

Power of performed test with alpha = 0.0500: for Replication : 0.0540

Power of performed test with alpha = 0.0500: for Treatment : 0.0710

Least square means for Replication :

Group	Mean	SEM
1.000	1.275	0.0337
2.000	1.307	0.0505
3.000	1.240	0.0337
4.000	1.262	0.0337
5.000	1.243	0.0505
6.000	1.253	0.0337

Least square means for Treatment :

Group	Mean	SEM
Before	1.283	0.0194
After	1.244	0.0275

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at Site SHB 96-34

Two Way Analysis of Variance

Monday, September 24, 2007, 5:53:35 PM

Data source: SHB 96-34 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.353)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.00516	0.00103	0.795	0.617
Treatment	1	0.00265	0.00265	2.047	0.248
Residual	3	0.00389	0.00130		
Total	9	0.0128	0.00143		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.617).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.248).

Power of performed test with alpha = 0.0500: for Replication : 0.0540

Power of performed test with alpha = 0.0500: for Treatment : 0.114

Least square means for Replication :

Group	Mean	SEM
1.000	1.369	0.0255
2.000	1.372	0.0382
3.000	1.317	0.0255
4.000	1.331	0.0255
5.000	1.316	0.0382
6.000	1.320	0.0255

Least square means for Treatment :

Group	Mean	SEM
Before	1.356	0.0147
After	1.319	0.0208

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at Site SHB 96-34

Two Way Analysis of Variance

Monday, September 24, 2007, 5:53:44 PM

Data source: SHB 96-34 data in drill pad density stats

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.387)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0122	0.00245	0.751	0.637
Treatment	1	0.00112	0.00112	0.345	0.598
Residual	3	0.00977	0.00326		
Total	9	0.0228	0.00254		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Treatment. There is not a statistically significant difference (P = 0.637).

The difference in the mean values among the different levels of Treatment is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.598).

Power of performed test with alpha = 0.0500: for Replication : 0.0540

Power of performed test with alpha = 0.0500: for Treatment : 0.0521

Least square means for Replication :

Group	Mean	SEM
1.000	1.455	0.0404
2.000	1.428	0.0605
3.000	1.413	0.0404
4.000	1.376	0.0404
5.000	1.402	0.0605
6.000	1.355	0.0404

Least square means for Treatment :

Group	Mean	SEM
Before	1.393	0.0233
After	1.417	0.0329

Paired t-test Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal in Section 34

Paired t-test:

Wednesday, September 26, 2007, 12:28:44 PM

Data source: Data 42 in drill pad density stats

Normality Test: Passed (P = 0.285)

Treatment Name	N	Missing	Mean	Std Dev	SEM
0-2 before	9	0	1.317	0.0352	0.0117
0-2 after	9	0	1.257	0.0453	0.0151
Difference	9	0	0.0591	0.0422	0.0141

t = 4.201 with 8 degrees of freedom. (P = 0.003)

95 percent confidence interval for difference of means: 0.0266 to 0.0915

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant change (P = 0.003)

Power of performed test with alpha = 0.050: 0.954

Paired t-test Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal in Section 34

Paired t-test:

Wednesday, September 26, 2007, 12:29:10 PM

Data source: Data 42 in drill pad density stats

Normality Test: Passed (P = 0.645)

Treatment Name	N	Missing	Mean	Std Dev	SEM
0-6 before	9	0	1.323	0.0505	0.0168
0-6 after	9	0	1.355	0.0697	0.0232
Difference	9	0	-0.0325	0.0802	0.0267

t = -1.214 with 8 degrees of freedom. (P = 0.260)

95 percent confidence interval for difference of means: -0.0941 to 0.0292

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.260)

Power of performed test with alpha = 0.050: 0.090

The power of the performed test (0.090) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Paired t-test Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal in Section 34

Paired t-test:

Wednesday, September 26, 2007, 12:29:29 PM

Data source: Data 42 in drill pad density stats

Normality Test: Passed (P = 0.526)

Treatment Name	N	Missing	Mean	Std Dev	SEM
0-12 before	9	0	1.353	0.0403	0.0134
0-12 after	9	0	1.388	0.0472	0.0157
Difference	9	0	-0.0344	0.0591	0.0197

t = -1.747 with 8 degrees of freedom. (P = 0.119)

95 percent confidence interval for difference of means: -0.0799 to 0.0110

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.119)

Power of performed test with alpha = 0.050: 0.234

The power of the performed test (0.234) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Paired t-test Results for Dry Soil Bulk Density Measured from 0-5.1 cm Before and After Oak Mat Construction and Removal at All Sections

Paired t-test:

Thursday, September 27, 2007, 2:21:10 PM

Data source: Data 43 in drill pad density stats

Normality Test: Passed (P = 0.126)

Treatment Name	N	Missing	Mean	Std Dev	SEM
0-2 before	37	0	1.356	0.0534	0.00877
0-2 after	37	0	1.318	0.0614	0.0101
Difference	37	0	0.0377	0.0567	0.00933

t = 4.047 with 36 degrees of freedom. (P = <0.001)

95 percent confidence interval for difference of means: 0.0188 to 0.0567

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant change (P = <0.001)

Power of performed test with alpha = 0.050: 0.980

Paired t-test Results for Dry Soil Bulk Density Measured from 0-15.2 cm Before and After Oak Mat Construction and Removal at All Sections

Paired t-test:

Thursday, September 27, 2007, 2:21:43 PM

Data source: Data 43 in drill pad density stats

Normality Test: Passed (P = 0.669)

Treatment Name	N	Missing	Mean	Std Dev	SEM
0-6 before	37	0	1.352	0.0768	0.0126
0-6 after	37	0	1.379	0.0712	0.0117
Difference	37	0	-0.0264	0.0563	0.00925

t = -2.850 with 36 degrees of freedom. (P = 0.007)

95 percent confidence interval for difference of means: -0.0451 to -0.00760

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant change (P = 0.007)

Power of performed test with alpha = 0.050: 0.747

Paired t-test Results for Dry Soil Bulk Density Measured from 0-30.5 cm Before and After Oak Mat Construction and Removal at All Sections

Paired t-test:

Thursday, September 27, 2007, 2:22:09 PM

Data source: Data 43 in drill pad density stats

Normality Test: Passed (P = 0.781)

Treatment Name	N	Missing	Mean	Std Dev	SEM
0-12 before	37	0	1.350	0.0884	0.0145
0-12 after	37	0	1.405	0.0693	0.0114
Difference	37	0	-0.0555	0.0601	0.00988

t = -5.617 with 36 degrees of freedom. (P = <0.001)

95 percent confidence interval for difference of means: -0.0756 to -0.0355

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant change (P = <0.001)

Power of performed test with alpha = 0.050: 1.000

T-test Results for Dry Soil Bulk Density Measured from 0-5.1 cm at Reclaimed Cut and Fill Location SHB 2-29 versus the Nearby Undisturbed Range

t-test

Wednesday, October 17, 2007, 5:55:18 PM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.576)

Equal Variance Test: Passed (P = 0.504)

Group Name	N	Missing	Mean	Std Dev	SEM
2" NUR	2	0	1.400	0.0141	0.01000
2" PAD	4	0	1.354	0.0312	0.0156

Difference 0.0459

t = 1.894 with 4 degrees of freedom. (P = 0.131)

95 percent confidence interval for difference of means: -0.0214 to 0.113

The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups (P = 0.131).

Power of performed test with alpha = 0.050: 0.233

The power of the performed test (0.233) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

T-test Results for Dry Soil Bulk Density Measured from 5.1-15.2 cm at Reclaimed Cut and Fill Location SHB 2-29 versus the Nearby Undisturbed Range

t-test

Wednesday, October 17, 2007, 5:55:42 PM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.524)

Equal Variance Test: Passed (P = 0.492)

Group Name	N	Missing	Mean	Std Dev	SEM
6" NUR	2	0	1.325	0.0212	0.0150
6" PAD	4	0	1.452	0.0507	0.0254

Difference -0.127

t = -3.245 with 4 degrees of freedom. (P = 0.032)

95 percent confidence interval for difference of means: -0.236 to -0.0183

The difference in the mean values of the two groups is greater than would be expected by chance; there is a statistically significant difference between the input groups (P = 0.032).

Power of performed test with alpha = 0.050: 0.645

T-test Results for Dry Soil Bulk Density Measured from 15.2-45.7 cm at Reclaimed Cut and Fill Location SHB 2-29 versus the Nearby Undisturbed Range

t-test

Wednesday, October 17, 2007, 5:56:12 PM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.211)

Equal Variance Test: Passed (P = 0.216)

Group Name	N	Missing	Mean	Std Dev	SEM
18" NUR	2	0	1.370	0.0141	0.01000
18" PAD	4	0	1.564	0.125	0.0626

Difference -0.194

t = -2.064 with 4 degrees of freedom. (P = 0.108)

95 percent confidence interval for difference of means: -0.456 to 0.0670

The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups (P = 0.108).

Power of performed test with alpha = 0.050: 0.281

The power of the performed test (0.281) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

T-test Results for Dry Soil Bulk Density Measured from 0-5.1 cm at Reclaimed Cut and Fill Location SHB 7-29 versus the Nearby Undisturbed Range

t-test

Wednesday, October 17, 2007, 6:01:40 PM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.087)

Equal Variance Test: Passed (P = 0.271)

Group Name	N	Missing	Mean	Std Dev	SEM
2" NUR	2	0	1.245	0.00707	0.00500
2" PAD	4	0	1.450	0.0789	0.0394

Difference -0.205

t = -3.461 with 4 degrees of freedom. (P = 0.026)

95 percent confidence interval for difference of means: -0.370 to -0.0406

The difference in the mean values of the two groups is greater than would be expected by chance; there is a statistically significant difference between the input groups (P = 0.026).

Power of performed test with alpha = 0.050: 0.704

T-test Results for Dry Soil Bulk Density Measured from 5.1-15.2 cm at Reclaimed Cut and Fill Location SHB 7-29 versus the Nearby Undisturbed Range

t-test

Wednesday, October 17, 2007, 6:02:11 PM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.303)

Equal Variance Test: Passed (P = 0.386)

Group Name	N	Missing	Mean	Std Dev	SEM
6" NUR	2	0	1.215	0.0212	0.0150
6" PAD	4	0	1.425	0.0752	0.0376

Difference -0.210

t = -3.669 with 4 degrees of freedom. (P = 0.021)

95 percent confidence interval for difference of means: -0.368 to -0.0510

The difference in the mean values of the two groups is greater than would be expected by chance; there is a statistically significant difference between the input groups (P = 0.021).

Power of performed test with alpha = 0.050: 0.756

T-test Results for Dry Soil Bulk Density Measured from 15.2-45.7 cm at Reclaimed Cut and Fill Location SHB 7-29 versus the Nearby Undisturbed Range

t-test

Wednesday, October 17, 2007, 6:02:54 PM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.554)

Equal Variance Test: Passed (P = 0.134)

Group Name	N	Missing	Mean	Std Dev	SEM
18" NUR	2	0	1.250	0.113	0.0800
18" PAD	4	0	1.374	0.0462	0.0231

Difference -0.124

t = -2.060 with 4 degrees of freedom. (P = 0.108)

95 percent confidence interval for difference of means: -0.290 to 0.0430

The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups (P = 0.108).

Power of performed test with alpha = 0.050: 0.279

The power of the performed test (0.279) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

T-test Results for Dry Soil Bulk Density Measured from 0-5.1 cm at Reclaimed Cut and Fill Location SHB 10-29 versus the Nearby Undisturbed Range

t-test

Wednesday, October 17, 2007, 5:56:44 PM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.438)

Equal Variance Test: Passed (P = 0.129)

Group Name	N	Missing	Mean	Std Dev	SEM
2" NUR	2	0	1.465	0.00707	0.00500
2" PAD	4	0	1.473	0.0750	0.0375

Difference -0.00777

t = -0.138 with 4 degrees of freedom. (P = 0.897)

95 percent confidence interval for difference of means: -0.164 to 0.149

The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups (P = 0.897).

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

T-test Results for Dry Soil Bulk Density Measured from 5.1-15.2 cm at Reclaimed Cut and Fill Location SHB 10-29 versus the Nearby Undisturbed Range

t-test

Wednesday, October 17, 2007, 5:57:15 PM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.541)

Equal Variance Test: Passed (P = 0.077)

Group Name	N	Missing	Mean	Std Dev	SEM
6" NUR	2	0	1.430	0.0990	0.0700
6" PAD	4	0	1.505	0.0517	0.0258

Difference -0.0751

t = -1.299 with 4 degrees of freedom. (P = 0.264)

95 percent confidence interval for difference of means: -0.236 to 0.0854

The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups (P = 0.264).

Power of performed test with alpha = 0.050: 0.098

The power of the performed test (0.098) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

T-test Results for Dry Soil Bulk Density Measured from 15.2-45.7 cm at Reclaimed Cut and Fill Location SHB 10-29 versus the Nearby Undisturbed Range

t-test

Wednesday, October 17, 2007, 5:57:41 PM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.628)

Equal Variance Test: Passed (P = 0.120)

Group Name	N	Missing	Mean	Std Dev	SEM
18" NUR	2	0	1.410	0.0283	0.0200
18" PAD	4	0	1.516	0.136	0.0678

Difference -0.106

t = -1.030 with 4 degrees of freedom. (P = 0.361)

95 percent confidence interval for difference of means: -0.390 to 0.179

The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups (P = 0.361).

Power of performed test with alpha = 0.050: 0.055

The power of the performed test (0.055) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

T-test Results for Dry Soil Bulk Density Measured from 0-5.1 cm at Reclaimed Cut and Fill Location SHB 12-29 versus the Nearby Undisturbed Range

t-test

Wednesday, October 17, 2007, 5:58:09 PM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.748)

Equal Variance Test: Failed (P < 0.050)

Test execution ended by user request, Rank Sum Test begun

Mann-Whitney Rank Sum Test

Wednesday, October 17, 2007, 5:58:09 PM

Data source: Data 1 in Notebook 1

Group	N	Missing	Median	25%	75%
2" NUR	2	0	1.435	1.430	1.440
2" PAD	4	0	1.592	1.462	1.715

Mann-Whitney U Statistic= 8.000

T = 3.000 n(small)= 2 n(big)= 4 P(est.)= 0.105 P(exact)= 0.133

The difference in the median values between the two groups is not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.133)

T-test Results for Dry Soil Bulk Density Measured from 5.1-15.2 cm at Reclaimed Cut and Fill Location SHB 12-29 versus the Nearby Undisturbed Range

t-test

Wednesday, October 17, 2007, 5:58:48 PM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.167)

Equal Variance Test: Passed (P = 0.315)

Group Name	N	Missing	Mean	Std Dev	SEM
6" NUR	2	0	1.430	0.0283	0.0200
6" PAD	4	0	1.600	0.157	0.0783

Difference -0.170

t = -1.438 with 4 degrees of freedom. (P = 0.224)

95 percent confidence interval for difference of means: -0.497 to 0.158

The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups (P = 0.224).

Power of performed test with alpha = 0.050: 0.125

The power of the performed test (0.125) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

T-test Results for Dry Soil Bulk Density Measured from 15.2-45.7 cm at Reclaimed Cut and Fill Location SHB 12-29 versus the Nearby Undisturbed Range

t-test

Wednesday, October 17, 2007, 5:59:13 PM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.301)

Equal Variance Test: Passed (P = 0.866)

Group Name	N	Missing	Mean	Std Dev	SEM
18" NUR	2	0	1.440	0.0849	0.0600
18" PAD	4	0	1.631	0.116	0.0582

Difference -0.191

t = -2.014 with 4 degrees of freedom. (P = 0.114)

95 percent confidence interval for difference of means: -0.454 to 0.0722

The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups (P = 0.114).

Power of performed test with alpha = 0.050: 0.266

The power of the performed test (0.266) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

T-test Results for Dry Soil Bulk Density Measured from 0-5.1 cm at Reclaimed Cut and Fill Location SHB 11-23 versus the Nearby Undisturbed Range

t-test

Wednesday, October 17, 2007, 5:53:03 PM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.443)

Equal Variance Test: Passed (P = 0.751)

Group Name	N	Missing	Mean	Std Dev	SEM
2" PAD	4	0	1.452	0.0461	0.0230
2" NUR	2	0	1.340	0.0283	0.0200

Difference 0.112

t = 3.066 with 4 degrees of freedom. (P = 0.037)

95 percent confidence interval for difference of means: 0.0106 to 0.214

The difference in the mean values of the two groups is greater than would be expected by chance; there is a statistically significant difference between the input groups (P = 0.037).

Power of performed test with alpha = 0.050: 0.592

T-test Results for Dry Soil Bulk Density Measured from 5.1-15.2 cm at Reclaimed Cut and Fill Location SHB 11-23 versus the Nearby Undisturbed Range

t-test

Wednesday, October 17, 2007, 5:53:55 PM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.677)

Equal Variance Test: Failed (P < 0.050)

Test execution ended by user request, Rank Sum Test begun

Mann-Whitney Rank Sum Test

Wednesday, October 17, 2007, 5:53:55 PM

Data source: Data 1 in Notebook 1

Group	N	Missing	Median	25%	75%
6" NUR	2	0	1.235	1.230	1.240
6" PAD	4	0	1.388	1.336	1.434

Mann-Whitney U Statistic= 8.000

T = 3.000 n(small)= 2 n(big)= 4 P(est.)= 0.100 P(exact)= 0.133

The difference in the median values between the two groups is not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.133)

T-test Results for Dry Soil Bulk Density Measured from 15.2-45.7 cm at Reclaimed Cut and Fill Location SHB 11-23 versus the Nearby Undisturbed Range

t-test

Wednesday, October 17, 2007, 5:54:34 PM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.527)

Equal Variance Test: Passed (P = 0.153)

Group Name	N	Missing	Mean	Std Dev	SEM
18" NUR	2	0	1.345	0.0212	0.0150
18" PAD	4	0	1.467	0.0879	0.0439

Difference -0.122

t = -1.831 with 4 degrees of freedom. (P = 0.141)

95 percent confidence interval for difference of means: -0.307 to 0.0629

The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups (P = 0.141).

Power of performed test with alpha = 0.050: 0.216

The power of the performed test (0.216) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

T-test Results for Dry Soil Bulk Density Measured from 0-5.1 cm at Reclaimed Cut and Fill Location SHB 12-34 versus the Nearby Undisturbed Range

t-test

Wednesday, October 17, 2007, 5:59:39 PM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.601)

Equal Variance Test: Passed (P = 0.310)

Group Name	N	Missing	Mean	Std Dev	SEM
2" NUR	2	0	1.285	0.0212	0.0150
2" PAD	4	0	1.397	0.0452	0.0226

Difference -0.112

t = -3.196 with 4 degrees of freedom. (P = 0.033)

95 percent confidence interval for difference of means: -0.210 to -0.0147

The difference in the mean values of the two groups is greater than would be expected by chance; there is a statistically significant difference between the input groups (P = 0.033).

Power of performed test with alpha = 0.050: 0.631

T-test Results for Dry Soil Bulk Density Measured from 5.1-15.2 cm at Reclaimed Cut and Fill Location SHB 12-34 versus the Nearby Undisturbed Range

t-test

Wednesday, October 17, 2007, 6:00:23 PM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.206)

Equal Variance Test: Passed (P = 0.618)

Group Name	N	Missing	Mean	Std Dev	SEM
6" NUR	2	0	1.255	0.0354	0.0250
6" PAD	4	0	1.358	0.114	0.0572

Difference -0.103

t = -1.187 with 4 degrees of freedom. (P = 0.301)

95 percent confidence interval for difference of means: -0.345 to 0.139

The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups (P = 0.301).

Power of performed test with alpha = 0.050: 0.079

The power of the performed test (0.079) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

T-test Results for Dry Soil Bulk Density Measured from 15.2-45.7 cm at Reclaimed Cut and Fill Location SHB 12-34 versus the Nearby Undisturbed Range

t-test

Wednesday, October 17, 2007, 6:00:49 PM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.649)

Equal Variance Test: Passed (P = 0.945)

Group Name	N	Missing	Mean	Std Dev	SEM
18" NUR	2	0	1.250	0.0707	0.0500
18" PAD	4	0	1.462	0.0664	0.0332

Difference -0.212

t = -3.621 with 4 degrees of freedom. (P = 0.022)

95 percent confidence interval for difference of means: -0.374 to -0.0494

The difference in the mean values of the two groups is greater than would be expected by chance; there is a statistically significant difference between the input groups (P = 0.022).

Power of performed test with alpha = 0.050: 0.745

Paired t-test Results for Mean Dry Soil Bulk Density Measured from 0-5.1 cm at Reclaimed Cut and Fill Locations versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, October 17, 2007, 3:45:39 PM

Data source: Data 1 in Adjusted Bulk Density RCAF v. NUR all depths

Normality Test: Passed (P = 0.265)

Treatment Name	N	Missing	Mean	Std Dev	SEM
2" PAD	6	0	1.452	0.0795	0.0325
2" NUR	6	0	1.362	0.0865	0.0353
Difference	6	0	0.0905	0.0938	0.0383

t = 2.363 with 5 degrees of freedom. (P = 0.065)

95 percent confidence interval for difference of means: -0.00796 to 0.189

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.065)

Power of performed test with alpha = 0.050: 0.406

The power of the performed test (0.406) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Paired t-test Results for Mean Dry Soil Bulk Density Measured from 5.1-15.2 cm at Reclaimed Cut and Fill Locations versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, October 17, 2007, 3:46:29 PM

Data source: Data 1 in Adjusted Bulk Density RCAF v. NUR all depths

Normality Test: Passed (P = 0.759)

Treatment Name	N	Missing	Mean	Std Dev	SEM
6" NUR	6	0	1.315	0.0990	0.0404
6" PAD	6	0	1.454	0.0879	0.0359
Difference	6	0	-0.139	0.0497	0.0203

t = -6.865 with 5 degrees of freedom. (P = 0.001)

95 percent confidence interval for difference of means: -0.191 to -0.0872

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant change (P = 0.001)

Power of performed test with alpha = 0.050: 1.000

Paired t-test Results for Mean Dry Soil Bulk Density Measured from 15.2-45.7 cm at Reclaimed Cut and Fill Locations versus the Nearby Undisturbed Range

Paired t-test:

Wednesday, October 17, 2007, 3:48:05 PM

Data source: Data 1 in Adjusted Bulk Density RCAF v. NUR all depths

Normality Test: Passed (P = 0.235)

Treatment Name	N	Missing	Mean	Std Dev	SEM
18" NUR	6	0	1.346	0.0809	0.0330
18" PAD	6	0	1.502	0.0894	0.0365
Difference	6	0	-0.156	0.0459	0.0187

t = -8.327 with 5 degrees of freedom. (P = <0.001)

95 percent confidence interval for difference of means: -0.204 to -0.108

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant change (P = <0.001)

Power of performed test with alpha = 0.050: 1.000

One Way ANOVA Results for Percent Change in Bulk Density from 0-5.1 cm versus 0-15.2 cm at Oak Mat Areas

One Way Analysis of Variance

Sunday, November 04, 2007, 9:10:08 AM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.100)

Equal Variance Test: Passed (P = 0.815)

Group Name	N	Missing	Mean	Std Dev	SEM
% Change 0-5.1 cm Depth Increm	37	0	-2.989	4.467	0.734
% Change 0-15.2 cm Depth Incre	37	0	1.855	3.981	0.654

Source of Variation	DF	SS	MS	F	P
Between Groups	1	434.163	434.163	24.257	<0.001
Residual	72	1288.702	17.899		
Total	73	1722.865			

The differences in the mean values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Power of performed test with alpha = 0.050: 0.999

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor:

Comparison	Diff of Means	p	q	P	P<0.050
% Change 0-1 vs. % Change 0-5	4.844	2	6.965	<0.001	Yes

One Way ANOVA Results for Percent Change in Bulk Density from 0-15.2 cm versus 0-30.5 cm at Oak Mat Areas

One Way Analysis of Variance

Sunday, November 04, 2007, 9:11:30 AM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.790)

Equal Variance Test: Passed (P = 0.777)

Group Name	N	Missing	Mean	Std Dev	SEM
% Change 0-15.2 cm Depth Incre	37	0	1.855	3.981	0.654
% Change 0-30.5 cm Depth Incr	37	0	3.942	4.259	0.700

Source of Variation	DF	SS	MS	F	P
Between Groups	1	80.558	80.558	4.741	0.033
Residual	72	1223.322	16.991		
Total	73	1303.879			

The differences in the mean values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = 0.033).

Power of performed test with alpha = 0.050: 0.468

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor:

Comparison	Diff of Means	p	q	P	P<0.050
% Change 0-3 vs. % Change 0-1	2.087	2	3.079	0.033	Yes

One Way ANOVA Results for Percent Change in Bulk Density from 0-5.1 cm versus 0-30.5 cm at Oak Mat Areas

One Way Analysis of Variance

Sunday, November 04, 2007, 9:12:18 AM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.100)

Equal Variance Test: Passed (P = 0.980)

Group Name	N	Missing	Mean	Std Dev	SEM
% Change 0-5.1 cm Depth Increm	37	0	-2.989	4.467	0.734
% Change 0-30.5 cm Depth Incr	37	0	3.942	4.259	0.700

Source of Variation	DF	SS	MS	F	P
Between Groups	1	888.753	888.753	46.669	<0.001
Residual	72	1371.140	19.044		
Total	73	2259.893			

The differences in the mean values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Power of performed test with alpha = 0.050: 1.000

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor:

Comparison	Diff of Means	p	q	P	P<0.050
% Change 0-3 vs. % Change 0-5	6.931	2	9.661	<0.001	Yes

One Way ANOVA Results for Percent Change in Bulk Density from 0-5.1 cm versus 5.1-15.2 cm at Cut and Fill Locations

One Way Analysis of Variance

Sunday, November 04, 2007, 9:13:42 AM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.590)

Equal Variance Test: Passed (P = 0.309)

Group Name	N	Missing	Mean	Std Dev	SEM
% Change 0-5.1 cm Depth Increm	6	0	6.981	7.173	2.928
% Change 5.1 to 15.2 cm Depth	6	0	10.947	3.949	1.612

Source of Variation	DF	SS	MS	F	P
Between Groups	1	47.184	47.184	1.407	0.263
Residual	10	335.259	33.526		
Total	11	382.443			

The differences in the mean values among the treatment groups are not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.263).

Power of performed test with alpha = 0.050: 0.085

The power of the performed test (0.085) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.

One Way ANOVA Results for Percent Change in Bulk Density from 5.1-15.2 cm versus 15.2-45.7 cm at Cut and Fill Locations

One Way Analysis of Variance

Sunday, November 04, 2007, 9:14:37 AM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.724)

Equal Variance Test: Passed (P = 0.957)

Group Name	N	Missing	Mean	Std Dev	SEM
% Change 5.1 to 15.2 cm Depth	6	0	10.947	3.949	1.612
% Change 15.2 to 45.7 cm Depth	6	0	11.692	3.477	1.420

Source of Variation	DF	SS	MS	F	P
Between Groups	1	1.666	1.666	0.120	0.736
Residual	10	138.435	13.843		
Total	11	140.101			

The differences in the mean values among the treatment groups are not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.736).

Power of performed test with alpha = 0.050: 0.048

The power of the performed test (0.048) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.

One Way ANOVA Results for Percent Change in Bulk Density from 0-5.1 cm versus 15.2-45.7 cm at Cut and Fill Locations

One Way Analysis of Variance

Sunday, November 04, 2007, 9:15:32 AM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.412)

Equal Variance Test: Passed (P = 0.288)

Group Name	N	Missing	Mean	Std Dev	SEM
% Change 0-5.1 cm Depth Increm	6	0	6.981	7.173	2.928
% Change 15.2 to 45.7 cm Depth	6	0	11.692	3.477	1.420

Source of Variation	DF	SS	MS	F	P
Between Groups	1	66.586	66.586	2.096	0.178
Residual	10	317.739	31.774		
Total	11	384.324			

The differences in the mean values among the treatment groups are not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.178).

Power of performed test with alpha = 0.050: 0.150

The power of the performed test (0.150) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.

T-test Results for Percent Change Dry Soil Bulk Density Measured from 0-5.1 cm at Oak Mat Areas versus Cut and Fill Locations

t-test

Thursday, October 11, 2007, 4:29:59 PM

Data source: Data 1 in Notebook 1

Normality Test: Failed ($P < 0.050$)

Test execution ended by user request, Rank Sum Test begun

Mann-Whitney Rank Sum Test

Thursday, October 11, 2007, 4:29:59 PM

Data source: Data 1 in Notebook 1

Group	N	Missing	Median	25%	75%
0-2" % Diff Bulk Denisty	6	0	10.521	0.704	13.768
% diff 0-2"	37	0	-2.288	-5.544	-0.509

Mann-Whitney U Statistic= 31.000

T = 212.000 n(small)= 6 n(big)= 37 ($P = 0.005$)

The difference in the median values between the two groups is greater than would be expected by chance; there is a statistically significant difference ($P = 0.005$)

APPENDIX C

STATISTICAL OUTPUT FOR SOIL PHYSIOCHEMICAL ANALYSIS

Paired t-test Results for Reclaimed Cut and Fill Location Soil pH versus the Nearby Undisturbed Range Measured from 0-61 cm

Paired t-test:

Thursday, October 11, 2007, 5:43:14 PM

Data source: Data 1 in 0-24 inch Soil Chemistry Paired T-tests

Normality Test: Passed (P = 0.460)

Treatment Name	N	Missing	Mean	Std Dev	SEM
pH	4	0	7.581	0.329	0.164
pH REF	4	0	7.593	0.646	0.323
Difference	4	0	-0.0122	0.401	0.201

t = -0.0609 with 3 degrees of freedom. (P = 0.955)

95 percent confidence interval for difference of means: -0.651 to 0.626

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.955)

Power of performed test with alpha = 0.050: 0.052

The power of the performed test (0.052) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Paired t-test Results for Reclaimed Cut and Fill Location Soil Electrical Conductivity versus the Nearby Undisturbed Range Measured from 0-61 cm

Paired t-test:

Thursday, October 11, 2007, 5:43:52 PM

Data source: Data 1 in 0-24 inch Soil Chemistry Paired T-tests

Normality Test: Passed (P = 0.315)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Conductivity	4	0	3.611	1.377	0.689
Conductivity REF	4	0	2.632	2.317	1.159
Difference	4	0	0.978	1.367	0.684

t = 1.431 with 3 degrees of freedom. (P = 0.248)

95 percent confidence interval for difference of means: -1.198 to 3.154

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.248)

Power of performed test with alpha = 0.050: 0.114

The power of the performed test (0.114) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Paired t-test Results for Reclaimed Cut and Fill Location Soil Percent Saturation versus the Nearby Undisturbed Range Measured from 0-61 cm

Paired t-test:

Thursday, October 11, 2007, 5:44:58 PM

Data source: Data 1 in 0-24 inch Soil Chemistry Paired T-tests

Normality Test: Passed (P = 0.286)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Saturation % REF	4	0	45.117	17.020	8.510
Saturation %	4	0	46.725	16.993	8.496
Difference	4	0	-1.608	2.275	1.137

t = -1.413 with 3 degrees of freedom. (P = 0.252)

95 percent confidence interval for difference of means: -5.228 to 2.012

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.252)

Power of performed test with alpha = 0.050: 0.111

The power of the performed test (0.111) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Paired t-test Results for Reclaimed Cut and Fill Location Soil Sodium Adsorption Ratio versus the Nearby Undisturbed Range Measured from 0-61 cm

Paired t-test:

Thursday, October 11, 2007, 5:46:32 PM

Data source: Data 1 in 0-24 inch Soil Chemistry Paired T-tests

Normality Test: Passed (P = 0.246)

Treatment Name	N	Missing	Mean	Std Dev	SEM
SAR	4	0	5.206	3.571	1.785
SAR REF	4	0	6.540	5.151	2.576
Difference	4	0	-1.334	2.474	1.237

t = -1.078 with 3 degrees of freedom. (P = 0.360)

95 percent confidence interval for difference of means: -5.271 to 2.604

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.360)

Power of performed test with alpha = 0.050: 0.062

The power of the performed test (0.062) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Paired t-test Results for Reclaimed Cut and Fill Location Soil Calcium versus the Nearby Undisturbed Range Measured from 0-61 cm

Paired t-test:

Thursday, October 11, 2007, 5:46:56 PM

Data source: Data 1 in 0-24 inch Soil Chemistry Paired T-tests

Normality Test: Passed (P = 0.272)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Calcium	4	0	18.691	3.901	1.951
Calcium REF	4	0	10.171	9.029	4.515
Difference	4	0	8.519	7.692	3.846

t = 2.215 with 3 degrees of freedom. (P = 0.114)

95 percent confidence interval for difference of means: -3.721 to 20.759

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.114)

Power of performed test with alpha = 0.050: 0.281

The power of the performed test (0.281) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Paired t-test Results for Reclaimed Cut and Fill Location Soil Magnesium versus the Nearby Undisturbed Range Measured from 0-61 cm

Paired t-test:

Thursday, October 11, 2007, 5:47:24 PM

Data source: Data 1 in 0-24 inch Soil Chemistry Paired T-tests

Normality Test: Passed (P = 0.368)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Magnesium REF	4	0	5.649	6.509	3.254
Magnesium	4	0	9.927	5.231	2.615
Difference	4	0	-4.278	4.298	2.149

t = -1.991 with 3 degrees of freedom. (P = 0.141)

95 percent confidence interval for difference of means: -11.116 to 2.561

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.141)

Power of performed test with alpha = 0.050: 0.227

The power of the performed test (0.227) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Paired t-test Results for Reclaimed Cut and Fill Location Soil Sodium versus the Nearby Undisturbed Range Measured from 0-61 cm

Paired t-test:

Thursday, October 11, 2007, 5:47:51 PM

Data source: Data 1 in 0-24 inch Soil Chemistry Paired T-tests

Normality Test: Passed (P = 0.456)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Sodium REF	4	0	21.365	20.921	10.460
Sodium	4	0	20.273	13.896	6.948
Difference	4	0	1.092	9.533	4.767

t = 0.229 with 3 degrees of freedom. (P = 0.833)

95 percent confidence interval for difference of means: -14.077 to 16.261

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.833)

Power of performed test with alpha = 0.050: 0.052

The power of the performed test (0.052) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Paired t-test Results for Reclaimed Cut and Fill Location Soil Coarse Fragment Percentage versus the Nearby Undisturbed Range Measured from 0-61 cm

Paired t-test:

Thursday, October 11, 2007, 5:48:36 PM

Data source: Data 1 in 0-24 inch Soil Chemistry Paired T-tests

Normality Test: Passed (P = 0.581)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Coarse Fragments REF	4	0	16.062	16.428	8.214
Coarse Fragments	4	0	15.375	12.614	6.307
Difference	4	0	0.687	5.173	2.586

t = 0.266 with 3 degrees of freedom. (P = 0.808)

95 percent confidence interval for difference of means: -7.544 to 8.917

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.808)

Power of performed test with alpha = 0.050: 0.052

The power of the performed test (0.052) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Paired t-test Results for Reclaimed Cut and Fill Location Soil Organic Matter versus the Nearby Undisturbed Range Measured from 0-61 cm

Paired t-test:

Thursday, October 11, 2007, 5:49:37 PM

Data source: Data 1 in 0-24 inch Soil Chemistry Paired T-tests

Normality Test: Passed (P = 0.565)

Treatment Name	N	Missing	Mean	Std Dev	SEM
OM	4	0	1.052	0.571	0.285
OM REF	4	0	0.929	0.333	0.167
Difference	4	0	0.123	0.257	0.128

t = 0.955 with 3 degrees of freedom. (P = 0.410)

95 percent confidence interval for difference of means: -0.286 to 0.531

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.410)

Power of performed test with alpha = 0.050: 0.052

The power of the performed test (0.052) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Paired t-test Results for Reclaimed Cut and Fill Location Percent Soil Calcium Carbonate versus the Nearby Undisturbed Range Measured from 0-61 cm

Paired t-test:

Thursday, October 11, 2007, 5:50:00 PM

Data source: Data 1 in 0-24 inch Soil Chemistry Paired T-tests

Normality Test: Passed (P = 0.148)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Lime	4	0	7.281	4.904	2.452
Lime REF	4	0	7.875	6.668	3.334
Difference	4	0	-0.594	2.089	1.045

t = -0.568 with 3 degrees of freedom. (P = 0.610)

95 percent confidence interval for difference of means: -3.918 to 2.731

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.610)

Power of performed test with alpha = 0.050: 0.052

The power of the performed test (0.052) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Paired t-test Results for Reclaimed Cut and Fill Location Soil Nitrate versus the Nearby Undisturbed Range Measured from 0-61 cm

Paired t-test:

Thursday, October 11, 2007, 5:51:12 PM

Data source: Data 1 in 0-24 inch Soil Chemistry Paired T-tests

Normality Test: Passed (P = 0.184)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Nitrate	4	0	7.250	4.173	2.087
Nitrate REF	4	0	2.600	1.727	0.863
Difference	4	0	4.650	4.119	2.059

t = 2.258 with 3 degrees of freedom. (P = 0.109)

95 percent confidence interval for difference of means: -1.904 to 11.204

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.109)

Power of performed test with alpha = 0.050: 0.292

The power of the performed test (0.292) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Paired t-test Results for Reclaimed Cut and Fill Location Soil Phosphorus versus the Nearby Undisturbed Range Measured from 0-61 cm

Paired t-test:

Thursday, October 11, 2007, 5:50:35 PM

Data source: Data 1 in 0-24 inch Soil Chemistry Paired T-tests

Normality Test: Passed (P = 0.413)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Phosphorus	4	0	5.106	2.490	1.245
Phosphorus REF	4	0	3.669	1.873	0.936
Difference	4	0	1.438	1.164	0.582

t = 2.470 with 3 degrees of freedom. (P = 0.090)

95 percent confidence interval for difference of means: -0.414 to 3.290

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.090)

Power of performed test with alpha = 0.050: 0.346

The power of the performed test (0.346) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Paired t-test Results for Reclaimed Cut and Fill Location Soil Potassium versus the Nearby Undisturbed Range Measured from 0-61 cm

Paired t-test:

Thursday, October 11, 2007, 5:49:11 PM

Data source: Data 1 in 0-24 inch Soil Chemistry Paired T-tests

Normality Test: Passed (P = 0.203)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Potassium REF	4	0	161.621	56.560	28.280
Potassium	4	0	216.063	68.097	34.048
Difference	4	0	-54.442	65.251	32.626

t = -1.669 with 3 degrees of freedom. (P = 0.194)

95 percent confidence interval for difference of means: -158.271 to 49.387

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.194)

Power of performed test with alpha = 0.050: 0.158

The power of the performed test (0.158) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Paired t-test Results for Reclaimed Cut and Fill Location Percent Sand versus the Nearby Undisturbed Range Measured from 0-61 cm

Paired t-test:

Monday, October 22, 2007, 7:45:21 PM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.709)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Col 2	5	1	45.810	20.973	10.487
Col 1	5	1	51.063	16.746	8.373
Difference	5	1	-5.252	6.672	3.336

t = -1.574 with 3 degrees of freedom. (P = 0.213)

95 percent confidence interval for difference of means: -15.868 to 5.364

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.213)

Power of performed test with alpha = 0.050: 0.140

The power of the performed test (0.140) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

Paired t-test Results for Reclaimed Cut and Fill Location Percent Clay versus the Nearby Undisturbed Range Measured from 0-61 cm

Paired t-test:

Monday, October 22, 2007, 7:47:06 PM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.328)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Col 6	5	2	24.416	14.488	8.365
Col 5	5	1	22.875	9.420	4.710
Difference	5	2	0.916	3.263	1.884

t = 0.486 with 2 degrees of freedom. (P = 0.675)

95 percent confidence interval for difference of means: -7.190 to 9.023

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.675)

Power of performed test with alpha = 0.050: 0.058

The power of the performed test (0.058) is below the desired power of 0.800.
Less than desired power indicates you are less likely to detect a difference when one actually exists.
Negative results should be interpreted cautiously.

T-test Results for Oak Mat Removal Area Percent Change in Soil pH versus Reclaimed Cut and Fill Locations Measured from 0-61 cm

t-test

Wednesday, October 24, 2007, 7:25:56 PM

Data source: Data 1 in Notebook 1

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Rank Sum Test begun

Mann-Whitney Rank Sum Test

Wednesday, October 24, 2007, 7:25:56 PM

Data source: Data 1 in Notebook 1

Group	N	Missing	Median	25%	75%
% Change pH	37	0	1.353	-0.121	2.467
% Change pH RCAF	4	0	-0.778	-4.212	4.543

Mann-Whitney U Statistic= 90.000

T = 68.000 n(small)= 4 n(big)= 37 (P = 0.496)

The difference in the median values between the two groups is not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.496)

T-test Results for Oak Mat Removal Area Percent Change in Electrical Conductivity versus Reclaimed Cut and Fill Locations Measured from 0-61 cm

t-test

Wednesday, October 24, 2007, 7:28:38 PM

Data source: Data 1 in RCAF v. OMRA Soil Chem % Change 0-24 inches

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Rank Sum Test begun

Mann-Whitney Rank Sum Test

Wednesday, October 24, 2007, 7:28:38 PM

Data source: Data 1 in RCAF v. OMRA Soil Chem % Change 0-24 inches

Group	N	Missing	Median	25%	75%
% Change EC	37	0	-10.896	-37.079	4.448
% Change EC RCAF	4	0	112.396	-2.259	420.687

Mann-Whitney U Statistic= 25.000

T = 133.000 n(small)= 4 n(big)= 37 (P = 0.033)

The difference in the median values between the two groups is greater than would be expected by chance; there is a statistically significant difference (P = 0.033)

T-test Results for Oak Mat Removal Area Percent Change in Saturation Percent versus Reclaimed Cut and Fill Locations Measured from 0-61 cm

t-test

Wednesday, October 24, 2007, 7:37:56 PM

Data source: Data 1 in RCAF v. OMRA Soil Chem % Change 0-24 inches

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Rank Sum Test begun

Mann-Whitney Rank Sum Test

Wednesday, October 24, 2007, 7:37:56 PM

Data source: Data 1 in RCAF v. OMRA Soil Chem % Change 0-24 inches

Group	N	Missing	Median	25%	75%
% Change Sat % RCAF	4	0	5.833	0.610	8.320
% Change Sat %	37	0	-1.609	-21.140	8.251

Mann-Whitney U Statistic= 54.000

T = 104.000 n(small)= 4 n(big)= 37 (P = 0.392)

The difference in the median values between the two groups is not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.392)

T-test Results for Oak Mat Removal Area Percent Change in Sodium Adsorption Ratio versus Reclaimed Cut and Fill Locations Measured from 0-61 cm

t-test

Wednesday, October 24, 2007, 7:29:38 PM

Data source: Data 1 in RCAF v. OMRA Soil Chem % Change 0-24 inches

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Rank Sum Test begun

Mann-Whitney Rank Sum Test

Wednesday, October 24, 2007, 7:29:38 PM

Data source: Data 1 in RCAF v. OMRA Soil Chem % Change 0-24 inches

Group	N	Missing	Median	25%	75%
% Change SAR	37	0	-19.444	-37.811	5.228
% Change SAR RCAF	4	0	-27.310	-39.806	150.429

Mann-Whitney U Statistic= 73.000

T = 85.000 n(small)= 4 n(big)= 37 (P = 0.982)

The difference in the median values between the two groups is not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.982)

T-test Results for Oak Mat Removal Area Percent Change in Coarse Fragment Percent versus Reclaimed Cut and Fill Locations Measured from 0-61 cm

t-test

Wednesday, October 24, 2007, 7:30:27 PM

Data source: Data 1 in RCAF v. OMRA Soil Chem % Change 0-24 inches

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Rank Sum Test begun

Mann-Whitney Rank Sum Test

Wednesday, October 24, 2007, 7:30:27 PM

Data source: Data 1 in RCAF v. OMRA Soil Chem % Change 0-24 inches

Group	N	Missing	Median	25%	75%
% Change Rock	38	1	-3.333	-14.636	25.833
% Change Rock RCAF	4	0	14.175	-23.330	49.649

Mann-Whitney U Statistic= 73.000

T = 85.000 n(small)= 4 n(big)= 37 (P = 0.982)

The difference in the median values between the two groups is not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.982)

T-test Results for Oak Mat Removal Area Percent Change in Soil Calcium Carbonate Percent versus Reclaimed Cut and Fill Locations Measured from 0-61 cm

t-test

Wednesday, October 24, 2007, 7:31:25 PM

Data source: Data 1 in RCAF v. OMRA Soil Chem % Change 0-24 inches

Normality Test: Passed (P = 0.092)

Equal Variance Test: Passed (P = 0.058)

Group Name	N	Missing	Mean	Std Dev	SEM
% Change CaCO ₃	37	0	-18.018	33.558	5.517
% Change CaCO ₃ RCAF	4	0	48.218	109.699	54.850

Difference -66.236

t = -2.839 with 39 degrees of freedom. (P = 0.007)

95 percent confidence interval for difference of means: -113.431 to -19.042

The difference in the mean values of the two groups is greater than would be expected by chance; there is a statistically significant difference between the input groups (P = 0.007).

Power of performed test with alpha = 0.050: 0.745

T-test Results for Oak Mat Removal Area Percent Change in Soil Nitrate versus Reclaimed Cut and Fill Locations Measured from 0-61 cm

t-test

Wednesday, October 24, 2007, 7:34:11 PM

Data source: Data 1 in RCAF v. OMRA Soil Chem % Change 0-24 inches

Normality Test: Passed (P = 0.660)

Equal Variance Test: Failed (P < 0.050)

Test execution ended by user request, Rank Sum Test begun

Mann-Whitney Rank Sum Test

Wednesday, October 24, 2007, 7:34:11 PM

Data source: Data 1 in RCAF v. OMRA Soil Chem % Change 0-24 inches

Group	N	Missing	Median	25%	75%
% Change NO3	35	2	23.529	-18.438	56.667
% Change NO3 RCAF	4	0	286.195	123.665	369.528

Mann-Whitney U Statistic= 18.000

T = 124.000 n(small)= 4 n(big)= 33 (P = 0.020)

The difference in the median values between the two groups is greater than would be expected by chance; there is a statistically significant difference (P = 0.020)

T-test Results for Oak Mat Removal Area Percent Change in Soil Phosphorus versus Reclaimed Cut and Fill Locations Measured from 0-61 cm

t-test

Wednesday, October 24, 2007, 7:32:13 PM

Data source: Data 1 in RCAF v. OMRA Soil Chem % Change 0-24 inches

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Rank Sum Test begun

Mann-Whitney Rank Sum Test

Wednesday, October 24, 2007, 7:32:13 PM

Data source: Data 1 in RCAF v. OMRA Soil Chem % Change 0-24 inches

Group	N	Missing	Median	25%	75%
% Change Phos	33	0	-14.833	-36.824	10.831
% Change Phos RCAF	4	0	43.209	18.435	64.564

Mann-Whitney U Statistic= 22.000

T = 120.000 n(small)= 4 n(big)= 33 (P = 0.033)

The difference in the median values between the two groups is greater than would be expected by chance; there is a statistically significant difference (P = 0.033)

T-test Results for Oak Mat Removal Area Percent Change in Soil Potassium versus Reclaimed Cut and Fill Locations Measured from 0-61 cm

t-test

Wednesday, October 24, 2007, 7:33:01 PM

Data source: Data 1 in RCAF v. OMRA Soil Chem % Change 0-24 inches

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Rank Sum Test begun

Mann-Whitney Rank Sum Test

Wednesday, October 24, 2007, 7:33:01 PM

Data source: Data 1 in RCAF v. OMRA Soil Chem % Change 0-24 inches

Group	N	Missing	Median	25%	75%
% Change Potas	33	0	-6.443	-20.894	10.255
% Change Potas RCAF	4	0	49.469	9.582	78.193

Mann-Whitney U Statistic= 27.000

T = 115.000 n(small)= 4 n(big)= 33 (P = 0.060)

The difference in the median values between the two groups is not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.060)

T-test Results for Oak Mat Removal Area Percent Change in Sand Percent versus Reclaimed Cut and Fill Locations Measured from 0-61 cm

t-test

Wednesday, October 24, 2007, 7:34:52 PM

Data source: Data 1 in RCAF v. OMRA Soil Chem % Change 0-24 inches

Normality Test: Passed (P = 0.295)

Equal Variance Test: Passed (P = 0.396)

Group Name	N	Missing	Mean	Std Dev	SEM
% Change Sand	37	0	-0.139	13.208	2.171
% Change Sand RCAF	4	0	15.675	17.033	8.517

Difference -15.813

t = -2.219 with 39 degrees of freedom. (P = 0.032)

95 percent confidence interval for difference of means: -30.229 to -1.398

The difference in the mean values of the two groups is greater than would be expected by chance; there is a statistically significant difference between the input groups (P = 0.032).

Power of performed test with alpha = 0.050: 0.478

T-test Results for Oak Mat Removal Area Percent Change in Clay Percent versus Reclaimed Cut and Fill Locations Measured from 0-61 cm

t-test

Wednesday, October 24, 2007, 7:36:56 PM

Data source: Data 1 in RCAF v. OMRA Soil Chem % Change 0-24 inches

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Rank Sum Test begun

Mann-Whitney Rank Sum Test

Wednesday, October 24, 2007, 7:36:56 PM

Data source: Data 1 in RCAF v. OMRA Soil Chem % Change 0-24 inches

Group	N	Missing	Median	25%	75%
% Change Clay	37	0	4.615	-2.943	10.977
% Change Clay RCAF	4	0	-8.497	-35.072	14.806

Mann-Whitney U Statistic= 99.500

T = 58.500 n(small)= 4 n(big)= 37 (P = 0.272)

The difference in the median values between the two groups is not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.272)

APPENDIX D

STATISTICAL OUTPUT FOR EFFECT OF MATTING DURATION AND
SEASONALITY

Linear Regression Results for the Percent Change in Grass Density Measured at Oak Mat Areas in Section 7 versus the Duration of Matting

Linear Regression

Tuesday, September 25, 2007, 2:18:01 PM

Data source: Sec 7 Duration v. Plant Density in Notebook 5

% change Grass Den = 46.619 + (0.00268 * duration)

N = 7

R = 0.00163 Rsqr = 0.00000267 Adj Rsqr = 0.000

Standard Error of Estimate = 93.541

	Coefficient	Std. Error	t	P
Constant	46.619	91.349	0.510	0.632
duration	0.00268	0.734	0.00365	0.997

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	0.117	0.117	0.0000134	0.997
Residual	5	43749.243	8749.849		
Total	6	43749.359	7291.560		

Normality Test: Passed (P = 0.063)

Constant Variance Test: Passed (P = 0.150)

Power of performed test with alpha = 0.050: 0.025

The power of the performed test (0.025) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Forb Density Measured at Oak Mat Areas in Section 7 versus the Duration of Matting

Linear Regression

Tuesday, September 25, 2007, 2:18:41 PM

Data source: Sec 7 Duration v. Plant Density in Notebook 5

% change Forb Den = $38.013 + (0.258 * \text{duration})$

N = 7

R = 0.0828 Rsqr = 0.00685 Adj Rsqr = 0.000

Standard Error of Estimate = 176.988

	Coefficient	Std. Error	t	P
Constant	38.013	172.841	0.220	0.835
duration	0.258	1.389	0.186	0.860

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	1081.007	1081.007	0.0345	0.860
Residual	5	156623.755	31324.751		
Total	6	157704.762	26284.127		

Normality Test: Passed (P = 0.100)

Constant Variance Test: Passed (P = 0.720)

Power of performed test with alpha = 0.050: 0.036

The power of the performed test (0.036) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Shrub Density Measured at Oak Mat Areas in Section 7 versus the Duration of Matting

Linear Regression

Tuesday, September 25, 2007, 2:19:11 PM

Data source: Sec 7 Duration v. Plant Density in Notebook 5

% change Shrub Den = -80.051 + (0.177 * duration)

N = 7

R = 0.512 Rsqr = 0.262 Adj Rsqr = 0.115

Standard Error of Estimate = 16.900

	Coefficient	Std. Error	t	P
Constant	-80.051	16.504	-4.850	0.005
duration	0.177	0.133	1.333	0.240

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	507.697	507.697	1.778	0.240
Residual	5	1428.017	285.603		
Total	6	1935.714	322.619		

Normality Test: Passed (P = 0.266)

Constant Variance Test: Passed (P = 0.491)

Power of performed test with alpha = 0.050: 0.204

The power of the performed test (0.204) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Grass Density Measured at Oak Mat Areas in Section 28 versus the Duration of Matting

Linear Regression

Tuesday, September 25, 2007, 2:14:26 PM

Data source: Sec 28 Duration v. Plant Density in Notebook 4

% change Grass Den = $9.672 - (0.164 * \text{duration})$

N = 4

R = 0.0734 Rsqr = 0.00538 Adj Rsqr = 0.000

Standard Error of Estimate = 50.277

	Coefficient	Std. Error	t	P
Constant	9.672	204.558	0.0473	0.967
duration	-0.164	1.577	-0.104	0.927

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	27.365	27.365	0.0108	0.927
Residual	2	5055.622	2527.811		
Total	3	5082.987	1694.329		

Normality Test: Passed (P = 0.182)

Constant Variance Test: Failed (P = <0.001)

Power of performed test with alpha = 0.050: 0.030

The power of the performed test (0.030) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Forb Density Measured at Oak Mat Areas in Section 28 versus the Duration of Matting

Linear Regression

Tuesday, September 25, 2007, 2:14:58 PM

Data source: Sec 28 Duration v. Plant Density in Notebook 4

% change Forb Den = -234.404 + (3.272 * duration)

N = 4

R = 0.316 Rsqr = 0.0999 Adj Rsqr = 0.000

Standard Error of Estimate = 221.423

	Coefficient	Std. Error	t	P
Constant	-234.404	900.882	-0.260	0.819
duration	3.272	6.944	0.471	0.684

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	10885.761	10885.761	0.222	0.684
Residual	2	98056.427	49028.213		
Total	3	108942.188	36314.063		

Normality Test: Passed (P = 0.594)

Constant Variance Test: Failed (P = <0.001)

Power of performed test with alpha = 0.050: 0.051

The power of the performed test (0.051) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Shrub Density Measured at Oak Mat Areas in Section 28 versus the Duration of Matting

Linear Regression

Tuesday, September 25, 2007, 2:15:24 PM

Data source: Sec 28 Duration v. Plant Density in Notebook 4

% change Shrub Den = $175.279 - (1.426 * \text{duration})$

N = 4

R = 0.414 Rsqr = 0.171 Adj Rsqr = 0.000

Standard Error of Estimate = 70.765

	Coefficient	Std. Error	t	P
Constant	175.279	287.916	0.609	0.605
duration	-1.426	2.219	-0.643	0.586

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	2067.863	2067.863	0.413	0.586
Residual	2	10015.470	5007.735		
Total	3	12083.333	4027.778		

Normality Test: Passed (P = 0.520)

Constant Variance Test: Failed (P = <0.001)

Power of performed test with alpha = 0.050: 0.064

The power of the performed test (0.064) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Grass Density Measured at Oak Mat Areas in Section 34 versus the Duration of Matting

Linear Regression

Tuesday, September 25, 2007, 1:38:16 PM

Data source: Sec 34 Duration v. Plant Density in Notebook 2

% change Grass Den = $9.272 + (0.101 * \text{duration})$

N = 9

R = 0.0715 Rsqr = 0.00511 Adj Rsqr = 0.000

Standard Error of Estimate = 64.265

	Coefficient	Std. Error	t	P
Constant	9.272	55.453	0.167	0.872
duration	0.101	0.532	0.190	0.855

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	148.416	148.416	0.0359	0.855
Residual	7	28910.190	4130.027		
Total	8	29058.606	3632.326		

Normality Test: Passed (P = 0.564)

Constant Variance Test: Passed (P = 0.050)

Power of performed test with alpha = 0.050: 0.037

The power of the performed test (0.037) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Forb Density Measured at Oak Mat Areas in Section 34 versus the Duration of Matting

Linear Regression

Tuesday, September 25, 2007, 1:41:10 PM

Data source: Sec 34 Duration v. Plant Density in Notebook 2

% change Forb Den = -91.563 + (1.103 * duration)

N = 9

R = 0.478 Rsqr = 0.229 Adj Rsqr = 0.119

Standard Error of Estimate = 92.441

	Coefficient	Std. Error	t	P
Constant	-91.563	79.765	-1.148	0.289
duration	1.103	0.765	1.441	0.193

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	17736.388	17736.388	2.076	0.193
Residual	7	59817.800	8545.400		
Total	8	77554.188	9694.273		

Normality Test: Passed (P = 0.465)

Constant Variance Test: Passed (P = 0.948)

Power of performed test with alpha = 0.050: 0.247

The power of the performed test (0.247) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Shrub Density Measured at Oak Mat Areas in Section 20 versus the Duration of Matting

Linear Regression

Tuesday, September 25, 2007, 2:02:15 PM

Data source: Sec 20 Duration v. Plant Density in Notebook 3

% change Shrub Den = -55.146 + (0.442 * duration)

N = 17

R = 0.132 Rsqr = 0.0173 Adj Rsqr = 0.000

Standard Error of Estimate = 76.706

	Coefficient	Std. Error	t	P
Constant	-55.146	85.160	-0.648	0.527
duration	0.442	0.859	0.514	0.615

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	1555.607	1555.607	0.264	0.615
Residual	15	88256.702	5883.780		
Total	16	89812.309	5613.269		

Normality Test: Passed (P = 0.323)

Constant Variance Test: Passed (P = 0.454)

Power of performed test with alpha = 0.050: 0.072

The power of the performed test (0.072) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Grass Canopy Cover Measured at Oak Mat Areas in All Sections versus the Duration of Matting

Linear Regression

Tuesday, September 25, 2007, 2:33:15 PM

Data source: All data Duration v. % Change Plant Cover in Notebook 1

% change Grass Cov = 20.763 - (0.0711 * duration)

N = 43

R = 0.0904 Rsqr = 0.00816 Adj Rsqr = 0.000

Standard Error of Estimate = 37.811

	Coefficient	Std. Error	t	P
Constant	20.763	14.938	1.390	0.172
duration	-0.0711	0.122	-0.581	0.564

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	482.483	482.483	0.337	0.564
Residual	41	58616.636	1429.674		
Total	42	59099.119	1407.122		

Normality Test: Passed (P = 0.219)

Constant Variance Test: Passed (P = 0.065)

Power of performed test with alpha = 0.050: 0.083

The power of the performed test (0.083) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Grass Canopy Cover Measured at Oak Mat Areas in Section 7 versus the Duration of Matting

Linear Regression

Tuesday, September 25, 2007, 3:06:48 PM

Data source: Sec 7 Duration v. % Change Plant Cover in Notebook 5

% change Grass Cov = 20.160 - (0.0720 * duration)

N = 7

R = 0.147 Rsqr = 0.0217 Adj Rsqr = 0.000

Standard Error of Estimate = 27.514

	Coefficient	Std. Error	t	P
Constant	20.160	26.869	0.750	0.487
duration	-0.0720	0.216	-0.333	0.753

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	84.038	84.038	0.111	0.753
Residual	5	3785.010	757.002		
Total	6	3869.048	644.841		

Normality Test: Passed (P = 0.721)

Constant Variance Test: Passed (P = 0.968)

Power of performed test with alpha = 0.050: 0.048

The power of the performed test (0.048) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Forb Canopy Cover Measured at Oak Mat Areas in Section 7 versus the Duration of Matting

Linear Regression

Tuesday, September 25, 2007, 3:07:18 PM

Data source: Sec 7 Duration v. % Change Plant Cover in Notebook 5

% change Forb Cov = -47.790 + (0.603 * duration)

N = 7

R = 0.554 Rsqr = 0.306 Adj Rsqr = 0.168

Standard Error of Estimate = 51.724

	Coefficient	Std. Error	t	P
Constant	-47.790	50.512	-0.946	0.388
duration	0.603	0.406	1.486	0.197

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	5909.022	5909.022	2.209	0.197
Residual	5	13376.692	2675.338		
Total	6	19285.714	3214.286		

Normality Test: Passed (P = 0.094)

Constant Variance Test: Passed (P = 0.341)

Power of performed test with alpha = 0.050: 0.238

The power of the performed test (0.238) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Shrub Canopy Cover Measured at Oak Mat Areas in Section 7 versus the Duration of Matting

Linear Regression

Tuesday, September 25, 2007, 3:07:57 PM

Data source: Sec 7 Duration v. % Change Plant Cover in Notebook 5

% change Shrub Cov = -76.585 - (0.0462 * duration)

N = 7

R = 0.269 Rsqr = 0.0723 Adj Rsqr = 0.000

Standard Error of Estimate = 9.433

	Coefficient	Std. Error	t	P
Constant	-76.585	9.212	-8.314	<0.001
duration	-0.0462	0.0740	-0.624	0.560

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	34.668	34.668	0.390	0.560
Residual	5	444.888	88.978		
Total	6	479.556	79.926		

Normality Test: Passed (P = 0.180)

Constant Variance Test: Passed (P = 0.341)

Power of performed test with alpha = 0.050: 0.079

The power of the performed test (0.079) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Grass Canopy Cover Measured at Oak Mat Areas in Section 28 versus the Duration of Matting

Linear Regression

Tuesday, September 25, 2007, 2:59:00 PM

Data source: Sec 28 Duration v. % Change Plant Cover in Notebook 4

% change Grass Cov = $100.139 - (0.713 * \text{duration})$

N = 4

R = 0.788 Rsqr = 0.620 Adj Rsqr = 0.431

Standard Error of Estimate = 12.577

	Coefficient	Std. Error	t	P
Constant	100.139	51.171	1.957	0.189
duration	-0.713	0.394	-1.808	0.212

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	516.966	516.966	3.268	0.212
Residual	2	316.368	158.184		
Total	3	833.333	277.778		

Normality Test: Passed (P = 0.199)

Constant Variance Test: Failed (P = <0.001)

Power of performed test with alpha = 0.050: 0.185

The power of the performed test (0.185) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Forb Canopy Cover Measured at Oak Mat Areas in Section 28 versus the Duration of Matting

Linear Regression

Tuesday, September 25, 2007, 2:59:39 PM

Data source: Sec 28 Duration v. % Change Plant Cover in Notebook 4

% change Forb Cov = -215.704 + (1.934 * duration)

N = 4

R = 0.755 Rsqr = 0.571 Adj Rsqr = 0.356

Standard Error of Estimate = 37.833

	Coefficient	Std. Error	t	P
Constant	-215.704	153.925	-1.401	0.296
duration	1.934	1.186	1.630	0.245

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	3804.060	3804.060	2.658	0.245
Residual	2	2862.607	1431.303		
Total	3	6666.667	2222.222		

Normality Test: Passed (P = 0.623)

Constant Variance Test: Failed (P = <0.001)

Power of performed test with alpha = 0.050: 0.165

The power of the performed test (0.165) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Shrub Canopy Cover Measured at Oak Mat Areas in Section 28 versus the Duration of Matting

Linear Regression

Tuesday, September 25, 2007, 3:00:13 PM

Data source: Sec 28 Duration v. % Change Plant Cover in Notebook 4

% change Shrub Cov = -11.626 - (0.236 * duration)

N = 4

R = 0.177 Rsqr = 0.0312 Adj Rsqr = 0.000

Standard Error of Estimate = 29.582

	Coefficient	Std. Error	t	P
Constant	-11.626	120.356	-0.0966	0.932
duration	-0.236	0.928	-0.254	0.823

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	56.455	56.455	0.0645	0.823
Residual	2	1750.164	875.082		
Total	3	1806.618	602.206		

Normality Test: Passed (P = 0.598)

Constant Variance Test: Failed (P = <0.001)

Power of performed test with alpha = 0.050: 0.037

The power of the performed test (0.037) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Grass Canopy Cover Measured at Oak Mat Areas in Section 34 versus the Duration of Matting

Linear Regression

Tuesday, September 25, 2007, 2:40:53 PM

Data source: Sec 34 Duration v. % Change Plant Cover in Notebook 2

% change Grass Cov = -29.237 + (0.410 * duration)

N = 9

R = 0.413 Rsqr = 0.170 Adj Rsqr = 0.0517

Standard Error of Estimate = 41.335

	Coefficient	Std. Error	t	P
Constant	-29.237	35.667	-0.820	0.439
duration	0.410	0.342	1.198	0.270

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	2453.432	2453.432	1.436	0.270
Residual	7	11960.149	1708.593		
Total	8	14413.580	1801.698		

Normality Test: Passed (P = 0.647)

Constant Variance Test: Passed (P = 0.775)

Power of performed test with alpha = 0.050: 0.188

The power of the performed test (0.188) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Forb Canopy Cover Measured at Oak Mat Areas in Section 34 versus the Duration of Matting

Linear Regression

Tuesday, September 25, 2007, 2:41:30 PM

Data source: Sec 34 Duration v. % Change Plant Cover in Notebook 2

% change Forb Cov = -83.192 + (0.970 * duration)

N = 9

R = 0.432 Rsqr = 0.186 Adj Rsqr = 0.0702

Standard Error of Estimate = 92.445

	Coefficient	Std. Error	t	P
Constant	-83.192	79.768	-1.043	0.332
duration	0.970	0.766	1.267	0.246

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	13710.562	13710.562	1.604	0.246
Residual	7	59822.771	8546.110		
Total	8	73533.333	9191.667		

Normality Test: Passed (P = 0.438)

Constant Variance Test: Passed (P = 0.809)

Power of performed test with alpha = 0.050: 0.204

The power of the performed test (0.204) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Grass Canopy Cover Measured at Oak Mat Areas in Section 20 versus the Duration of Matting

Linear Regression

Tuesday, September 25, 2007, 2:46:36 PM

Data source: Data 1 in Notebook 3

% change Grass Cov = 47.577 - (0.290 * duration)

N = 17

R = 0.171 Rsqr = 0.0291 Adj Rsqr = 0.000

Standard Error of Estimate = 38.610

	Coefficient	Std. Error	t	P
Constant	47.577	42.866	1.110	0.285
duration	-0.290	0.433	-0.671	0.512

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	671.153	671.153	0.450	0.512
Residual	15	22360.873	1490.725		
Total	16	23032.026	1439.502		

Normality Test: Passed (P = 0.450)

Constant Variance Test: Passed (P = 0.936)

Power of performed test with alpha = 0.050: 0.094

The power of the performed test (0.094) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Shrub Canopy Cover Measured at Oak Mat Areas in Section 20 versus the Duration of Matting

Linear Regression

Tuesday, September 25, 2007, 2:48:18 PM

Data source: Sec 20 Duration v. % Change Plant Cover in Notebook 3

% change Shrub Cov = -70.902 - (0.0134 * duration)

N = 17

R = 0.0175 Rsqr = 0.000307 Adj Rsqr = 0.000

Standard Error of Estimate = 17.664

	Coefficient	Std. Error	t	P
Constant	-70.902	19.610	-3.616	0.003
duration	-0.0134	0.198	-0.0679	0.947

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	1.437	1.437	0.00461	0.947
Residual	15	4679.989	311.999		
Total	16	4681.426	292.589		

Normality Test: Passed (P = 0.331)

Constant Variance Test: Passed (P = 0.382)

Power of performed test with alpha = 0.050: 0.029

The power of the performed test (0.029) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Grass Density Measured at Oak Mat Areas in Section 7 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 12:00:10 PM

Data source: Data 1 in OMRA Veg Density Seasonality Take 2

% change Grass Den = -19.798 + (0.280 * Julian Rem)

N = 7

R = 0.420 Rsqr = 0.177 Adj Rsqr = 0.0120

Standard Error of Estimate = 84.876

	Coefficient	Std. Error	t	P
Constant	-19.798	71.963	-0.275	0.794
Julian Rem	0.280	0.270	1.036	0.348

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	7729.412	7729.412	1.073	0.348
Residual	5	36019.948	7203.990		
Total	6	43749.359	7291.560		

Normality Test: Passed (P = 0.188)

Constant Variance Test: Passed (P = 0.150)

Power of performed test with alpha = 0.050: 0.144

The power of the performed test (0.144) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Forb Denisty Measured at Oak Mat Areas in Section 7 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 12:00:40 PM

Data source: Data 1 in OMRA Veg Density Seasonality Take 2

% change Forb Den = 75.724 - (0.0340 * Julian Rem)

N = 7

R = 0.0269 Rsqr = 0.000723 Adj Rsqr = 0.000

Standard Error of Estimate = 177.533

	Coefficient	Std. Error	t	P
Constant	75.724	150.522	0.503	0.636
Julian Rem	-0.0340	0.566	-0.0602	0.954

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	114.046	114.046	0.00362	0.954
Residual	5	157590.715	31518.143		
Total	6	157704.762	26284.127		

Normality Test: Passed (P = 0.087)

Constant Variance Test: Passed (P = 0.905)

Power of performed test with alpha = 0.050: 0.028

The power of the performed test (0.028) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Shrub Denisty Measured at Oak Mat Areas in Section 7 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 12:01:17 PM

Data source: Data 1 in OMRA Veg Density Seasonality Take 2

% change Shrub Den = -39.178 - (0.0864 * Julian Rem)

N = 7

R = 0.616 Rsqr = 0.380 Adj Rsqr = 0.256

Standard Error of Estimate = 15.493

	Coefficient	Std. Error	t	P
Constant	-39.178	13.136	-2.983	0.031
Julian Rem	-0.0864	0.0494	-1.751	0.140

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	735.578	735.578	3.065	0.140
Residual	5	1200.136	240.027		
Total	6	1935.714	322.619		

Normality Test: Passed (P = 0.314)

Constant Variance Test: Passed (P = 0.341)

Power of performed test with alpha = 0.050: 0.301

The power of the performed test (0.301) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Grass Density Measured at Oak Mat Areas in Section 28 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 11:58:33 AM

Data source: Data 1 in OMRA Veg Density Seasonality Take 2

% change Grass Den = 5.761 - (0.237 * Julian Rem)

N = 4

R = 0.366 Rsqr = 0.134 Adj Rsqr = 0.000

Standard Error of Estimate = 46.908

	Coefficient	Std. Error	t	P
Constant	5.761	38.801	0.148	0.896
Julian Rem	-0.237	0.426	-0.557	0.634

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	682.228	682.228	0.310	0.634
Residual	2	4400.759	2200.380		
Total	3	5082.987	1694.329		

Normality Test: Passed (P = 0.491)

Constant Variance Test: Failed (P = <0.001)

Power of performed test with alpha = 0.050: 0.058

The power of the performed test (0.058) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Forb Denisty Measured at Oak Mat Areas in Section 28 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 11:59:09 AM

Data source: Data 1 in OMRA Veg Density Seasonality Take 2

% change Forb Den = $84.930 + (1.406 * \text{Julian Rem})$

N = 4

R = 0.469 Rsqr = 0.220 Adj Rsqr = 0.000

Standard Error of Estimate = 206.165

	Coefficient	Std. Error	t	P
Constant	84.930	170.535	0.498	0.668
Julian Rem	1.406	1.874	0.750	0.531

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	23934.155	23934.155	0.563	0.531
Residual	2	85008.032	42504.016		
Total	3	108942.188	36314.063		

Normality Test: Passed (P = 0.695)

Constant Variance Test: Failed (P = <0.001)

Power of performed test with alpha = 0.050: 0.073

The power of the performed test (0.073) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Shrub Density Measured at Oak Mat Areas in Section 28 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 11:59:41 AM

Data source: Data 1 in OMRA Veg Density Seasonality Take 2

% change Shrub Den = $2.497 - (0.149 * \text{Julian Rem})$

N = 4

R = 0.150 Rsqr = 0.0224 Adj Rsqr = 0.000

Standard Error of Estimate = 76.854

	Coefficient	Std. Error	t	P
Constant	2.497	63.572	0.0393	0.972
Julian Rem	-0.149	0.699	-0.214	0.850

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	270.142	270.142	0.0457	0.850
Residual	2	11813.191	5906.596		
Total	3	12083.333	4027.778		

Normality Test: Passed (P = 0.705)

Constant Variance Test: Failed (P = <0.001)

Power of performed test with alpha = 0.050: 0.035

The power of the performed test (0.035) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Grass Density Measured at Oak Mat Areas in Section 34 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 11:38:55 AM

Data source: Data 1 in OMRA Veg Density Seasonality Take 2

% change Grass Den = $20.936 - (0.0168 * \text{Julian Rem})$

N = 9

R = 0.0256 Rsqr = 0.000653 Adj Rsqr = 0.000

Standard Error of Estimate = 64.409

	Coefficient	Std. Error	t	P
Constant	20.936	36.147	0.579	0.581
Julian Rem	-0.0168	0.248	-0.0677	0.948

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	18.989	18.989	0.00458	0.948
Residual	7	29039.617	4148.517		
Total	8	29058.606	3632.326		

Normality Test: Passed (P = 0.617)

Constant Variance Test: Passed (P = 0.550)

Power of performed test with alpha = 0.050: 0.029

The power of the performed test (0.029) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Forb Density Measured at Oak Mat Areas in Section 34 versus the Date of Complete Mat Removal (reciprocal transformation)

Linear Regression

Sunday, October 28, 2007, 11:40:59 AM

Data source: Data 1 in OMRA Veg Density Seasonality Take 2

$$1.0/(\text{col}(15)) = -0.0144 - (0.00495 * 1.0/(\text{col}(12)))$$

N = 9

R = 0.0321 Rsqr = 0.00103 Adj Rsqr = 0.000

Standard Error of Estimate = 0.027

	Coefficient	Std. Error	t	P
Constant	-0.0144	0.00974	-1.474	0.184
1.0/(col(12))	-0.00495	0.0583	-0.0848	0.935

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	0.00000525	0.00000525	0.00720	0.935
Residual	7	0.00510	0.000729		
Total	8	0.00511	0.000639		

Normality Test: Passed (P = 0.640)

Constant Variance Test: Failed (P = 0.016)

Power of performed test with alpha = 0.050: 0.030

The power of the performed test (0.030) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Shrub Denisty Measured at Oak Mat Areas in Section 34 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 11:39:51 AM

Data source: Data 1 in OMRA Veg Density Seasonality Take 2

% change Shrub Den = -86.958 + (0.312 * Julian Rem)

N = 9

R = 0.963 Rsqr = 0.928 Adj Rsqr = 0.918

Standard Error of Estimate = 8.516

	Coefficient	Std. Error	t	P
Constant	-86.958	4.779	-18.195	<0.001
Julian Rem	0.312	0.0328	9.508	<0.001

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	6555.781	6555.781	90.396	<0.001
Residual	7	507.662	72.523		
Total	8	7063.443	882.930		

Normality Test: Passed (P = 0.745)

Constant Variance Test: Passed (P = 0.491)

Power of performed test with alpha = 0.050: 0.998

Linear Regression Results for the Percent Change in Forb Denisty Measured at Oak Mat Areas in Section 20 versus the Date of Complete Mat Removal (reciprocal transformation)

Linear Regression

Sunday, October 28, 2007, 11:55:57 AM

Data source: Data 1 in OMRA Veg Density Seasonality Take 2

$$1.0/(\text{col}(24)) = -0.0218 + (0.368 * 1.0/(\text{col}(20)))$$

N = 15 Missing Observations = 2

R = 0.0485 Rsqr = 0.00235 Adj Rsqr = 0.000

Standard Error of Estimate = 0.021

	Coefficient	Std. Error	t	P
Constant	-0.0218	0.0147	-1.481	0.163
1.0/(col(20))	0.368	2.105	0.175	0.864

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	0.0000138	0.0000138	0.0306	0.864
Residual	13	0.00587	0.000451		
Total	14	0.00588	0.000420		

Normality Test: Passed (P = 0.509)

Constant Variance Test: Failed (P = 0.027)

Power of performed test with alpha = 0.050: 0.037

The power of the performed test (0.037) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Shrub Density Measured at Oak Mat Areas in Section 20 versus the Date of Complete Mat Removal (reciprocal transformation)

Linear Regression

Sunday, October 28, 2007, 11:57:00 AM

Data source: Data 1 in OMRA Veg Density Seasonality Take 2

$$1.0/(\text{col}(26)) = -0.0259 + (1.469 * 1.0/(\text{col}(20)))$$

N = 15 Missing Observations = 2

R = 0.120 Rsqr = 0.0143 Adj Rsqr = 0.000

Standard Error of Estimate = 0.035

	Coefficient	Std. Error	t	P
Constant	-0.0259	0.0243	-1.066	0.306
1.0/(col(20))	1.469	3.380	0.434	0.671

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	0.000228	0.000228	0.189	0.671
Residual	13	0.0157	0.00121		
Total	14	0.0159	0.00114		

Normality Test: Passed (P = 0.125)

Constant Variance Test: Passed (P = 0.575)

Power of performed test with alpha = 0.050: 0.061

The power of the performed test (0.061) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Grass Canopy Cover Measured at Oak Mat Areas in All Sections versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 12:04:22 PM

Data source: Data 1 in OMRA Veg Cover Seasonality Take 2

% change Grass Cov = -1.620 + (0.0933 * Julian Rem)

N = 43

R = 0.213 Rsqr = 0.0452 Adj Rsqr = 0.0219

Standard Error of Estimate = 37.098

	Coefficient	Std. Error	t	P
Constant	-1.620	11.767	-0.138	0.891
Julian Rem	0.0933	0.0669	1.393	0.171

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	2672.406	2672.406	1.942	0.171
Residual	41	56426.714	1376.261		
Total	42	59099.119	1407.122		

Normality Test: Passed (P = 0.070)

Constant Variance Test: Failed (P = 0.021)

Power of performed test with alpha = 0.050: 0.276

The power of the performed test (0.276) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Grass Canopy Cover Measured at Oak Mat Areas in Section 7 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 12:20:12 PM

Data source: Data 1 in OMRA Veg Cover Seasonality Take 2

% change Grass Cov = $-45.156 + (0.254 * \text{Julian Rem})$

N = 7

R = 0.640 Rsqr = 0.410 Adj Rsqr = 0.292

Standard Error of Estimate = 42.695

	Coefficient	Std. Error	t	P
Constant	-45.156	36.199	-1.247	0.267
Julian Rem	0.254	0.136	1.864	0.121

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	6332.483	6332.483	3.474	0.121
Residual	5	9114.343	1822.869		
Total	6	15446.825	2574.471		

Normality Test: Passed (P = 0.254)

Constant Variance Test: Passed (P = 0.181)

Power of performed test with alpha = 0.050: 0.329

The power of the performed test (0.329) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Forb Canopy Cover Measured at Oak Mat Areas in Section 7 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 12:20:42 PM

Data source: Data 1 in OMRA Veg Cover Seasonality Take 2

% change Forb Cov = $66.383 - (0.0738 * \text{Julian Rem})$

N = 7

R = 0.106 Rsqr = 0.0113 Adj Rsqr = 0.000

Standard Error of Estimate = 96.978

	Coefficient	Std. Error	t	P
Constant	66.383	82.223	0.807	0.456
Julian Rem	-0.0738	0.309	-0.239	0.821

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	536.134	536.134	0.0570	0.821
Residual	5	47023.390	9404.678		
Total	6	47559.524	7926.587		

Normality Test: Passed (P = 0.269)

Constant Variance Test: Passed (P = 0.255)

Power of performed test with alpha = 0.050: 0.040

The power of the performed test (0.040) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Shrub Canopy Cover Measured at Oak Mat Areas in Section 7 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 12:21:10 PM

Data source: Data 1 in OMRA Veg Cover Seasonality Take 2

% change Shrub Cov = -77.779 - (0.0259 * Julian Rem)

N = 7

R = 0.327 Rsqr = 0.107 Adj Rsqr = 0.000

Standard Error of Estimate = 10.477

	Coefficient	Std. Error	t	P
Constant	-77.779	8.883	-8.756	<0.001
Julian Rem	-0.0259	0.0334	-0.775	0.473

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	65.911	65.911	0.600	0.473
Residual	5	548.812	109.762		
Total	6	614.723	102.454		

Normality Test: Passed (P = 0.322)

Constant Variance Test: Passed (P = 0.217)

Power of performed test with alpha = 0.050: 0.100

The power of the performed test (0.100) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Grass Canopy Cover Measured at Oak Mat Areas in Section 28 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 12:18:24 PM

Data source: Data 1 in OMRA Veg Cover Seasonality Take 2

% change Grass Cov = 39.027 - (0.308 * Julian Rem)

N = 4

R = 0.339 Rsqr = 0.115 Adj Rsqr = 0.000

Standard Error of Estimate = 66.515

	Coefficient	Std. Error	t	P
Constant	39.027	55.020	0.709	0.552
Julian Rem	-0.308	0.605	-0.510	0.661

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	1151.407	1151.407	0.260	0.661
Residual	2	8848.593	4424.297		
Total	3	10000.000	3333.333		

Normality Test: Passed (P = 0.436)

Constant Variance Test: Failed (P = <0.001)

Power of performed test with alpha = 0.050: 0.054

The power of the performed test (0.054) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Forb Canopy Cover Measured at Oak Mat Areas in Section 28 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 12:18:55 PM

Data source: Data 1 in OMRA Veg Cover Seasonality Take 2

% change Forb Cov = 8.227 + (0.461 * Julian Rem)

N = 4

R = 0.699 Rsqr = 0.488 Adj Rsqr = 0.232

Standard Error of Estimate = 36.759

	Coefficient	Std. Error	t	P
Constant	8.227	30.407	0.271	0.812
Julian Rem	0.461	0.334	1.381	0.301

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	2575.267	2575.267	1.906	0.301
Residual	2	2702.510	1351.255		
Total	3	5277.778	1759.259		

Normality Test: Passed (P = 0.662)

Constant Variance Test: Failed (P = <0.001)

Power of performed test with alpha = 0.050: 0.137

The power of the performed test (0.137) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Shrub Canopy Cover Measured at Oak Mat Areas in Section 28 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 12:19:32 PM

Data source: Data 1 in OMRA Veg Cover Seasonality Take 2

% change Shrub Cov = 45.732 - (0.717 * Julian Rem)

N = 4

R = 0.421 Rsqr = 0.177 Adj Rsqr = 0.000

Standard Error of Estimate = 120.350

	Coefficient	Std. Error	t	P
Constant	45.732	99.550	0.459	0.691
Julian Rem	-0.717	1.094	-0.655	0.579

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	6222.878	6222.878	0.430	0.579
Residual	2	28968.095	14484.047		
Total	3	35190.972	11730.324		

Normality Test: Passed (P = 0.705)

Constant Variance Test: Failed (P = <0.001)

Power of performed test with alpha = 0.050: 0.065

The power of the performed test (0.065) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Grass Canopy Cover Measured at Oak Mat Areas in Section 34 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 12:09:32 PM

Data source: Data 1 in OMRA Veg Cover Seasonality Take 2

% change Grass Cov = -6.744 + (0.0722 * Julian Rem)

N = 9

R = 0.148 Rsqr = 0.0219 Adj Rsqr = 0.000

Standard Error of Estimate = 47.351

	Coefficient	Std. Error	t	P
Constant	-6.744	26.574	-0.254	0.807
Julian Rem	0.0722	0.182	0.396	0.704

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	351.381	351.381	0.157	0.704
Residual	7	15694.852	2242.122		
Total	8	16046.233	2005.779		

Normality Test: Passed (P = 0.320)

Constant Variance Test: Passed (P = 0.308)

Power of performed test with alpha = 0.050: 0.055

The power of the performed test (0.055) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Forb Canopy Cover Measured at Oak Mat Areas in Section 34 versus the Date of Complete Mat Removal (reciprocal transformation)

Linear Regression

Sunday, October 28, 2007, 12:11:22 PM

Data source: Data 1 in OMRA Veg Cover Seasonality Take 2

$$1.0/(\text{col}(15)) = -0.0200 + (0.408 * 1.0/(\text{col}(12)))$$

N = 7 Missing Observations = 2

R = 0.0692 Rsqr = 0.00479 Adj Rsqr = 0.000

Standard Error of Estimate = 0.018

	Coefficient	Std. Error	t	P
Constant	-0.0200	0.0242	-0.828	0.446
1.0/(col(12))	0.408	2.629	0.155	0.883

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	0.00000746	0.00000746	0.0241	0.883
Residual	5	0.00155	0.000310		
Total	6	0.00156	0.000260		

Normality Test: Passed (P = 0.279)

Constant Variance Test: Passed (P = 0.545)

Power of performed test with alpha = 0.050: 0.034

The power of the performed test (0.034) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Shrub Canopy Cover Measured at Oak Mat Areas in Section 34 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 12:10:20 PM

Data source: Data 1 in OMRA Veg Cover Seasonality Take 2

% change Shrub Cov = $-105.516 + (0.289 * \text{Julian Rem})$

N = 9

R = 0.898 Rsqr = 0.807 Adj Rsqr = 0.780

Standard Error of Estimate = 13.870

	Coefficient	Std. Error	t	P
Constant	-105.516	7.784	-13.556	<0.001
Julian Rem	0.289	0.0534	5.414	<0.001

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	5638.820	5638.820	29.313	<0.001
Residual	7	1346.569	192.367		
Total	8	6985.389	873.174		

Normality Test: Passed (P = 0.311)

Constant Variance Test: Passed (P = 0.676)

Power of performed test with alpha = 0.050: 0.948

Linear Regression Results for the Percent Change in Shrub Canopy Cover Measured at Oak Mat Areas in Section 20 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 12:12:42 PM

Data source: Data 1 in OMRA Veg Cover Seasonality Take 2

% change Shrub Cov = -67.770 - (0.0217 * Julian Rem)

N = 17

R = 0.0602 Rsqr = 0.00362 Adj Rsqr = 0.000

Standard Error of Estimate = 16.755

	Coefficient	Std. Error	t	P
Constant	-67.770	15.880	-4.268	<0.001
Julian Rem	-0.0217	0.0930	-0.234	0.818

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	15.311	15.311	0.0545	0.818
Residual	15	4210.807	280.720		
Total	16	4226.118	264.132		

Normality Test: Passed (P = 0.117)

Constant Variance Test: Passed (P = 0.326)

Power of performed test with alpha = 0.050: 0.041

The power of the performed test (0.041) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-5.1 cm at Oak Mat Areas in All Sections versus the Duration of Matting

Linear Regression

Tuesday, September 18, 2007, 6:48:32 PM

Data source: All Data Duration / Date v. Density in Notebook 1

$$0-2'' \% \text{ diff} = -5.275 + (0.0212 * \text{Duration (days)})$$

N = 37 Missing Observations = 1

R = 0.194 Rsqr = 0.0377 Adj Rsqr = 0.0102

Standard Error of Estimate = 4.444

	Coefficient	Std. Error	t	P
Constant	-5.275	2.085	-2.530	0.016
Duration (days)	0.0212	0.0181	1.171	0.250

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	27.070	27.070	1.371	0.250
Residual	35	691.190	19.748		
Total	36	718.260	19.952		

Normality Test: Passed (P = 0.591)

Constant Variance Test: Passed (P = 0.110)

Power of performed test with alpha = 0.050: 0.208

The power of the performed test (0.208) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

=====
% Confidence Intervals:
=====

Row	Predicted	95% Conf-L	95% Conf-U
1	-0.326	-5.176	4.524
2	-3.258	-4.812	-1.703
3	-2.875	-4.371	-1.379
4	-3.173	-4.689	-1.656
5	-3.555	-5.333	-1.777
6	-2.981	-4.465	-1.498
7	-0.411	-5.121	4.299
8	-2.960	-4.444	-1.476
9	-2.726	-4.278	-1.175
10	-3.003	-4.486	-1.519
11	-2.195	-4.219	-0.172
12	-2.238	-4.212	-0.264
13	-4.086	-6.497	-1.675
14	-4.022	-6.347	-1.697
15	-2.047	-4.254	0.160
16	-3.916	-6.103	-1.729

17	-3.725	-5.681	-1.769
18	-1.473	-4.492	1.545
19	-3.364	-4.983	-1.745
20	-3.236	-4.780	-1.693
21	-3.236	-4.780	-1.693
22	-3.704	-5.636	-1.771
23	-3.109	-4.606	-1.611
24	-4.150	-6.649	-1.650
25	-2.535	-4.215	-0.856
26	-3.173	-4.689	-1.656
27	-3.958	-6.200	-1.717
28	-2.790	-4.313	-1.267
29	-2.705	-4.268	-1.142
30	-2.960	-4.444	-1.476
31	-3.427	-5.094	-1.761
32	-3.300	-4.878	-1.722
33	-2.599	-4.229	-0.969
34	-3.619	-5.460	-1.777
35	-2.833	-4.341	-1.325
36	-3.555	-5.333	-1.777
37	-3.385	-5.019	-1.751

Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-15.2 cm at Oak Mat Areas in All Sections versus the Duration of Matting

Linear Regression

Tuesday, September 18, 2007, 6:49:19 PM

Data source: All Data Duration / Date v. Density in Notebook 1

$$0-6" \% \text{ diff} = 1.696 + (0.00147 * \text{Duration (days)})$$

N = 37 Missing Observations = 1

R = 0.0151 Rsqr = 0.000228 Adj Rsqr = 0.000

Standard Error of Estimate = 4.037

	Coefficient	Std. Error	t	P
Constant	1.696	1.894	0.896	0.376
Duration (days)	0.00147	0.0165	0.0894	0.929

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	0.130	0.130	0.00799	0.929
Residual	35	570.312	16.295		
Total	36	570.442	15.846		

Normality Test: Passed (P = 0.748)

Constant Variance Test: Passed (P = 0.934)

Power of performed test with alpha = 0.050: 0.031

The power of the performed test (0.031) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

=====
% Confidence Intervals:
=====

Row	Predicted	95% Conf-L	95% Conf-U
1	2.040	-2.366	6.445
2	1.836	0.425	3.248
3	1.863	0.504	3.222
4	1.842	0.465	3.220
5	1.816	0.201	3.431
6	1.856	0.508	3.203
7	2.034	-2.245	6.312
8	1.857	0.509	3.205
9	1.873	0.464	3.283
10	1.854	0.507	3.201
11	1.910	0.0719	3.748
12	1.907	0.114	3.700
13	1.779	-0.411	3.969
14	1.783	-0.329	3.896
15	1.920	-0.0845	3.925
16	1.791	-0.195	3.777

17	1.804	0.0273	3.581
18	1.960	-0.782	4.702
19	1.829	0.358	3.300
20	1.838	0.436	3.240
21	1.838	0.436	3.240
22	1.805	0.0504	3.561
23	1.847	0.486	3.207
24	1.775	-0.496	4.045
25	1.886	0.361	3.412
26	1.842	0.465	3.220
27	1.788	-0.248	3.824
28	1.869	0.486	3.252
29	1.875	0.455	3.294
30	1.857	0.509	3.205
31	1.825	0.311	3.338
32	1.833	0.400	3.267
33	1.882	0.401	3.363
34	1.811	0.139	3.484
35	1.866	0.496	3.236
36	1.816	0.201	3.431
37	1.828	0.343	3.312

Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-30.5 cm at Oak Mat Areas in All Sections versus the Duration of Matting

Linear Regression

Tuesday, September 18, 2007, 6:50:04 PM

Data source: All Data Duration / Date v. Density in Notebook 1

0-12" % diff = 4.379 - (0.00406 * Duration (days))

N = 37 Missing Observations = 1

R = 0.0389 Rsqr = 0.00152 Adj Rsqr = 0.000

Standard Error of Estimate = 4.316

	Coefficient	Std. Error	t	P
Constant	4.379	2.025	2.163	0.037
Duration (days)	-0.00406	0.0176	-0.231	0.819

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	0.990	0.990	0.0532	0.819
Residual	35	651.889	18.625		
Total	36	652.880	18.136		

Normality Test: Passed (P = 0.824)

Constant Variance Test: Passed (P = 0.501)

Power of performed test with alpha = 0.050: 0.042

The power of the performed test (0.042) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

=====
% Confidence Intervals:
=====

Row	Predicted	95% Conf-L	95% Conf-U
1	3.432	-1.278	8.143
2	3.993	2.484	5.502
3	3.920	2.467	5.373
4	3.977	2.504	5.450
5	4.050	2.323	5.777
6	3.940	2.500	5.381
7	3.449	-1.126	8.023
8	3.936	2.495	5.377
9	3.891	2.385	5.398
10	3.944	2.504	5.385
11	3.790	1.825	5.755
12	3.798	1.881	5.715
13	4.151	1.810	6.493
14	4.139	1.881	6.397
15	3.761	1.618	5.905
16	4.119	1.995	6.242

17	4.082	2.183	5.982
18	3.652	0.720	6.583
19	4.013	2.441	5.586
20	3.989	2.490	5.488
21	3.989	2.490	5.488
22	4.078	2.202	5.955
23	3.965	2.510	5.419
24	4.164	1.736	6.591
25	3.855	2.224	5.486
26	3.977	2.504	5.450
27	4.127	1.950	6.304
28	3.904	2.425	5.383
29	3.887	2.370	5.405
30	3.936	2.495	5.377
31	4.026	2.407	5.644
32	4.001	2.469	5.534
33	3.867	2.284	5.450
34	4.062	2.274	5.850
35	3.912	2.447	5.376
36	4.050	2.323	5.777
37	4.017	2.430	5.604

Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-5.1 cm at Oak Mat Areas in Section 7 versus the Duration of Matting

Linear Regression

Tuesday, September 18, 2007, 7:10:50 PM

Data source: Data 1 in Notebook 1

$$0\text{-}2'' \text{ \% diff} = -10.304 + (0.0397 * \text{Duration (days)})$$

N = 6

R = 0.328 Rsqr = 0.107 Adj Rsqr = 0.000

Standard Error of Estimate = 6.936

	Coefficient	Std. Error	t	P
Constant	-10.304	7.480	-1.378	0.240
Duration (days)	0.0397	0.0573	0.693	0.526

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	23.137	23.137	0.481	0.526
Residual	4	192.454	48.113		
Total	5	215.591	43.118		

Normality Test: Passed (P = 0.543)

Constant Variance Test: Passed (P = 0.060)

Power of performed test with alpha = 0.050: 0.085

The power of the performed test (0.085) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

=====
% Confidence Intervals:
=====

Row	Predicted	95% Conf-L	95% Conf-U
1	-6.529	-15.401	2.342
2	-5.814	-13.775	2.146
3	-6.370	-14.966	2.225
4	-7.086	-17.183	3.012
5	-6.013	-14.136	2.110
6	-1.205	-20.123	17.712

Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-15.2 cm at Oak Mat Areas in Section 7 versus the Duration of Matting

Linear Regression

Tuesday, September 18, 2007, 7:11:37 PM

Data source: Data 1 in Notebook 1

0-6" % diff = -0.615 - (0.00336 * Duration (days))

N = 6

R = 0.0478 Rsqr = 0.00228 Adj Rsqr = 0.000

Standard Error of Estimate = 4.246

	Coefficient	Std. Error	t	P
Constant	-0.615	4.579	-0.134	0.900
Duration (days)	-0.00336	0.0351	-0.0957	0.928

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	0.165	0.165	0.00915	0.928
Residual	4	72.111	18.028		
Total	5	72.276	14.455		

Normality Test: Passed (P = 0.613)

Constant Variance Test: Passed (P = 0.060)

Power of performed test with alpha = 0.050: 0.030

The power of the performed test (0.030) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

=====
% Confidence Intervals:
=====

Row	Predicted	95% Conf-L	95% Conf-U
1	-0.933	-6.364	4.497
2	-0.994	-5.867	3.879
3	-0.947	-6.208	4.314
4	-0.887	-7.068	5.295
5	-0.977	-5.949	3.995
6	-1.383	-12.963	10.197

Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-30.5 cm at Oak Mat Areas in Section 7 versus the Duration of Matting

Linear Regression

Tuesday, September 18, 2007, 7:12:20 PM

Data source: Data 1 in Notebook 1

0-12" % diff = 4.079 - (0.0280 * Duration (days))

N = 6

R = 0.325 Rsqr = 0.106 Adj Rsqr = 0.000

Standard Error of Estimate = 4.934

	Coefficient	Std. Error	t	P
Constant	4.079	5.321	0.767	0.486
Duration (days)	-0.0280	0.0408	-0.687	0.530

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	11.501	11.501	0.472	0.530
Residual	4	97.383	24.346		
Total	5	108.884	21.777		

Normality Test: Passed (P = 0.648)

Constant Variance Test: Passed (P = 0.060)

Power of performed test with alpha = 0.050: 0.084

The power of the performed test (0.084) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

=====
% Confidence Intervals:
=====

Row	Predicted	95% Conf-L	95% Conf-U
1	1.418	-4.893	7.728
2	0.914	-4.749	6.576
3	1.306	-4.808	7.420
4	1.810	-5.373	8.993
5	1.054	-4.725	6.832
6	-2.336	-15.793	11.121

Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-5.1 cm at Oak Mat Areas in Section 28 versus the Duration of Matting

Linear Regression

Wednesday, September 19, 2007, 8:10:22 AM

Data source: Section 28 Density Data in Notebook 1

% diff 0-2" = -7.731 + (0.0277 * Duration (days))

N = 4

R = 0.306 Rsqr = 0.0934 Adj Rsqr = 0.000

Standard Error of Estimate = 1.947

	Coefficient	Std. Error	t	P
Constant	-7.731	7.923	-0.976	0.432
Duration (days)	0.0277	0.0611	0.454	0.694

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	0.781	0.781	0.206	0.694
Residual	2	7.584	3.792		
Total	3	8.365	2.788		

Normality Test: Passed (P = 0.464)

Constant Variance Test: Failed (P = <0.001)

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

=====
% Confidence Intervals:
=====

Row	Predicted	95% Conf-L	95% Conf-U
1	-4.404	-9.183	0.375
2	-4.764	-11.850	2.321
3	-3.711	-9.693	2.271
4	-3.766	-9.385	1.852

Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-15.2 cm at Oak Mat Areas in Section 28 versus the Duration of Matting

Linear Regression

Wednesday, September 19, 2007, 8:10:56 AM

Data source: Section 28 Density Data in Notebook 1

% diff 0-6" = $-0.522 + (0.0107 * \text{Duration (days)})$

N = 4

R = 0.0652 Rsqr = 0.00425 Adj Rsqr = 0.000

Standard Error of Estimate = 3.704

	Coefficient	Std. Error	t	P
Constant	-0.522	15.069	-0.0347	0.975
Duration (days)	0.0107	0.116	0.0924	0.935

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	0.117	0.117	0.00853	0.935
Residual	2	27.434	13.717		
Total	3	27.551	9.184		

Normality Test: Passed (P = 0.518)

Constant Variance Test: Failed (P = <0.001)

Power of performed test with alpha = 0.050: 0.029

The power of the performed test (0.029) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

=====
% Confidence Intervals:
=====

Row	Predicted	95% Conf-L	95% Conf-U
1	0.765	-8.324	9.854
2	0.626	-12.851	14.103
3	1.034	-10.343	12.411
4	1.012	-9.674	11.699

Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-30.5 cm at Oak Mat Areas in Section 28 versus the Duration of Matting

Linear Regression

Wednesday, September 19, 2007, 8:11:31 AM

Data source: Section 28 Density Data in Notebook 1

% diff 0-12" = $4.712 - (0.0228 * \text{Duration (days)})$

N = 4

R = 0.254 Rsqr = 0.0644 Adj Rsqr = 0.000

Standard Error of Estimate = 1.963

	Coefficient	Std. Error	t	P
Constant	4.712	7.985	0.590	0.615
Duration (days)	-0.0228	0.0615	-0.371	0.746

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	0.530	0.530	0.138	0.746
Residual	2	7.703	3.852		
Total	3	8.234	2.745		

Normality Test: Passed (P = 0.176)

Constant Variance Test: Failed (P = <0.001)

Power of performed test with alpha = 0.050: 0.045

The power of the performed test (0.045) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

=====
% Confidence Intervals:
=====

Row	Predicted	95% Conf-L	95% Conf-U
1	1.971	-2.845	6.787
2	2.268	-4.873	9.410
3	1.400	-4.628	7.429
4	1.446	-4.217	7.109

Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-5.1 cm at Oak Mat Areas in Section 34 versus the Duration of Matting

Linear Regression

Wednesday, September 19, 2007, 8:24:10 AM

Data source: Section 34 Density Data in Notebook 1

% diff 0-2" = -6.404 + (0.0169 * Duration (days))

N = 9

R = 0.206 Rsqr = 0.0424 Adj Rsqr = 0.000

Standard Error of Estimate = 3.676

	Coefficient	Std. Error	t	P
Constant	-6.404	3.172	-2.019	0.083
Duration (days)	0.0169	0.0304	0.557	0.595

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	4.187	4.187	0.310	0.595
Residual	7	94.617	13.517		
Total	8	98.804	12.350		

Normality Test: Passed (P = 0.479)

Constant Variance Test: Passed (P = 0.913)

Power of performed test with alpha = 0.050: 0.074

The power of the performed test (0.074) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

=====
% Confidence Intervals:
=====

Row	Predicted	95% Conf-L	95% Conf-U
1	-5.455	-9.546	-1.364
2	-5.404	-9.346	-1.463
3	-3.829	-8.787	1.130
4	-5.320	-9.027	-1.613
5	-5.167	-8.509	-1.826
6	-3.371	-10.005	3.263
7	-4.879	-7.810	-1.948
8	-4.778	-7.675	-1.880
9	-4.778	-7.675	-1.880

Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-15.2 cm at Oak Mat Areas in Section 34 versus the Duration of Matting

Linear Regression

Wednesday, September 19, 2007, 8:24:58 AM

Data source: Section 34 Density Data in Notebook 1

% diff 0-6" = -2.042 + (0.0441 * Duration (days))

N = 9

R = 0.332 Rsqr = 0.110 Adj Rsqr = 0.000

Standard Error of Estimate = 5.718

	Coefficient	Std. Error	t	P
Constant	-2.042	4.934	-0.414	0.691
Duration (days)	0.0441	0.0474	0.931	0.383

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	28.349	28.349	0.867	0.383
Residual	7	228.879	32.697		
Total	8	257.228	32.154		

Normality Test: Passed (P = 0.763)

Constant Variance Test: Passed (P = 0.381)

Power of performed test with alpha = 0.050: 0.132

The power of the performed test (0.132) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

=====
% Confidence Intervals:
=====

Row	Predicted	95% Conf-L	95% Conf-U
1	0.427	-5.936	6.789
2	0.559	-5.571	6.689
3	4.659	-3.053	12.371
4	0.779	-4.986	6.545
5	1.176	-4.021	6.373
6	5.850	-4.468	16.167
7	1.926	-2.633	6.484
8	2.190	-2.317	6.697
9	2.190	-2.317	6.697

Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-30.5 cm at Oak Mat Areas in Section 34 versus the Duration of Matting

Linear Regression

Wednesday, September 19, 2007, 8:25:30 AM

Data source: Section 34 Density Data in Notebook 1

% diff 0-12" = -5.084 + (0.0777 * Duration (days))

N = 9

R = 0.788 Rsqr = 0.621 Adj Rsqr = 0.566

Standard Error of Estimate = 2.775

	Coefficient	Std. Error	t	P
Constant	-5.084	2.394	-2.123	0.071
Duration (days)	0.0777	0.0230	3.383	0.012

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	88.140	88.140	11.447	0.012
Residual	7	53.900	7.700		
Total	8	142.040	17.755		

Normality Test: Passed (P = 0.111)

Constant Variance Test: Passed (P = 0.775)

Power of performed test with alpha = 0.050: 0.742

=====
% Confidence Intervals:
=====

Row	Predicted	95% Conf-L	95% Conf-U
1	-0.730	-3.818	2.358
2	-0.497	-3.472	2.478
3	6.734	2.991	10.476
4	-0.108	-2.906	2.690
5	0.592	-1.930	3.114
6	8.833	3.826	13.839
7	1.913	-0.299	4.126
8	2.380	0.193	4.567
9	2.380	0.193	4.567

Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-5.1 cm at Oak Mat Areas in Section 20 versus the Duration of Matting

Linear Regression

Tuesday, September 18, 2007, 7:25:12 PM

Data source: Section 20 Data Analysis in Notebook 1

0-2" % diff = -1.036 - (0.00260 * Duration (days))

N = 17 Missing Observations = 1

R = 0.0154 Rsqr = 0.000237 Adj Rsqr = 0.000

Standard Error of Estimate = 3.884

	Coefficient	Std. Error	t	P
Constant	-1.036	4.312	-0.240	0.813
Duration (days)	-0.00260	0.0435	-0.0597	0.953

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	0.0537	0.0537	0.00356	0.953
Residual	15	226.313	15.088		
Total	16	226.367	14.148		

Normality Test: Passed (P = 0.252)

Constant Variance Test: Passed (P = 0.302)

Power of performed test with alpha = 0.050: 0.029

The power of the performed test (0.029) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

=====
% Confidence Intervals:
=====

Row	Predicted	95% Conf-L	95% Conf-U
1	-1.319	-3.628	0.990
2	-1.228	-4.138	1.681
3	-1.301	-3.368	0.766
4	-1.174	-5.698	3.350
5	-1.371	-4.977	2.235
6	-1.293	-3.313	0.726
7	-1.197	-4.991	2.597
8	-1.340	-4.092	1.412
9	-1.350	-4.369	1.668
10	-1.319	-3.628	0.990
11	-1.262	-3.463	0.938
12	-1.278	-3.315	0.759
13	-1.363	-4.742	2.015
14	-1.239	-3.893	1.415
15	-1.335	-3.964	1.294
16	-1.247	-3.727	1.234

17	-1.267	-3.399	0.864
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Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-15.2 cm at Oak Mat Areas in Section 20 versus the Duration of Matting

Linear Regression

Tuesday, September 18, 2007, 7:25:57 PM

Data source: Section 20 Data Analysis in Notebook 1

0-6" % diff = 6.867 - (0.0424 * Duration (days))

N = 17 Missing Observations = 1

R = 0.323 Rsqr = 0.104 Adj Rsqr = 0.0446

Standard Error of Estimate = 2.865

	Coefficient	Std. Error	t	P
Constant	6.867	3.180	2.159	0.047
Duration (days)	-0.0424	0.0321	-1.322	0.206

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	14.332	14.332	1.746	0.206
Residual	15	123.094	8.206		
Total	16	137.426	8.589		

Normality Test: Passed (P = 0.140)

Constant Variance Test: Passed (P = 0.666)

Power of performed test with alpha = 0.050: 0.240

The power of the performed test (0.240) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

=====
% Confidence Intervals:
=====

Row	Predicted	95% Conf-L	95% Conf-U
1	2.244	0.541	3.947
2	3.728	1.582	5.874
3	2.541	1.016	4.065
4	4.619	1.283	7.955
5	1.396	-1.264	4.055
6	2.668	1.179	4.157
7	4.237	1.439	7.035
8	1.905	-0.125	3.935
9	1.735	-0.491	3.961
10	2.244	0.541	3.947
11	3.177	1.554	4.800
12	2.923	1.420	4.425
13	1.523	-0.969	4.015
14	3.559	1.602	5.516
15	1.990	0.0507	3.928
16	3.432	1.602	5.261

17	3.092	1.520	4.664
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Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-30.5 cm at Oak Mat Areas in Section 20 versus the Duration of Matting

Linear Regression

Tuesday, September 18, 2007, 7:26:31 PM

Data source: Section 20 Data Analysis in Notebook 1

0-12" % diff = 9.714 - (0.0344 * Duration (days))

N = 17 Missing Observations = 1

R = 0.224 Rsqr = 0.0502 Adj Rsqr = 0.000

Standard Error of Estimate = 3.447

	Coefficient	Std. Error	t	P
Constant	9.714	3.827	2.538	0.023
Duration (days)	-0.0344	0.0386	-0.890	0.388

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	9.412	9.412	0.792	0.388
Residual	15	178.261	11.884		
Total	16	187.673	11.730		

Normality Test: Passed (P = 0.623)

Constant Variance Test: Passed (P = 0.673)

Power of performed test with alpha = 0.050: 0.134

The power of the performed test (0.134) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

=====
% Confidence Intervals:
=====

Row	Predicted	95% Conf-L	95% Conf-U
1	5.968	3.919	8.017
2	7.171	4.588	9.754
3	6.209	4.374	8.043
4	7.893	3.878	11.908
5	5.281	2.080	8.481
6	6.312	4.520	8.104
7	7.583	4.216	10.951
8	5.693	3.250	8.136
9	5.556	2.877	8.234
10	5.968	3.919	8.017
11	6.724	4.771	8.677
12	6.518	4.710	8.326
13	5.384	2.385	8.382
14	7.034	4.678	9.389
15	5.762	3.429	8.095
16	6.930	4.729	9.132

17	6.655	4.764	8.547
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Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-5.1 cm at Oak Mat Areas in All Sections versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 2:26:53 PM

Data source: Data 1 in Notebook 1

% diff 0-2" = -2.112 - (0.00550 * Julian rem)

N = 37 Missing Observations = 3

R = 0.109 Rsqr = 0.0118 Adj Rsqr = 0.000

Standard Error of Estimate = 4.503

	Coefficient	Std. Error	t	P
Constant	-2.112	1.545	-1.367	0.180
Julian rem	-0.00550	0.00850	-0.647	0.522

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	8.486	8.486	0.418	0.522
Residual	35	709.774	20.279		
Total	36	718.260	19.952		

Normality Test: Passed (P = 0.197)

Constant Variance Test: Passed (P = 0.143)

Power of performed test with alpha = 0.050: 0.093

The power of the performed test (0.093) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-15.2 cm at Oak Mat Areas in All Sections versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 2:27:25 PM

Data source: Data 1 in Notebook 1

% diff 0-6" = 2.304 - (0.00281 * Julian rem)

N = 37 Missing Observations = 3

R = 0.0624 Rsqr = 0.00390 Adj Rsqr = 0.000

Standard Error of Estimate = 4.029

	Coefficient	Std. Error	t	P
Constant	2.304	1.382	1.667	0.104
Julian rem	-0.00281	0.00760	-0.370	0.713

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	2.224	2.224	0.137	0.713
Residual	35	568.218	16.235		
Total	36	570.442	15.846		

Normality Test: Passed (P = 0.801)

Constant Variance Test: Passed (P = 0.782)

Power of performed test with alpha = 0.050: 0.055

The power of the performed test (0.055) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-30.5 cm at Oak Mat Areas in All Sections versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 2:27:54 PM

Data source: Data 1 in Notebook 1

% diff 0-12" = 2.946 + (0.00624 * Julian rem)

N = 37 Missing Observations = 3

R = 0.129 Rsqr = 0.0168 Adj Rsqr = 0.000

Standard Error of Estimate = 4.283

	Coefficient	Std. Error	t	P
Constant	2.946	1.469	2.005	0.053
Julian rem	0.00624	0.00808	0.772	0.445

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	10.944	10.944	0.597	0.445
Residual	35	641.936	18.341		
Total	36	652.880	18.136		

Normality Test: Passed (P = 0.600)

Constant Variance Test: Passed (P = 0.117)

Power of performed test with alpha = 0.050: 0.115

The power of the performed test (0.115) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-5.1 cm at Oak Mat Areas in Section 7 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 2:40:14 PM

Data source: Data 1 in Notebook 1

% Change 0-2 Inch Increment = $-1.207 - (0.0155 * \text{Julian rem})$

N = 6

R = 0.193 Rsqr = 0.0371 Adj Rsqr = 0.000

Standard Error of Estimate = 7.204

	Coefficient	Std. Error	t	P
Constant	-1.207	11.327	-0.107	0.920
Julian rem	-0.0155	0.0394	-0.393	0.715

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	8.003	8.003	0.154	0.715
Residual	4	207.588	51.897		
Total	5	215.591	43.118		

Normality Test: Passed (P = 0.771)

Constant Variance Test: Passed (P = 0.060)

Power of performed test with alpha = 0.050: 0.052

The power of the performed test (0.052) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-15.2 cm at Oak Mat Areas in Section 7 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 2:40:42 PM

Data source: Data 1 in Notebook 1

% Change 0-6 Inch Increment = $-2.722 + (0.00613 * \text{Julian rem})$

N = 6

R = 0.132 Rsqr = 0.0174 Adj Rsqr = 0.000

Standard Error of Estimate = 4.214

	Coefficient	Std. Error	t	P
Constant	-2.722	6.625	-0.411	0.702
Julian rem	0.00613	0.0231	0.266	0.803

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	1.256	1.256	0.0707	0.803
Residual	4	71.020	17.755		
Total	5	72.276	14.455		

Normality Test: Passed (P = 0.751)

Constant Variance Test: Passed (P = 0.060)

Power of performed test with alpha = 0.050: 0.042

The power of the performed test (0.042) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-30.5 cm at Oak Mat Areas in Section 7 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 2:41:17 PM

Data source: Data 1 in Notebook 1

% Change 0-12 Inch Increment = $-5.394 + (0.0219 * \text{Julian rem})$

N = 6

R = 0.384 Rsqr = 0.148 Adj Rsqr = 0.000

Standard Error of Estimate = 4.817

	Coefficient	Std. Error	t	P
Constant	-5.394	7.574	-0.712	0.516
Julian rem	0.0219	0.0264	0.832	0.452

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	16.075	16.075	0.693	0.452
Residual	4	92.809	23.202		
Total	5	108.884	21.777		

Normality Test: Passed (P = 0.524)

Constant Variance Test: Passed (P = 0.060)

Power of performed test with alpha = 0.050: 0.104

The power of the performed test (0.104) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-5.1 cm at Oak Mat Areas in Section 28 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 2:38:25 PM

Data source: Data 1 in Notebook 1

% Change 0-2 Inch Increment = $-4.333 + (0.00236 * \text{Julian rem})$

N = 4

R = 0.0899 Rsqr = 0.00808 Adj Rsqr = 0.000

Standard Error of Estimate = 2.037

	Coefficient	Std. Error	t	P
Constant	-4.333	1.685	-2.572	0.124
Julian rem	0.00236	0.0185	0.128	0.910

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	0.0676	0.0676	0.0163	0.910
Residual	2	8.297	4.149		
Total	3	8.365	2.788		

Normality Test: Passed (P = 0.643)

Constant Variance Test: Failed (P = <0.001)

Power of performed test with alpha = 0.050: 0.031

The power of the performed test (0.031) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-15.2 cm at Oak Mat Areas in Section 28 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 2:38:56 PM

Data source: Data 1 in Notebook 1

% Change 0-6 Inch Increment = $1.182 - (0.00445 * \text{Julian rem})$

N = 4

R = 0.0932 Rsqr = 0.00869 Adj Rsqr = 0.000

Standard Error of Estimate = 3.695

	Coefficient	Std. Error	t	P
Constant	1.182	3.057	0.387	0.736
Julian rem	-0.00445	0.0336	-0.132	0.907

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	0.240	0.240	0.0175	0.907
Residual	2	27.311	13.656		
Total	3	27.551	9.184		

Normality Test: Passed (P = 0.412)

Constant Variance Test: Failed (P = <0.001)

Power of performed test with alpha = 0.050: 0.031

The power of the performed test (0.031) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-30.5 cm at Oak Mat Areas in Section 28 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 2:39:29 PM

Data source: Data 1 in Notebook 1

% Change 0-12 Inch Increment = $2.772 - (0.0138 * \text{Julian rem})$

N = 4

R = 0.529 Rsqr = 0.280 Adj Rsqr = 0.000

Standard Error of Estimate = 1.722

	Coefficient	Std. Error	t	P
Constant	2.772	1.424	1.947	0.191
Julian rem	-0.0138	0.0156	-0.882	0.471

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	2.306	2.306	0.778	0.471
Residual	2	5.927	2.964		
Total	3	8.234	2.745		

Normality Test: Passed (P = 0.461)

Constant Variance Test: Failed (P = <0.001)

Power of performed test with alpha = 0.050: 0.085

The power of the performed test (0.085) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-5.1 cm at Oak Mat Areas in Section 34 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 2:28:57 PM

Data source: Data 1 in Notebook 1

% Change 0-2 Inch Increment = $-5.382 + (0.00518 * \text{Julian rem})$

N = 9

R = 0.135 Rsqr = 0.0183 Adj Rsqr = 0.000

Standard Error of Estimate = 3.722

	Coefficient	Std. Error	t	P
Constant	-5.382	2.089	-2.576	0.037
Julian rem	0.00518	0.0143	0.361	0.729

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	1.807	1.807	0.130	0.729
Residual	7	96.997	13.857		
Total	8	98.804	12.350		

Normality Test: Passed (P = 0.412)

Constant Variance Test: Passed (P = 0.381)

Power of performed test with alpha = 0.050: 0.052

The power of the performed test (0.052) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-15.2 cm at Oak Mat Areas in Section 34 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 2:29:36 PM

Data source: Data 1 in Notebook 1

% Change 0-6 Inch Increment = $1.333 + (0.00736 * \text{Julian rem})$

N = 9

R = 0.119 Rsqr = 0.0142 Adj Rsqr = 0.000

Standard Error of Estimate = 6.019

	Coefficient	Std. Error	t	P
Constant	1.333	3.378	0.395	0.705
Julian rem	0.00736	0.0232	0.317	0.760

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	3.649	3.649	0.101	0.760
Residual	7	253.579	36.226		
Total	8	257.228	32.154		

Normality Test: Passed (P = 0.587)

Constant Variance Test: Passed (P = 0.742)

Power of performed test with alpha = 0.050: 0.048

The power of the performed test (0.048) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-30.5 cm at Oak Mat Areas in Section 34 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 2:30:07 PM

Data source: Data 1 in Notebook 1

% Change 0-12 Inch Increment = $1.129 + (0.0107 * \text{Julian rem})$

N = 9

R = 0.234 Rsqr = 0.0548 Adj Rsqr = 0.000

Standard Error of Estimate = 4.379

	Coefficient	Std. Error	t	P
Constant	1.129	2.458	0.459	0.660
Julian rem	0.0107	0.0169	0.637	0.544

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	7.788	7.788	0.406	0.544
Residual	7	134.252	19.179		
Total	8	142.040	17.755		

Normality Test: Passed (P = 0.200)

Constant Variance Test: Passed (P = 0.983)

Power of performed test with alpha = 0.050: 0.084

The power of the performed test (0.084) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-5.1 cm at Oak Mat Areas in Section 20 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 2:30:42 PM

Data source: Data 1 in Notebook 1

% Change 0-2 Inch Increment = $0.641 - (0.0117 * \text{Julian rem})$

N = 17

R = 0.140 Rsqr = 0.0196 Adj Rsqr = 0.000

Standard Error of Estimate = 3.847

	Coefficient	Std. Error	t	P
Constant	0.641	3.646	0.176	0.863
Julian rem	-0.0117	0.0214	-0.547	0.592

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	4.428	4.428	0.299	0.592
Residual	15	221.939	14.796		
Total	16	226.367	14.148		

Normality Test: Passed (P = 0.197)

Constant Variance Test: Passed (P = 0.096)

Power of performed test with alpha = 0.050: 0.076

The power of the performed test (0.076) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-15.2 cm at Oak Mat Areas in Section 20 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 2:31:12 PM

Data source: Data 1 in Notebook 1

% Change 0-6 Inch Increment = $0.285 + (0.0150 * \text{Julian rem})$

N = 17

R = 0.231 Rsqr = 0.0533 Adj Rsqr = 0.000

Standard Error of Estimate = 2.945

	Coefficient	Std. Error	t	P
Constant	0.285	2.791	0.102	0.920
Julian rem	0.0150	0.0163	0.919	0.372

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	7.331	7.331	0.845	0.372
Residual	15	130.095	8.673		
Total	16	137.426	8.589		

Normality Test: Passed (P = 0.417)

Constant Variance Test: Passed (P = 0.585)

Power of performed test with alpha = 0.050: 0.140

The power of the performed test (0.140) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Results for the Percent Change in Dry Soil Bulk Density Measured from 0-30.5 cm at Oak Mat Areas in Section 20 versus the Date of Complete Mat Removal

Linear Regression

Sunday, October 28, 2007, 2:37:46 PM

Data source: Data 1 in Notebook 1

% Change 0-12 Inch Increment = $0.178 + (0.0376 * \text{Julian rem})$

N = 17

R = 0.495 Rsqr = 0.245 Adj Rsqr = 0.195

Standard Error of Estimate = 3.073

	Coefficient	Std. Error	t	P
Constant	0.178	2.913	0.0610	0.952
Julian rem	0.0376	0.0171	2.206	0.043

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	45.978	45.978	4.867	0.043
Residual	15	141.695	9.446		
Total	16	187.673	11.730		

Normality Test: Passed (P = 0.111)

Constant Variance Test: Passed (P = 0.612)

Power of performed test with alpha = 0.050: 0.528

APPENDIX E

STATISTICAL OUTPUT FOR ANCILLARY OAK MAT ANALYSIS

Linear Regression Results Indicating Prediction of Forb Cover at Oak Mat Removal Areas by Grass Cover**Linear Regression**

Tuesday, October 30, 2007, 2:32:31 PM

Data source: Data 1 in Notebook 1Total Forbs Cov = $-0.500 + (0.756 * \text{Total Grass Cov})$

N = 43

R = 0.564 Rsqr = 0.318 Adj Rsqr = 0.301

Standard Error of Estimate = 1.242

	Coefficient	Std. Error	t	P
Constant	-0.500	0.664	-0.753	0.456
Total Grass Cov	0.756	0.173	4.368	<0.001

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	29.426	29.426	19.083	<0.001
Residual	41	63.225	1.542		
Total	42	92.651	2.206		

Normality Test: Passed (P = 0.070)

Constant Variance Test: Passed (P = 0.212)

Power of performed test with alpha = 0.050: 0.981

Linear Regression Results Indicating Prediction of Shrub Density at Oak Mat Removal Areas by Grass Density (ln transformed)

Linear Regression

Tuesday, October 30, 2007, 2:35:29 PM

Data source: Data 1 in Notebook 1

$$\ln(\text{col}(9)) = -1.597 + (0.523 * \ln(\text{col}(4)))$$

N = 43

R = 0.331 Rsqr = 0.109 Adj Rsqr = 0.0877

Standard Error of Estimate = 0.614

	Coefficient	Std. Error	t	P
Constant	-1.597	1.239	-1.289	0.205
ln(col(4))	0.523	0.233	2.244	0.030

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	1.901	1.901	5.037	0.030
Residual	41	15.475	0.377		
Total	42	17.376	0.414		

Normality Test: Passed (P = 0.144)

Constant Variance Test: Passed (P = 0.464)

Power of performed test with alpha = 0.050: 0.585

Linear Regression Results Indicating Prediction of Grass Cover at Oak Mat Removal Areas by Grass Density

Linear Regression

Tuesday, October 30, 2007, 4:20:45 PM

Data source: Data 1 in Notebook 2

Total Grass Cov = 2.625 + (0.00483 * Total Grass Den)

N = 43

R = 0.380 Rsqr = 0.144 Adj Rsqr = 0.123

Standard Error of Estimate = 1.036

	Coefficient	Std. Error	t	P
Constant	2.625	0.430	6.110	<0.001
Total Grass Den	0.00483	0.00184	2.627	0.012

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	7.412	7.412	6.902	0.012
Residual	41	44.029	1.074		
Total	42	51.442	1.225		

Normality Test: Passed (P = 0.641)

Constant Variance Test: Passed (P = 0.406)

Power of performed test with alpha = 0.050: 0.715

Linear Regression Results Indicating Prediction of Forb Density at Oak Mat Removal Areas by Soil Bulk Density in the 0-30.5 cm Depth Increment (ln transformation)

Linear Regression

Thursday, November 01, 2007, 3:52:12 PM

Data source: Data 1 in Copy of OMRA multiple regression 1

$$\ln(\text{col}(7)) = -0.445 + (5.952 * \ln(\text{col}(25)))$$

N = 36 Missing Observations = 7

R = 0.346 Rsqr = 0.120 Adj Rsqr = 0.0938

Standard Error of Estimate = 0.795

	Coefficient	Std. Error	t	P
Constant	-0.445	0.946	-0.470	0.641
ln(col(25))	5.952	2.768	2.150	0.039

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	2.923	2.923	4.623	0.039
Residual	34	21.499	0.632		
Total	35	24.423	0.698		

Normality Test: Passed (P = 0.256)

Constant Variance Test: Passed (P = 0.143)

Power of performed test with alpha = 0.050: 0.545

Linear Regression Results Indicating Prediction of Forb Cover at Oak Mat Removal Areas by Dry Soil Bulk Density in the 0-15.2 cm Depth Increment

Linear Regression

Tuesday, October 30, 2007, 2:50:55 PM

Data source: Data 1 in Notebook 1

Total Forbs Cov = $-10.249 + (9.068 * 0-15.2 \text{ after})$

N = 36 Missing Observations = 7

R = 0.440 Rsqr = 0.193 Adj Rsqr = 0.169

Standard Error of Estimate = 1.350

	Coefficient	Std. Error	t	P
Constant	-10.249	4.386	-2.337	0.025
0-15.2 after	9.068	3.178	2.853	0.007

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	14.827	14.827	8.141	0.007
Residual	34	61.923	1.821		
Total	35	76.750	2.193		

Normality Test: Passed (P = 0.056)

Constant Variance Test: Passed (P = 0.124)

Power of performed test with alpha = 0.050: 0.773

Linear Regression Results Indicating Prediction of Grass Cover at Oak Mat Removal Areas by Soil pH in the 0-15.2 cm Depth Increment

Linear Regression

Tuesday, October 30, 2007, 3:50:12 PM

Data source: Data 1 in Notebook 2

Total Grass Cov = $20.345 - (2.254 * \text{pH})$

N = 37 Missing Observations = 6

R = 0.589 Rsqr = 0.347 Adj Rsqr = 0.328

Standard Error of Estimate = 0.919

	Coefficient	Std. Error	t	P
Constant	20.345	3.858	5.274	<0.001
pH	-2.254	0.523	-4.311	<0.001

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	15.708	15.708	18.581	<0.001
Residual	35	29.589	0.845		
Total	36	45.297	1.258		

Normality Test: Passed (P = 0.560)

Constant Variance Test: Passed (P = 0.376)

Power of performed test with alpha = 0.050: 0.976

Multiple Linear Regression Results Indicating Prediction of Grass Density at Oak Mat Removal Areas by Soil Nitrate and Total Nitrogen in the 0-15.2 cm Depth Increment

Multiple Linear Regression Tuesday, October 30, 2007, 3:23:40 PM

Data source: Data 1 in Notebook 2

Total Grass Den = 93.919 - (10.265 * Nitrate) + (0.174 * Total Nitrogen)

N = 19 Missing Observations = 24

R = 0.627 Rsqr = 0.393 Adj Rsqr = 0.317

Standard Error of Estimate = 82.313

	Coefficient	Std. Error	t	P	VIF
Constant	93.919	75.792	1.239	0.233	
Nitrate	-10.265	5.314	-1.932	0.071	1.091
Total Nitrogen	0.174	0.0575	3.024	0.008	1.091

Analysis of Variance:

	DF	SS	MS	F	P
Regression	2	70262.890	35131.445	5.185	0.018
Residual	16	108406.794	6775.425		
Total	18	178669.684	9926.094		

Column	SSIncr	SSMarg
Nitrate	8299.107	25282.755
Total Nitrogen	61963.784	61963.784

The dependent variable Total Grass Den can be predicted from a linear combination of the independent variables:

	P
Nitrate	0.071
Total Nitrogen	0.008

Not all of the independent variables appear necessary (or the multiple linear model may be underspecified). The following appear to account for the ability to predict Total Grass Den ($P < 0.05$): Total Nitrogen

Normality Test: Passed ($P = 0.451$)

Constant Variance Test: Passed ($P = 0.319$)

Power of performed test with $\alpha = 0.050$: 0.838

Linear Regression Results Indicating Prediction of Grass Density at Oak Mat Removal Areas by Soil Total Nitrogen in the 0-15.2 cm Depth Increment

Linear Regression

Tuesday, October 30, 2007, 3:24:47 PM

Data source: Data 1 in Notebook 2

Total Grass Den = 66.665 + (0.142 * Total Nitrogen)

N = 19 Missing Observations = 24

R = 0.502 Rsqr = 0.252 Adj Rsqr = 0.208

Standard Error of Estimate = 88.680

	Coefficient	Std. Error	t	P
Constant	66.665	80.227	0.831	0.418
Total Nitrogen	0.142	0.0593	2.392	0.029

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	44980.135	44980.135	5.720	0.029
Residual	17	133689.549	7864.091		
Total	18	178669.684	9926.094		

Normality Test: Passed (P = 0.660)

Constant Variance Test: Passed (P = 0.357)

Power of performed test with alpha = 0.050: 0.597

Linear Regression Results Indicating Prediction of Forb Cover at Oak Mat Removal Areas by Soil Total Nitrogen in the 0-15.2 cm Depth Increment (ln transformation)

Linear Regression

Thursday, November 01, 2007, 3:49:35 PM

Data source: Data 1 in Copy of OMRA Multiple Regression 2

$$\ln(\text{col}(13)) = 8.718 - (1.178 * \ln(\text{col}(43)))$$

N = 19 Missing Observations = 24

R = 0.716 Rsqr = 0.512 Adj Rsqr = 0.484

Standard Error of Estimate = 0.386

	Coefficient	Std. Error	t	P
Constant	8.718	1.991	4.379	<0.001
$\ln(\text{col}(43))$	-1.178	0.279	-4.226	<0.001

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	2.659	2.659	17.860	<0.001
Residual	17	2.531	0.149		
Total	18	5.190	0.288		

Normality Test: Passed (P = 0.348)

Constant Variance Test: Passed (P = 0.082)

Power of performed test with alpha = 0.050: 0.949

Linear Regression Results Indicating Prediction of Shrub Density at Oak Mat Removal Areas by Available Soil Phosphorus in the 0-15.2 cm Depth Increment (ln transformation)

Linear Regression

Thursday, November 01, 2007, 3:47:30 PM

Data source: Data 1 in Copy of OMRA Multiple Regression 2

$$\ln(\text{col}(8)) = 3.023 - (0.938 * \ln(\text{col}(29)))$$

N = 37 Missing Observations = 6

R = 0.466 Rsqr = 0.217 Adj Rsqr = 0.195

Standard Error of Estimate = 0.597

	Coefficient	Std. Error	t	P
Constant	3.023	0.601	5.032	<0.001
$\ln(\text{col}(29))$	-0.938	0.301	-3.118	0.004

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	3.462	3.462	9.724	0.004
Residual	35	12.460	0.356		
Total	36	15.922	0.442		

Normality Test: Passed (P = 0.741)

Constant Variance Test: Passed (P = 0.236)

Power of performed test with alpha = 0.050: 0.838

Linear Regression Results Indicating Prediction of Grass Cover at Oak Mat Removal Areas by Available Soil Calcium in the 0-15.2 cm Depth Increment

Linear Regression

Tuesday, October 30, 2007, 3:53:36 PM

Data source: Data 1 in Notebook 2

Total Grass Cov = $4.741 - (0.252 * \text{Calcium})$

N = 37 Missing Observations = 6

R = 0.318 Rsqr = 0.101 Adj Rsqr = 0.0753

Standard Error of Estimate = 1.079

	Coefficient	Std. Error	t	P
Constant	4.741	0.540	8.784	<0.001
Calcium	-0.252	0.127	-1.983	0.055

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	4.576	4.576	3.933	0.055
Residual	35	40.721	1.163		
Total	36	45.297	1.258		

Normality Test: Passed (P = 0.488)

Constant Variance Test: Passed (P = 0.753)

Power of performed test with alpha = 0.050: 0.484

The power of the performed test (0.484) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Multiple Linear Regression Results Indicating Prediction of Percent Change in Grass Cover at Oak Mat Removal Areas by Percent Soil Sand and Clay in the 0-15.2 cm Depth Increment

Multiple Linear Regression

Tuesday, October 30, 2007, 3:56:55 PM

Data source: Data 1 in Notebook 2

% change Grass Cov = -221.497 + (2.145 * Sand) + (5.895 * Clay)

N = 37 Missing Observations = 6

R = 0.482 Rsqr = 0.232 Adj Rsqr = 0.187

Standard Error of Estimate = 34.006

	Coefficient	Std. Error	t	P	VIF
Constant	-221.497	84.885	-2.609	0.013	
Sand	2.145	0.957	2.243	0.032	3.840
Clay	5.895	1.902	3.099	0.004	3.840

Analysis of Variance:

	DF	SS	MS	F	P
Regression	2	11894.554	5947.277	5.143	0.011
Residual	34	39318.598	1156.429		
Total	36	51213.152	1422.588		

Column	SSIncr	SSMarg
Sand	791.221	5816.366
Clay	11103.332	11103.332

The dependent variable % change Grass Cov can be predicted from a linear combination of the independent variables:

	P
Sand	0.032
Clay	0.004

All independent variables appear to contribute to predicting % change Grass Cov ($P < 0.05$).

Normality Test: Passed ($P = 0.212$)

Constant Variance Test: Passed ($P = 0.795$)

Power of performed test with $\alpha = 0.050$: 0.865

Linear Regression Results Indicating Prediction of Forb Density at Oak Mat Removal Areas by Soil Sand Percentage in the 0-15.2 cm Depth Increment (ln transformation)

Linear Regression

Thursday, November 01, 2007, 3:45:26 PM

Data source: Data 1 in Copy of OMRA Multiple Regression 2

$$\ln(\text{col}(4)) = -6.636 + (2.180 * \ln(\text{col}(36)))$$

N = 37 Missing Observations = 6

R = 0.662 Rsqr = 0.438 Adj Rsqr = 0.422

Standard Error of Estimate = 0.626

	Coefficient	Std. Error	t	P
Constant	-6.636	1.573	-4.220	<0.001
$\ln(\text{col}(36))$	2.180	0.417	5.226	<0.001

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	10.718	10.718	27.308	<0.001
Residual	35	13.737	0.392		
Total	36	24.455	0.679		

Normality Test: Passed (P = 0.517)

Constant Variance Test: Passed (P = 0.101)

Power of performed test with alpha = 0.050: 0.996

Linear Regression Results Indicating Prediction of Forb Cover at Oak Mat Removal Areas by Soil Sand Percentage in the 0-15.2 cm Depth Increment (ln transformation)

Linear Regression

Thursday, November 01, 2007, 3:50:38 PM

Data source: Data 1 in Copy of OMRA Multiple Regression 2

$$\ln(\text{col}(13)) = -6.142 + (1.801 * \ln(\text{col}(36)))$$

N = 37 Missing Observations = 6

R = 0.739 Rsqr = 0.546 Adj Rsqr = 0.533

Standard Error of Estimate = 0.417

	Coefficient	Std. Error	t	P
Constant	-6.142	1.046	-5.873	<0.001
$\ln(\text{col}(36))$	1.801	0.277	6.493	<0.001

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	7.316	7.316	42.160	<0.001
Residual	35	6.074	0.174		
Total	36	13.390	0.372		

Normality Test: Passed (P = 0.704)

Constant Variance Test: Passed (P = 0.538)

Power of performed test with alpha = 0.050: 1.000

Paired t-test Results for Oak Mat Removal Area Grass Canopy Cover in 2006 versus 2007 (ln transformed)**Paired t-test:**

Friday, September 28, 2007, 11:41:21 AM

Data source: SEc 20 2006 vs 2007 data in Oak mat veg data MDM 9.12.07**Normality Test:** Passed (P = 0.116)

Treatment Name	N	Missing	Mean	Std Dev	SEM
ln(col(1))	16	0	-0.0336	0.744	0.186
ln(col(2))	16	0	1.130	0.255	0.0637
Difference	16	0	-1.164	0.781	0.195

t = -5.962 with 15 degrees of freedom. (P = <0.001)

95 percent confidence interval for difference of means: -1.580 to -0.748

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant change (P = <0.001)

Power of performed test with alpha = 0.050: 1.000

Paired t-test Results for Oak Mat Removal Area Grass Density in 2006 versus 2007**Paired t-test:**

Friday, September 28, 2007, 11:29:49 AM

Data source: SEc 20 2006 vs 2007 data in Oak mat veg data MDM 9.12.07**Normality Test:** Passed (P = 0.676)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Grass Density 2006	16	0	140.500	85.742	21.436
Grass Density 2007	16	0	267.813	96.721	24.180
Difference	16	0	-127.313	105.162	26.291

t = -4.843 with 15 degrees of freedom. (P = <0.001)

95 percent confidence interval for difference of means: -183.350 to -71.275

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant change (P = <0.001)

Power of performed test with alpha = 0.050: 0.996

Paired t-test Results for Oak Mat Removal Area Grass Diversity in 2006 versus 2007 (ln transformed)**Paired t-test:**

Friday, September 28, 2007, 11:39:48 AM

Data source: SEc 20 2006 vs 2007 data in Oak mat veg data MDM 9.12.07**Normality Test:** Passed (P = 0.501)

Treatment Name	N	Missing	Mean	Std Dev	SEM
ln(col(5))	16	0	0.0776	0.204	0.0509
ln(col(6))	16	0	0.871	0.208	0.0519
Difference	16	0	-0.793	0.298	0.0746

t = -10.627 with 15 degrees of freedom. (P = <0.001)

95 percent confidence interval for difference of means: -0.952 to -0.634

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant change (P = <0.001)

Power of performed test with alpha = 0.050: 1.000

Paired t-test Results for Oak Mat Removal Area Forb Canopy Cover in 2006 versus 2007**Paired t-test:**

Friday, September 28, 2007, 11:33:17 AM

Data source: SEc 20 2006 vs 2007 data in Oak mat veg data MDM 9.12.07**Normality Test:** Passed (P = 0.229)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Forb cover 2006	16	0	1.000	0.966	0.241
Forb Cover 2007	16	0	1.188	0.403	0.101
Difference	16	0	-0.188	1.126	0.282

t = -0.666 with 15 degrees of freedom. (P = 0.516)

95 percent confidence interval for difference of means: -0.788 to 0.413

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.516)

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.
 Less than desired power indicates you are less likely to detect a difference when one actually exists.
 Negative results should be interpreted cautiously.

Paired t-test Results for Oak Mat Removal Area Forb Density in 2006 versus 2007**Paired t-test:**

Friday, September 28, 2007, 11:34:02 AM

Data source: SEc 20 2006 vs 2007 data in Oak mat veg data MDM 9.12.07**Normality Test:** Passed (P = 0.176)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Forb Density 2006	16	0	4.475	4.769	1.192
Forb density 2007	16	0	3.938	2.863	0.716
Difference	16	0	0.538	5.759	1.440

t = 0.373 with 15 degrees of freedom. (P = 0.714)

95 percent confidence interval for difference of means: -2.532 to 3.607

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.714)

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.
 Less than desired power indicates you are less likely to detect a difference when one actually exists.
 Negative results should be interpreted cautiously.

Paired t-test Results for Oak Mat Removal Area Forb Diversity in 2006 versus 2007 (ln transformation)**Paired t-test:**

Friday, September 28, 2007, 11:49:14 AM

Data source: SEc 20 2006 vs 2007 data in Oak mat veg data MDM 9.12.07**Normality Test:** Passed (P = 0.481)

Treatment Name	N	Missing	Mean	Std Dev	SEM
ln(col(19))	16	0	-1.128	0.781	0.195
ln(col(20))	16	0	0.112	0.315	0.0787
Difference	16	0	-1.239	0.840	0.210

t = -5.906 with 15 degrees of freedom. (P = <0.001)

95 percent confidence interval for difference of means: -1.687 to -0.792

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant change (P = <0.001)

Power of performed test with alpha = 0.050: 1.000

Paired t-test Results for Oak Mat Removal Area Shrub Canopy Cover in 2006 versus 2007**Paired t-test:**

Friday, September 28, 2007, 11:36:57 AM

Data source: SEc 20 2006 vs 2007 data in Oak mat veg data MDM 9.12.07**Normality Test:** Passed (P = 0.362)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Shrub cover 2006	16	0	2.016	1.496	0.374
Shrub cover 2007	16	0	3.313	1.778	0.445
Difference	16	0	-1.297	1.879	0.470

t = -2.761 with 15 degrees of freedom. (P = 0.015)

95 percent confidence interval for difference of means: -2.298 to -0.296

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant change (P = 0.015)

Power of performed test with alpha = 0.050: 0.676

Paired t-test Results for Oak Mat Removal Area Shrub Density in 2006 versus 2007 (ln transformation)**Paired t-test:**

Friday, September 28, 2007, 11:51:08 AM

Data source: SEc 20 2006 vs 2007 data in Oak mat veg data MDM 9.12.07**Normality Test:** Failed (P < 0.050)

Treatment Name	N	Missing	Mean	Std Dev	SEM
ln(col(26))	16	0	1.198	0.739	0.185
ln(col(27))	16	0	1.435	0.673	0.168
Difference	16	0	-0.237	1.001	0.250

t = -0.946 with 15 degrees of freedom. (P = 0.359)

95 percent confidence interval for difference of means: -0.771 to 0.297

The change that occurred with the treatment is not great enough to exclude the possibility that the difference is due to chance (P = 0.359)

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.

Paired t-test Results for Oak Mat Removal Area Shrub Diversity in 2006 versus 2007**Paired t-test:**

Friday, September 28, 2007, 11:38:05 AM

Data source: SEc 20 2006 vs 2007 data in Oak mat veg data MDM 9.12.07**Normality Test:** Passed (P = 0.516)

Treatment Name	N	Missing	Mean	Std Dev	SEM
Shrub diversity 2006	16	0	0.612	0.299	0.0747
Shrub diversity 2007	16	0	2.688	1.014	0.254
Difference	16	0	-2.075	0.926	0.231

t = -8.968 with 15 degrees of freedom. (P = <0.001)

95 percent confidence interval for difference of means: -2.568 to -1.582

The change that occurred with the treatment is greater than would be expected by chance; there is a statistically significant change (P = <0.001)

Power of performed test with alpha = 0.050: 1.000

T-test Results for Percent Change in Grass Density Relative to the Nearby Undisturbed Range at Oak Mat Areas that were wither Mowed or Not Mowed Prior to Mat Construction

t-test

Thursday, September 27, 2007, 3:42:20 PM

Data source: Data 1 in Notebook 1

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Rank Sum Test begun

Mann-Whitney Rank Sum Test

Thursday, September 27, 2007, 3:42:20 PM

Data source: Data 1 in Notebook 1

Group	N	Missing	Median	25%	75%
% change Grass Den	10	0	46.806	25.114	69.406
% change Grass Den	7	0	15.217	-2.886	51.154

Mann-Whitney U Statistic= 51.000

T = 47.000 n(small)= 7 n(big)= 10 (P = 0.130)

The difference in the median values between the two groups is not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.130)

T-test Results for Percent Change in Grass Cover Relative to the Nearby Undisturbed Range at Oak Mat Areas that were wither Mowed or Not Mowed Prior to Mat Construction

t-test

Thursday, September 27, 2007, 3:46:52 PM

Data source: Data 1 in Notebook 1

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Rank Sum Test begun

Mann-Whitney Rank Sum Test

Thursday, September 27, 2007, 3:46:52 PM

Data source: Data 1 in Notebook 1

Group	N	Missing	Median	25%	75%
% change Grass Cov	7	0	0.000	-18.750	25.000
% change Grass Cov	10	0	33.333	33.333	50.000

Mann-Whitney U Statistic= 51.000

T = 47.000 n(small)= 7 n(big)= 10 (P = 0.119)

The difference in the median values between the two groups is not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.119)

T-test Results for Percent Change in Grass Diversity Relative to the Nearby Undisturbed Range at Oak Mat Areas that were wither Mowed or Not Mowed Prior to Mat Construction

t-test

Thursday, September 27, 2007, 3:48:24 PM

Data source: Data 1 in Notebook 1

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Rank Sum Test begun

Mann-Whitney Rank Sum Test

Thursday, September 27, 2007, 3:48:24 PM

Data source: Data 1 in Notebook 1

Group	N	Missing	Median	25%	75%
% Change Grass Richness	7	0	0.000	-33.333	37.500
% Change Grass Richness	10	0	0.000	0.000	0.000

Mann-Whitney U Statistic= 39.500

T = 58.500 n(small)= 7 n(big)= 10 (P = 0.659)

The difference in the median values between the two groups is not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.659)

T-test Results for Percent Change in Forb Density Relative to the Nearby Undisturbed Range at Oak Mat Areas that were wither Mowed or Not Mowed Prior to Mat Construction

t-test

Thursday, September 27, 2007, 3:45:51 PM

Data source: Data 1 in Notebook 1

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Rank Sum Test begun

Mann-Whitney Rank Sum Test

Thursday, September 27, 2007, 3:45:51 PM

Data source: Data 1 in Notebook 1

Group	N	Missing	Median	25%	75%
% change Forb Den	10	0	-35.833	-62.500	0.000
% change Forb Den	7	0	-25.000	-47.500	-18.750

Mann-Whitney U Statistic= 35.500

T = 62.500 n(small)= 7 n(big)= 10 (P = 1.000)

The difference in the median values between the two groups is not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 1.000)

T-test Results for Percent Change in Forb Cover Relative to the Nearby Undisturbed Range at Oak Mat Areas that were wither Mowed or Not Mowed Prior to Mat Construction

t-test

Thursday, September 27, 2007, 3:47:20 PM

Data source: Data 1 in Notebook 1

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Rank Sum Test begun

Mann-Whitney Rank Sum Test

Thursday, September 27, 2007, 3:47:20 PM

Data source: Data 1 in Notebook 1

Group	N	Missing	Median	25%	75%
% change Forb Cov	7	0	0.000	0.000	0.000
% change Forb Cov	10	0	0.000	0.000	25.000

Mann-Whitney U Statistic= 34.500

T = 63.500 n(small)= 7 n(big)= 10 (P = 1.000)

The difference in the median values between the two groups is not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 1.000)

T-test Results for Percent Change in Forb Diversity Relative to the Nearby Undisturbed Range at Oak Mat Areas that were wither Mowed or Not Mowed Prior to Mat Construction

t-test

Thursday, September 27, 2007, 3:48:55 PM

Data source: Data 1 in Notebook 1

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Rank Sum Test begun

Mann-Whitney Rank Sum Test

Thursday, September 27, 2007, 3:48:55 PM

Data source: Data 1 in Notebook 1

Group	N	Missing	Median	25%	75%
% Change Forb Richness	7	0	0.000	0.000	0.000
% Change Forb Richness	10	0	0.000	0.000	0.000

Mann-Whitney U Statistic= 33.000

T = 65.000 n(small)= 7 n(big)= 10 (P = 0.794)

The difference in the median values between the two groups is not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.794)

T-test Results for Percent Change in Shrub Density Relative to the Nearby Undisturbed Range at Oak Mat Areas that were wither Mowed or Not Mowed Prior to Mat Construction

t-test

Thursday, September 27, 2007, 3:46:21 PM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.079)

Equal Variance Test: Passed (P = 0.430)

Group Name	N	Missing	Mean	Std Dev	SEM
% change Shrub Den	7	0	-56.410	36.535	13.809
% change Shrub Den	10	0	18.381	80.809	25.554

Difference -74.791

t = -2.275 with 15 degrees of freedom. (P = 0.038)

95 percent confidence interval for difference of means: -144.876 to -4.706

The difference in the mean values of the two groups is greater than would be expected by chance; there is a statistically significant difference between the input groups (P = 0.038).

Power of performed test with alpha = 0.050: 0.472

T-test Results for Percent Change in Shrub Cover Relative to the Nearby Undisturbed Range at Oak Mat Areas that were wither Mowed or Not Mowed Prior to Mat Construction

t-test

Thursday, September 27, 2007, 3:47:49 PM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.311)

Equal Variance Test: Passed (P = 0.114)

Group Name	N	Missing	Mean	Std Dev	SEM
% change Shrub Cov	7	0	-69.444	24.627	9.308
% change Shrub Cov	10	0	-74.131	10.285	3.253

Difference 4.686

t = 0.544 with 15 degrees of freedom. (P = 0.595)

95 percent confidence interval for difference of means: -13.690 to 23.063

The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups (P = 0.595).

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

T-test Results for Percent Change in Shrub Diversity Relative to the Nearby Undisturbed Range at Oak Mat Areas that were wither Mowed or Not Mowed Prior to Mat Construction

t-test

Thursday, September 27, 2007, 3:49:24 PM

Data source: Data 1 in Notebook 1

Normality Test: Passed (P = 0.066)

Equal Variance Test: Passed (P = 0.404)

Group Name	N	Missing	Mean	Std Dev	SEM
% Change Shrub Richness	7	0	-9.524	53.452	20.203
% Change Shrub Richness	10	0	7.500	56.581	17.892

Difference -17.024

t = -0.624 with 15 degrees of freedom. (P = 0.542)

95 percent confidence interval for difference of means: -75.164 to 41.116

The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups (P = 0.542).

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Result for Percent Change in Dry Soil Bulk Density from 0-5.1 cm at Oak Mat Areas Relative to the Percent Sand in the 0-15.2 cm Depth Increment (reciprocal transformation)

Linear Regression

Tuesday, September 25, 2007, 10:57:19 AM

Data source: Data 1 in Linear regression % s, c vs. % Change in Bulk Density

$$1.0/(\text{col}(4)) = 0.0239 - (0.000417 * 1.0/(\text{col}(1)))$$

N = 36

R = 0.0622 Rsqr = 0.00387 Adj Rsqr = 0.000

Standard Error of Estimate = 0.006

	Coefficient	Std. Error	t	P
Constant	0.0239	0.00105	22.691	<0.001
1.0/(col(1))	-0.000417	0.00115	-0.363	0.719

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	0.00000454	0.00000454	0.132	0.719
Residual	34	0.00117	0.0000344		
Total	35	0.00117	0.0000335		

Normality Test: Passed (P = 0.703)

Constant Variance Test: Passed (P = 0.647)

Power of performed test with alpha = 0.050: 0.055

The power of the performed test (0.055) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Result for Percent Change in Dry Soil Bulk Density from 0-15.2 cm at Oak Mat Areas Relative to the Percent Sand in the 0-15.2 cm Depth Increment.

Linear Regression

Tuesday, September 25, 2007, 10:52:49 AM

Data source: Data 1 in Linear regression % s, c vs. % Change in Bulk Density

% diff Bulk Density0-6 Inch In = 4.925 - (0.0672 * SAND 0-6)

N = 36

R = 0.197 Rsqr = 0.0390 Adj Rsqr = 0.0107

Standard Error of Estimate = 3.972

	Coefficient	Std. Error	t	P
Constant	4.925	2.618	1.881	0.069
SAND 0-6	-0.0672	0.0573	-1.174	0.249

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	21.745	21.745	1.378	0.249
Residual	34	536.466	15.778		
Total	35	558.212	15.949		

Normality Test: Passed (P = 0.408)

Constant Variance Test: Passed (P = 0.356)

Power of performed test with alpha = 0.050: 0.209

The power of the performed test (0.209) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Linear Regression Result for Percent Change in Dry Soil Bulk Density from 0-15.2 cm at Oak Mat Areas Relative to the Percent Clay in the 0-15.2 cm Depth Increment.

Linear Regression

Tuesday, September 25, 2007, 10:54:33 AM

Data source: Data 1 in Linear regression % s, c vs. % Change in Bulk Density

% diff Bulk Density0-6 Inch In = -0.630 + (0.108 * CLAY 0-6)

N = 36

R = 0.159 Rsqr = 0.0254 Adj Rsqr = 0.000

Standard Error of Estimate = 4.000

	Coefficient	Std. Error	t	P
Constant	-0.630	2.820	-0.224	0.824
CLAY 0-6	0.108	0.115	0.942	0.353

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	14.197	14.197	0.887	0.353
Residual	34	544.015	16.000		
Total	35	558.212	15.949		

Normality Test: Passed (P = 0.509)

Constant Variance Test: Passed (P = 0.187)

Power of performed test with alpha = 0.050: 0.150

The power of the performed test (0.150) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists.

Negative results should be interpreted cautiously.

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm at Oak Mat Roadways and the Nearby Undisturbed Range at Site JF 38-5

Two Way Analysis of Variance

Tuesday, September 18, 2007, 1:12:03 PM

Data source: Data 4 in Road Density Statistics part 2 2007

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.320)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0312	0.00623	0.530	0.749
Location	1	0.206	0.206	17.490	0.009
Residual	5	0.0588	0.0118		
Total	11	0.296	0.0269		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Location. There is not a statistically significant difference (P = 0.749).

The difference in the mean values among the different levels of Location is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.009). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.0512

Power of performed test with alpha = 0.0500: for Location : 0.903

Least square means for Replication :

Group Mean

1.000	1.107
2.000	1.142
3.000	1.207
4.000	1.136
5.000	1.219
6.000	1.248

Std Err of LS Mean = 0.0767

Least square means for Location :

Group Mean

Road	1.307
Control	1.046

Std Err of LS Mean = 0.0443

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Location**

Comparison	Diff of Means	p	q	P	P<0.050
Road vs. Control	0.262	2	5.914	0.009	Yes

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm at Oak Mat Roadways and the Nearby Undisturbed Range at Site JF 38-5

Two Way Analysis of Variance

Tuesday, September 18, 2007, 1:12:51 PM

Data source: Data 4 in Road Density Statistics part 2 2007

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.265)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0136	0.00272	2.368	0.183
Location	1	0.0462	0.0462	40.224	0.001
Residual	5	0.00575	0.00115		
Total	11	0.0656	0.00596		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Location. There is not a statistically significant difference (P = 0.183).

The difference in the mean values among the different levels of Location is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.001). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.210

Power of performed test with alpha = 0.0500: for Location : 0.999

Least square means for Replication :

Group Mean

1.000	1.403
2.000	1.403
3.000	1.466
4.000	1.398
5.000	1.432
6.000	1.485

Std Err of LS Mean = 0.0240

Least square means for Location :

Group Mean

Road	1.493
Control	1.369

Std Err of LS Mean = 0.0138

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Location**

Comparison	Diff of Means	p	q	P	P<0.050
Road vs. Control	0.124	2	8.969	0.002	Yes

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm at Oak Mat Roadways and the Nearby Undisturbed Range at Site JF 38-5

Two Way Analysis of Variance

Tuesday, September 18, 2007, 1:13:14 PM

Data source: Data 4 in Road Density Statistics part 2 2007

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.436)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0132	0.00264	4.164	0.072
Location	1	0.0194	0.0194	30.727	0.003
Residual	5	0.00316	0.000633		
Total	11	0.0358	0.00325		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Location. There is not a statistically significant difference (P = 0.072).

The difference in the mean values among the different levels of Location is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.003). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.443

Power of performed test with alpha = 0.0500: for Location : 0.991

Least square means for Replication :

Group Mean

1.000	1.449
2.000	1.486
3.000	1.533
4.000	1.482
5.000	1.533
6.000	1.537

Std Err of LS Mean = 0.0178

Least square means for Location :

Group Mean

Road	1.543
Control	1.463

Std Err of LS Mean = 0.0103

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Location**

Comparison	Diff of Means	p	q	P	P<0.050
Road vs. Control	0.0805	2	7.839	0.003	Yes

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm at Oak Mat Roadways and the Nearby Undisturbed Range at Site JF 19-7

Two Way Analysis of Variance

Tuesday, September 18, 2007, 1:04:04 PM

Data source: Data 2 in Road Density Statistics part 2 2007

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.158)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0516	0.0103	4.221	0.070
Location	1	0.0168	0.0168	6.863	0.047
Residual	5	0.0122	0.00245		
Total	11	0.0806	0.00733		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Location. There is not a statistically significant difference (P = 0.070).

The difference in the mean values among the different levels of Location is greater than would be expected by chance after allowing for effects of differences in Replication. There is a statistically significant difference (P = 0.047). To isolate which group(s) differ from the others use a multiple comparison procedure.

Power of performed test with alpha = 0.0500: for Replication : 0.450

Power of performed test with alpha = 0.0500: for Location : 0.496

Least square means for Replication :

Group Mean

1.000 1.048

2.000 1.136

3.000 1.207

4.000 1.237

5.000 1.101

6.000 1.195

Std Err of LS Mean = 0.0350

Least square means for Location :

Group Mean

Road 1.191

Control 1.116

Std Err of LS Mean = 0.0202

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor: **Location**

Comparison	Diff of Means	p	q	P	P<0.050
Road vs. Control	0.0748	2	3.705	0.047	Yes

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm at Oak Mat Roadways and the Nearby Undisturbed Range at Site JF 19-7

Two Way Analysis of Variance

Tuesday, September 18, 2007, 1:04:38 PM

Data source: Data 2 in Road Density Statistics part 2 2007

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.349)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0265	0.00530	2.201	0.203
Location	1	0.00344	0.00344	1.427	0.286
Residual	5	0.0120	0.00241		
Total	11	0.0420	0.00382		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Location. There is not a statistically significant difference (P = 0.203).

The difference in the mean values among the different levels of Location is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.286).

Power of performed test with alpha = 0.0500: for Replication : 0.188

Power of performed test with alpha = 0.0500: for Location : 0.0818

Least square means for Replication :

Group	Mean
1.000	1.321
2.000	1.398
3.000	1.442
4.000	1.451
5.000	1.364
6.000	1.437

Std Err of LS Mean = 0.0347

Least square means for Location :

Group	Mean
Road	1.419
Control	1.385

Std Err of LS Mean = 0.0200

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm at Oak Mat Roadways and the Nearby Undisturbed Range at Site JF 19-7

Two Way Analysis of Variance

Tuesday, September 18, 2007, 1:04:59 PM

Data source: Data 2 in Road Density Statistics part 2 2007

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.305)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0185	0.00370	1.019	0.492
Location	1	0.00208	0.00208	0.572	0.483
Residual	5	0.0182	0.00363		
Total	11	0.0387	0.00352		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Location. There is not a statistically significant difference (P = 0.492).

The difference in the mean values among the different levels of Location is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.483).

Power of performed test with alpha = 0.0500: for Replication : 0.0530

Power of performed test with alpha = 0.0500: for Location : 0.0500

Least square means for Replication :

Group	Mean
1.000	1.417
2.000	1.486
3.000	1.542
4.000	1.486
5.000	1.495
6.000	1.523

Std Err of LS Mean = 0.0426

Least square means for Location :

Group	Mean
Road	1.505
Control	1.478

Std Err of LS Mean = 0.0246

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm at Oak Mat Roadways and the Nearby Undisturbed Range at Site JF 67-7

Two Way Analysis of Variance

Tuesday, September 18, 2007, 12:56:55 PM

Data source: Data 1 in Road Density Statistics part 2 2007

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.343)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0400	0.00799	2.207	0.203
Location	1	0.00262	0.00262	0.723	0.434
Residual	5	0.0181	0.00362		
Total	11	0.0607	0.00552		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Location. There is not a statistically significant difference (P = 0.203).

The difference in the mean values among the different levels of Location is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.434).

Power of performed test with alpha = 0.0500: for Replication : 0.189

Power of performed test with alpha = 0.0500: for Location : 0.0500

Least square means for Replication :

Group	Mean
1.000	1.201
2.000	1.089
3.000	1.219
4.000	1.065
5.000	1.101
6.000	1.113

Std Err of LS Mean = 0.0425

Least square means for Location :

Group	Mean
Road	1.116
Control	1.146

Std Err of LS Mean = 0.0246

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm at Oak Mat Roadways and the Nearby Undisturbed Range at Site JF 67-7

Two Way Analysis of Variance

Tuesday, September 18, 2007, 12:58:57 PM

Data source: Data 1 in Road Density Statistics part 2 2007

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.453)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0132	0.00265	0.511	0.761
Location	1	0.00175	0.00175	0.339	0.586
Residual	5	0.0259	0.00518		
Total	11	0.0409	0.00372		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Location. There is not a statistically significant difference (P = 0.761).

The difference in the mean values among the different levels of Location is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.586).

Power of performed test with alpha = 0.0500: for Replication : 0.0512

Power of performed test with alpha = 0.0500: for Location : 0.0500

Least square means for Replication :

Group	Mean
1.000	1.359
2.000	1.350
3.000	1.403
4.000	1.335
5.000	1.432
6.000	1.388

Std Err of LS Mean = 0.0509

Least square means for Location :

Group	Mean
Road	1.366
Control	1.390

Std Err of LS Mean = 0.0294

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm at Oak Mat Roadways and the Nearby Undisturbed Range at Site JF 67-7

Two Way Analysis of Variance

Tuesday, September 18, 2007, 1:00:43 PM

Data source: Data 1 in Road Density Statistics part 2 2007

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.637)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0141	0.00282	0.438	0.807
Location	1	0.0000647	0.0000647	0.0101	0.924
Residual	5	0.0322	0.00643		
Total	11	0.0463	0.00421		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Location. There is not a statistically significant difference (P = 0.807).

The difference in the mean values among the different levels of Location is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.924).

Power of performed test with alpha = 0.0500: for Replication : 0.0512

Power of performed test with alpha = 0.0500: for Location : 0.0500

Least square means for Replication :

Group	Mean
1.000	1.491
2.000	1.486
3.000	1.533
4.000	1.421
5.000	1.509
6.000	1.500

Std Err of LS Mean = 0.0567

Least square means for Location :

Group	Mean
Road	1.492
Control	1.488

Std Err of LS Mean = 0.0327

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm at Oak Mat Roadways and the Nearby Undisturbed Range at Site JF 120-7

Two Way Analysis of Variance

Tuesday, September 18, 2007, 1:07:47 PM

Data source: Data 3 in Road Density Statistics part 2 2007

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.145)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.124	0.0248	3.959	0.079
Location	1	0.0279	0.0279	4.458	0.088
Residual	5	0.0313	0.00626		
Total	11	0.183	0.0167		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Location. There is not a statistically significant difference (P = 0.079).

The difference in the mean values among the different levels of Location is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.088).

Power of performed test with alpha = 0.0500: for Replication : 0.417

Power of performed test with alpha = 0.0500: for Location : 0.321

Least square means for Replication :

Group	Mean
1.000	1.302
2.000	1.343
3.000	1.331
4.000	1.237
5.000	1.118
6.000	1.083

Std Err of LS Mean = 0.0560

Least square means for Location :

Group	Mean
Road	1.284
Control	1.187

Std Err of LS Mean = 0.0323

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm at Oak Mat Roadways and the Nearby Undisturbed Range at Site JF 120-7

Two Way Analysis of Variance

Tuesday, September 18, 2007, 1:08:38 PM

Data source: Data 3 in Road Density Statistics part 2 2007

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.269)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0193	0.00385	0.942	0.525
Location	1	0.0262	0.0262	6.410	0.052
Residual	5	0.0205	0.00409		
Total	11	0.0660	0.00600		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Location. There is not a statistically significant difference (P = 0.525).

The difference in the mean values among the different levels of Location is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.052).

Power of performed test with alpha = 0.0500: for Replication : 0.0512

Power of performed test with alpha = 0.0500: for Location : 0.465

Least square means for Replication :

Group	Mean
1.000	1.490
2.000	1.480
3.000	1.495
4.000	1.471
5.000	1.403
6.000	1.398

Std Err of LS Mean = 0.0452

Least square means for Location :

Group	Mean
Road	1.503
Control	1.409

Std Err of LS Mean = 0.0261

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm at Oak Mat Roadways and the Nearby Undisturbed Range at Site JF 120-7

Two Way Analysis of Variance

Tuesday, September 18, 2007, 1:10:12 PM

Data source: Data 3 in Road Density Statistics part 2 2007

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.609)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.00846	0.00169	0.317	0.883
Location	1	0.00141	0.00141	0.265	0.629
Residual	5	0.0266	0.00533		
Total	11	0.0365	0.00332		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Location. There is not a statistically significant difference (P = 0.883).

The difference in the mean values among the different levels of Location is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.629).

Power of performed test with alpha = 0.0500: for Replication : 0.0512

Power of performed test with alpha = 0.0500: for Location : 0.0500

Least square means for Replication :

Group Mean

1.000 1.495
2.000 1.495
3.000 1.528
4.000 1.574
5.000 1.528
6.000 1.519

Std Err of LS Mean = 0.0516

Least square means for Location :

Group Mean

Road 1.534
Control 1.513

Std Err of LS Mean = 0.0298

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-5.1 cm at Oak Mat Roadways and the Nearby Undisturbed Range at Site JF 37-8

Two Way Analysis of Variance

Tuesday, September 18, 2007, 1:14:56 PM

Data source: Data 5 in Road Density Statistics part 2 2007

General Linear Model (No Interactions)

Dependent Variable: 0-2

Normality Test: Passed (P = 0.590)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0430	0.00859	0.970	0.513
Location	1	0.000186	0.000186	0.0210	0.890
Residual	5	0.0443	0.00886		
Total	11	0.0875	0.00795		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Location. There is not a statistically significant difference (P = 0.513).

The difference in the mean values among the different levels of Location is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.890).

Power of performed test with alpha = 0.0500: for Replication : 0.0512

Power of performed test with alpha = 0.0500: for Location : 0.0500

Least square means for Replication :

Group Mean

1.000 1.142
2.000 1.166
3.000 1.201
4.000 1.266
5.000 1.118
6.000 1.278

Std Err of LS Mean = 0.0666

Least square means for Location :

Group Mean

Road 1.199
Control 1.191

Std Err of LS Mean = 0.0384

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-15.2 cm at Oak Mat Roadways and the Nearby Undisturbed Range at Site JF 37-8

Two Way Analysis of Variance

Tuesday, September 18, 2007, 1:15:36 PM

Data source: Data 5 in Road Density Statistics part 2 2007

General Linear Model (No Interactions)

Dependent Variable: 0-6

Normality Test: Passed (P = 0.434)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0402	0.00804	2.161	0.209
Location	1	0.0203	0.0203	5.453	0.067
Residual	5	0.0186	0.00372		
Total	11	0.0791	0.00719		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Location. There is not a statistically significant difference (P = 0.209).

The difference in the mean values among the different levels of Location is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.067).

Power of performed test with alpha = 0.0500: for Replication : 0.183

Power of performed test with alpha = 0.0500: for Location : 0.396

Least square means for Replication :

Group	Mean
1.000	1.403
2.000	1.345
3.000	1.384
4.000	1.495
5.000	1.379
6.000	1.495

Std Err of LS Mean = 0.0431

Least square means for Location :

Group	Mean
Road	1.458
Control	1.376

Std Err of LS Mean = 0.0249

Two Way ANOVA Results for Dry Soil Bulk Density Measured from 0-30.5 cm at Oak Mat Roadways and the Nearby Undisturbed Range at Site JF 37-8

Two Way Analysis of Variance

Tuesday, September 18, 2007, 1:16:01 PM

Data source: Data 5 in Road Density Statistics part 2 2007

General Linear Model (No Interactions)

Dependent Variable: 0-12

Normality Test: Passed (P = 0.498)

Equal Variance Test: Passed (P = 1.000)

Source of Variation	DF	SS	MS	F	P
Replication	5	0.0564	0.0113	1.929	0.244
Location	1	0.0187	0.0187	3.199	0.134
Residual	5	0.0292	0.00585		
Total	11	0.104	0.00948		

The difference in the mean values among the different levels of Replication is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Location. There is not a statistically significant difference (P = 0.244).

The difference in the mean values among the different levels of Location is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Replication. There is not a statistically significant difference (P = 0.134).

Power of performed test with alpha = 0.0500: for Replication : 0.154

Power of performed test with alpha = 0.0500: for Location : 0.221

Least square means for Replication :

Group	Mean
1.000	1.500
2.000	1.412
3.000	1.449
4.000	1.630
5.000	1.482
6.000	1.523

Std Err of LS Mean = 0.0541

Least square means for Location :

Group	Mean
Road	1.539
Control	1.460

Std Err of LS Mean = 0.0312