An-Najah National University
Faculty of Graduate Studies

Ecological Investigations on Terresterial Arthropod Biodiversity Under Different Grassland Ecosystems in El-Fara' Area (Palestine)

By

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DEDICATION

To
My parent and my wife for their support and encouragement

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إقرار

أنا الموقع أدناه مقدم الرسالة التي تحمل العنوان:

Ecological Investigations on Terresterial Arthropod Biodiversity Under Different Grassland Ecosystems in El-Fara' Area

التنوع الحيوي لفضليات الأرجل
في انظمة بيئية مختلفة في منطقة وادي الفارعة

أقر بأن ما اشتملت عليه هذه الرسالة إنما هي نتاج جهدي الخاص، باستثناء من تمت الإشارة إليه حيثما ورد، وأن هذه الرسالة ككل، أو أي جزء منها لم يقدم من قبل لنيل أية درجة أو لقب علمي أو بحثي لدى أية مؤسسة تعليمية أو بحثية أخرى.

Declaration

The work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification.

Student's Name: .... :اسم الطالب

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Date: .... :التاريخ

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Ecological Investigations on Terresterial Arthropod Biodiversity Under Different Grassland Ecosystems in El-Fara' Area (Palestine)

By
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Abstract

Background: Despite the importance of arthropods in grassland ecosystems, few studies have examined how grassland arthropods have been impacted by disturbances in the Wadi Afara in the West Bank

Objectives: This work was aimed at studying the effects of animal grazing on arthropod diversity, including species composition, species richness and species diversity, in a semi-arid Mediterranean grassland ecosystem at Alfara' area in the Palestinian West Bank.

Methodology: The field work was conducted at the Tallouza village, located in the north-eastern part of the West-Bank. The experiment was established in 2006 in an area of about 2000 donums of a mainly grassland ecosystem usually used for grazing sheep and goats herds, under different land use management systems: recently fenced grassland, undisturbed natural grassland, and recently reclaimed agricultural land. Within this area, three sites (2000m² each) with similar topographic and edaphic features were selected to study the effect of land use management practices on arthropods diversity including species composition, species richness and species diversity: one site was previously a part of a grassland suffering from grazing by mainly sheep and goats herds. In October 2005 the land was fenced and protected from any agricultural practices or grazing; a second site was under grazing for the last 25 years, and the third site was

undisturbed natural grassland where no human activities, agricultural practices or grazing had taken place for the last 5 years. Terrestrial arthropod communities were sampled seasonally at the three sites using pitfall traps, over the period of Apr 2006 to Apr 2007. One year of collections at comparison sites were used to quantify the seasonal variation of arthropod species and these parameters were correlated with climatic and edaphic conditions.

Results and discussion: Arthropods communities were found to be sensitive to livestock grazing. Overall population levels of arthropods were highest in the the undisturbed natural grassland, followed by grazed grasslands, and the fenced grassland. Certain insect orders (Coleoptera and Hymenoptera) were generally, negatively impacted by livestock grazing. However, members of the family (Carabidea, ground beetles) (order Coleoptera) especially *Carabus impressus,* were richer in grazed sites. On the other hand families of Hymenoptera like (Sphegidae, Cephidea and Apiddae) were not detected in the grazed grassland. On the other hand the unidentified species (Form 5) of the family (Formicidae) found only in the grazed grassland.

A significant seasonal variation pattern was detected for total arthropod populations ($P<0.05$) at the different study sites, with the highest population levels detected in summer and early autumn, and lowest population levels detected in winter. The fluctuation patterns were comparable in the three sites. Comparable fluctuation patterns were also found for Hymenoptera and Coleoptera. Higher arthropod population levels in summer months coincided with higher air temperatures and lower

soil moisture content, whereas, lower arthropod population levels in winter, coincided with lower temperatures and higher soil moisture content.

Conclusion: Grazing has a considerable impact on the biodiversity of grassland arthropods in Alfara' area. Some of the insect components, especially *Carbus impressus*, of the family Carabidae (order Coleoptera) are well adapted to grazing disturbance, and therefore can be used as bioindicators of habitat disturbance such as grazing.

Chapter one

Introduction

1:1Background:

Arthropods can be used to show the developed changes of ecosystem because they are very sensitive to ecosystem change (Holloway and Stork, 1991). Some species react very fast to environmental changes and are ideally suited to act as bioindicators. Arthropods can therefore act as bioindicators of habitat disturbance such as pollution and climate change (Hawksworth and Ritchie, 1993). Arthropods are abundant and easy to sample, and so, they give more information per unit sample time (Hill, 1995).

Ecologically, invertebrates including arthropods have a great functional importance, and main component within most ecosystems (Wilson, 1987; Samways, 1994; Hill, 1995; Coleman and Hendrix, 2000). They are known for their overall success at proliferating into available niches. Also, they have a main role in food webs which affects the ecosystem function (Erwin, 1982; Niemelä *et al*., 1993; Kremen et al., 1993; Colwell and Coddington, 1994; McGeoch, 1998).

Arthropods are usually efficiently used in aquatic ecosystems to produce data on environmental quality (Kremen *et al*., 1993). The importance of arthropod species as indicators for ecosystem monitoring controlling is that their huge ecological diversity supplies a wide choice for designing suitable assessment programs (Kremen et al., 1993) which can be for both short-term and long-term controlling.

Arthropods are simply, quickly, and cheaply sampled, therefore giving aids to get timely, cost-effective ecosystem data.

Detailed sampling systems are available for practically all groups of arthropods in habitats levels from soils in forest canopies to deep groundwater fauna (Marshall et al., 1994).

Species identification of arthropods is not usually a difficult job compared with fungi or bacteria which needs DNA analysis and fatty acid profiles. With some practise nonspecialists can classify arthropods to species level according to systematic treatments when available. Using morphospecies allow the sorting of unknown arthropod groups into meaningful categories by nonspecialists (Marshall et al., 1994).

The arthropods are very important in grassland ecosystems, but few studies have examined how grassland arthropods have been impacted by disturbances, such as, overgrazing and reclmation.

This study forms part of a wider project investigating different systems of landuse in the Wadi El-Far'a area and the effect on biodiversity. In this study I assess the extent to which land-use influences the diversity and species composition of arthropods.

1:2 Literature Review:

There are many factors that can affect on the arthropods diversity:

1:2.1 The effect of vegetation:

Arthropods groups differed in their responses to grazing and grassland age in terms of species diversity and abundance (Gibson *et al.*, 1992).

In Scotland the relationships between grazers, vegetation and arthropods for upland, indigenous grasslands were consistent with the situation in lowland grasslands (Kruess and Tscharntke, 2002). The diversity of many arthropod taxa of lowland grasslands was favoured primarily by an increase in average vegetation height.

Additionally, patterns of arthropod abundance have been shown to be greatly affected by physical habitat conditions. For example, plant structural complexity or the height of the vegetation had an affect on arthropod numbers in different agroecosystems (Borges and Brown, 2001; Kruess and Tscharntke, 2002; Brose, 2003). Such vegetation structure effects on arthropod abundances have been identified for herbivores, detritivores and carnivores in a number of studies (Lagerlof and Wallin, 1993; Borges and Brown 2001; Kruess and Tscharntke, 2002; Brose, 2003).

Studies results of biodiversity assume that the composition and dynamics of animal communities are determined by plant species diversity (Elton, 1958; Hutchinson, 1959; Murdoch *et al*., 1972). Actually, in natural ecosystems the increase in the number of plant species results in the increase of diversity of herbivorous and predatory arthropod species (Siemann *et al*., 1998; Knops *et al*., 1999; Haddad *et al*., 2001). The plants diversity affects the abundance of arthropods, but these effects are often less consistent, partly because the response in abundance varies by trophic level (Root, 1973). Specifically, herbivores are predicted to decrease, while predators are predicted to increase, with the number of plant species in a community (Root, 1973).

In spite of the great concentration of the experiments on the effects of plant species diversity in agricultural (Andow, 1991) and natural ecosystems (Knops *et al*., 1999; Koricheva *et al*., 2000; Haddad *et al*., 2001; Parker *et al*., 2001; Otway *et al*., 2005), there is less concentration on intraspecific genetic diversity on multitrophic levels (Schmitt & Antonovics 1986; Power 1988).

Recently, it has been discovered that the effects of genetic variation increase to affect the composition and structure of diverse arthropod assemblages on individual plants (Dungey *et al*., 2000; Hochwender & Fritz, 2004; Wimp *et al*., 2005). For example, that the total richness and abundance of arthropods was found by Johnson & Agrawal (2005)to vary by as much as 2.4-fold and 3.9-fold between plant genotypes respectively. The variation in the arthropod community was connected with several genetically variable plant features, assuming that different plant genotypes offer distinct niches for arthropods. In an observational study of hybridizing trees, genetic diversity across 11 natural tree stands positively correlated with arthropod diversity (Wimp *et al*., 2004).

On the other hand, other effects stem from the independent influence of plant genotypes on the arthropod community, while there is abig richness and abundance of arthropods on diverse patches because of the great probability of including genotypes with special communities (analogous to the so-called-sampling effect (Loreau & Hector, 2001; Johnson & Agrawal,2005).

1:2.2 The effect of grazing:

Many years ago, there was a decrease in perennial grasses in arid and semi-arid grasslands throughout the world and an increase in shrubs and soil erosion (Van Auken, 2000). This result in desertification, with other many factors, the main one is overgrazing by livestock on which most workers agree overgrazing is the major cause of desertification (Fleischner, 1994). Livestock removal typically does not lead to rapid return of perennial grass (Fuhlendorf *et al*., 2001; Valone *et al*., 2002).

Invertebrate groups differ in their responses to grazing and grassland age according to species diversity, abundance, and variability over time. The effects of grazing on plant species composition does not strongly affect the development of a specific fauna on short turf leaf-miner assemblies, while spiders' responses could largely be explained by the effects of grazing on plant architecture. Spider species simply accumulated over time, whilst leaf-miners were the most labile group Spiders, leaf-miners and leafhoppers all contained some common species restricted to old grasslands, whilst herbivorous Coleoptera and Heteroptera did not (Gibson *et al*., 1992)

Both the plant and animal biodiversity depends critically upon the level of grazing. Too much grazing may often lead to land degradation and the loss of biodiversity, while too little grazing may lead to succession from grassland to woodland and the loss of the grassland habitat. Not only is the level of grazing important, but also the timing and the animals species involved (Watkinson and Ormerod, 2001)

There is increasing concern that the loss of biodiversity caused by intensive practices disturbs ecosystem functioning and sustainability of grazing systems, therefore management practices that modify invertebrate assemblages also risk interfering with these essential ecosystem processes and the sustainability of further production.(Reid, 2006).

The high grazing levels negatively affected the abundance and diversity of beetles (Mysterud & Austrheim, 2005), but did not affect the abundance and species richness of Diptera or Hemiptera, although Tipulidae larvae were excluded due to the capture technique (Mysterud *et al*., 2005). Grazing may also make the habitat more available for insect larvae (Evans *et al*., 2005).

Disruptions such as harvesting and ploughing have negative effects on assemblages of spiders (Topping & Sunderland, 1994; Thomas & Jepson, 1997).

Carabidae (ground beetles) and Staphylinadae (rove beetles) are considered as indicators of habitat disturbances, such as drainage of wetlands, or grassland for grazing animals, and their monitoring could provide one measure of ecosystem sustainability if intensive grazing management systems expand or intensify in the future (Byers *et al*., 2000).

More Coleoptera species occurred in the tall sward (an average of nine species) continuously grazed as opposed to ensiled subplots more beetle species but fewer individuals.species composition of ground (Carabidae) and rove (Staphylinadae) beetles varied between treatments more than the arithmetic differences in species numbers (Dennis *et al*., 2004).

The effect of grazing on large, ground –active beetles namely ground and above ground rove beetles and wolf spiders was not consistent (Dennis, 2003).

1:2.3 The effect of soil management:

The soil management system known as no-tillage can increase soil fauna, because of re-establishing the biological equilibrium, especially in the superficial layers (Winter *et al*., 1990). For example, a certain number of organisms, live on subterranean plant parts, can reach high population levels and, thus, the condition of crop pests (Stinner & House, 1990).

Soil compaction negatively affects and reduces insect survival (Brown & Gange, 1990) by creating a physical barrier to larval movement in the soil (Strnad & Bergman, 1987). In a review, Stinner & House (1990) with data from about 51 arthropod species concluded that, with a decrease in soil management operations, there was 28% increase in the number of species and damage caused to crops. Twenty nine percent were not affected and, additionally, there was a 43% decrease with these practices.

So that the studies of Arthropods few and the Arthropods as bioindicator for environment changes that's created the idea of study.

1:3 Objectives:

This present work was aimed at studying the effects of animal grazing on arthropod diversity, including species composition, species richness and species diversity, in a semi-arid Mediterranean grassland ecosystem at Alfara' area in the Palestinian West Bank.

Chapter two

Materials and Methods

Materials and Methods

2:1 The study area

The field work was conducted at the Tallouza village, located in the north-eastern part of the West-Bank (latitude 32.27N, longitude 35.31E, altitude) (Figure 2.1).

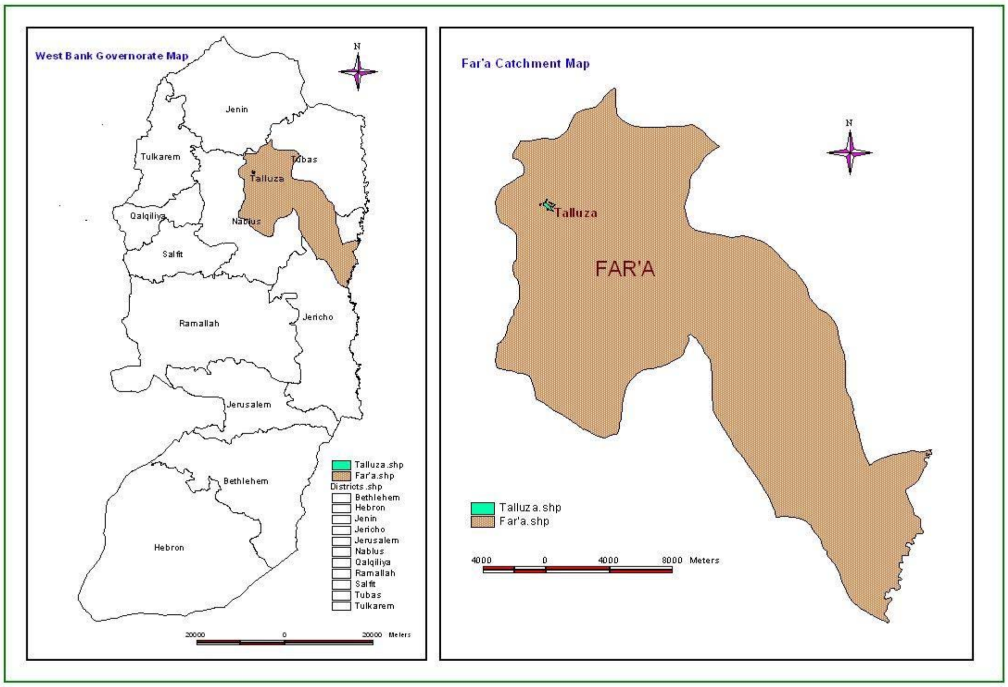

Figure 2.1: Map of West Bank showing the Study area.

The Tallouza village is located in the Wadi El-Far'a area which extends about 30 km from Nablus in the West to the Jordan River in the east with an area of 345 sq. The stream Wadi El-Far'a is a tributary of the Jordan River, and is considered one of the most important wetlands in the West Bank. Topography is a unique factor in Wadi El-Far'a which ranges from 1000 m above sea level in Nablus Mountains in the west to about 250 m below sea level at the point where Wadi El-Far'a meets the Jordan

River. These factors have contributed to the high and unique biodiversity, especially endemic plant species, of the regions ecosystems.

The experiment was established in 2006 in an area of about 2000 donums of a mainly grassland ecosystem, under different land use management grazing systems land, recently fenced grazing land, natural non- grazed grassland, and recently agricultural land.

The topography is hilly, with slopes generally less than 10%. Soils are brown with variable depth, but rarely deeper than 60 cm, and with a rock cover of about 30 %. The area has a Mediterranean climate, characterized by wet and mild winters. The average seasonal rainfall is 550 mm, falling mostly in winter. The rainy season begins in October – November and ends in April. Summers are dry and hot. At least 5 months of dry weather characterizes this area. The growing season of the vegetation is closely associated with the distribution of rainfall. Germination of annuals and regrowth of most perennials happen soon after the first rains. Growth is rather slow during the winter months of December-January, but the vegetation is usually well-established by mid-end January. Growth is rapid in spring and peak growth, coincided with seed set, occurrs in March-April. By mid-May, most of the herbaceous vegetation is dry and most seeds have been disappeared. The forage quality decreases at the beginning of the long dry summer. (Environment Quality Authority, 2004)

2:2 Experimental design

Within this area, three sites ($2000m^2$ each) with similar topographic and edaphic features were selected to study the effect of land use management practices on arthropods diversity including species composition, species richness and species diversity. **Site 1** was previously a part of a grassland suffering from grazing by mainly sheep and goats herds. In October 2005 the land was fenced and protected from any agricultural practices or grazing (Figure 2.2). **Site 2** was under grazing (mainly by sheep and goats herds) for the last 25 years (Figure 2.3). **Site 3 was a n**atural grassland where no human activities, agricultural practices or grazing had taken place for the last 5 years. This site was considered as the control treatment (Figure 2.4).

Figure 2.2: General view of the recently fenced non- grazed grassland site.

Figure 2.3: General view of the under grazing grassland site..

Figure 2.4: General view of the natural reserved grassland site.

Three 250m² (10x25 m) sampling plots (replicates) were selected at each site (land use treatment) (Figure 2.5).

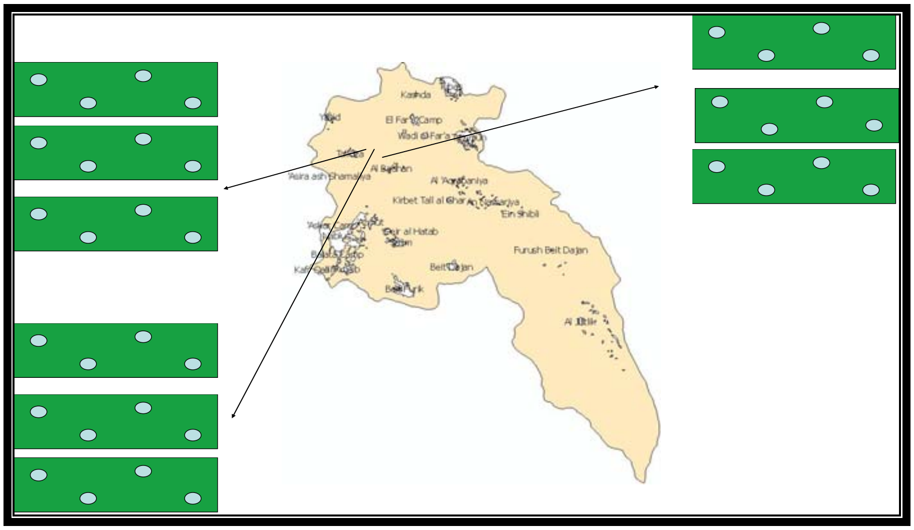

Figure 2.5: Map of Tallouza showing the experiment layout

2:3.Arthropods Sampling:

The activity and population dynamics of arthropods were recorded using pitfall traps (William & Marcos,1994; Hinds & Rickard 1973).

Pitfall Traps were made of about 450 ml plastic containers with 2 containers for each trap placed one in the other (Figure2.6).

One container is placed within another and removed and replaced by a new one at the end of the sampling session. The pitfall traps containing ethylene-glycol (to preserve the specimens trapped) will be dug and placed into the ground so that the lip of the trap was flushed with the ground surface, 4 in each plot.

The pitfall traps were opened for two consecutive weeks (day and night) during every season (Winter, Spring, Summer, and Autumn) in order to trap beetles, spiders, and scorpions. After one week the containers were removed and replaced by new containers.

Figure 2.6 :Pitfall trap

2:3:1. Processing of samples:

After removal of pitfall, the arthropods captured were stored in 70% ethanol. The catch from each trap were calculated from the total numbers of arthropods of each group for each 7-day period. These groups were based on broad taxonomic divisions except for the commonest, for which specific determinations were made whenever possible**.**

Samples were washed through a fine aquarium sieve in the laboratory and the invertebrates were extracted, arthropod catch size per pitfall recorded and preserved in ethyl alcohol (70% for pitfall).

Extracted specimens were stored in 70% ethyl alcohol. Each sample of Arthropods was sorted using a dissecting microscope. Individuals were then identified to the order level and in case of Coleoptera and Hymenoptera insects where identify using taxonomic keys and monographs (e.g., Borradaile *et al.,* 1961; Borror *et al*., 1981).

Species were initially assigned to morphospecies with a code number for each morphospecies and later identified, where possible, to species using available keys and insect collections.

2:4 Soil sampling and chemical analysis:

Composite soil samples were collected at the three study sites in mid April 2006 and 2007. At each study site, 2–3 kg composite soil samples at 0–15 cm depth were collected randomly with an auger from our different location withen the site. Soil samples were air dried, grounded, sieved with 2 mm mesh sieves and stored in plastic bags at room tempreture for chemical analysis. Composite soil samples were analyzed for texture, soil moisture content, pH and soil organic matter.

Soil texture was determined for each soil sample using a hydrometeric method as described by Day (1965).

Soil moisture content was determined by gravimetric techniques (Hesse, 1971).

Soil pH was determined on a suspension of 10 g air dry soil and 10 mL 0.01 M CaCl2 by using a pH-meter (Mclean, 1982).

Soil organic matter was determined by reduction of potassium dichromate by organic carbon compounds and subsequent determination of unreduced dichromate by oxidation-reduction titration with ferrous ammonium sulfate method (FAO, 1974), and later converted to soil organic carbon using a factor of 0.58 (Wang and Zhou, 1999).

2:5. Climatic data:

Annual rainfall (in mm), annual means of temperatures (min, mean, max) during the two growing seasons were obtained from the nearest metrological station located in Nablus.

2:6. Statistical analysis:

A one-way ANOVA was used to test for differences in abundance and species richness with land use.

Cluster analysis was performed to assist in finding type of speices throughout the three sites.

Single regression analyses of the results were carried out, The independent variables were climatic factors, and the dependent variables were arthropods groups the statistics were all computed using MTP11.

Chapter three

Results and Discussion

Results and Discussion

3.1 Arthropods abundance and diversity:

Over 39000 individual arthropods were trapped and counted during the period of study. Total arthropods catch was highest in natural grassland, followed by grazing grassland and lowest in the recently fenced grassland (Table 3.1). This pattern was largely attributed to the most common orders, particularly ants (Hymenoptera) which comprised more than 87% of the total catch in all three sites. Hymenoptera and adult beetles (Coleoptera) also showed similar pattern.

Average arthropods catch throughout the study period was 436/ pitfall in the sites under different land use types. Arthropods were distributed across three groups insects 427/ pitfall, spiders 8/ pitfall and other arthropods not insects 1/ pitfall. Population level for arthropods varied considerably between sites (p=0.951). The hymenoptera were found to be the most prevalent of the arthropod groups collected, with average number 381 / pitfall followed by the other insects (Diptera, Collembola, Hemiptera…etc), with average number 36 / pitfall. Coleopteran, spiders and the other arthropods (millipedes, centipedes... etc) all had fewer than 20/pitfall(Figure 3.1,3.2).

The number of individuals captured of both orders, Hymenoptera and Coleoptera were greater in the natural grass land than in the in the other sites. Species belonging to Hymenoptera were most common in the natural grassland with (491 / pitfall), followed by under grazing grassland 435 / pitfall and in the recently fenced land (382/ pitfall). Similarly,species belonging to Coleoptera were found to be higher in the natural grass land (

11/) followed by grazed grassland and recently fenced land (9/ pitfall) (Table 3.1).

The low numbers of arthropods detected in the fenced grassland land can be attributed to the lack of food sources of arthropods e.g (the absence of dung) and low vegetation cover.

In this study high grazing levels were found to have negatively affected the abundance and diversity of beetles, our result are therefor, in agreement with those of Mysterud & Austrheim (2005**)**. On the other hand species belonging to other arthropods including other insects (Diptera, Hemiptera, …etc) were more common in the under grazing than in the other land sites because sheep grazing did not seem to affect the abundance and species richness of Diptera or Hemiptera (Mysterud *et al*., 2005). Grazing seems to render accesible to insect larvae (Evans *et al*., 2005).

Table 3.1: Average number of arthropods catches per pitfall

Taxon	**Fenced (F) Mean ±SE**	**Grazed (G) Mean± SE**	**Natural (N) Mean± SE**	**ANOVA between seasons sites**				**Pairwise comparisons**
Abundance				F	G	N		
Total	382 ± 229	435 ± 225	491 ± 271	0.000	0.013	0.000	0.951	N>G>F
Aranaea	7.86 ± 2.26	8.02 ± 1.91	7.84 ± 2.28	0.000	0.000	0.001	0.997	G>F=N
Total insects	373 ± 229	425 ± 226	482 ± 272	0.026	0.095	0.048	0.952	N>G>F
Coleoptera	9 ± 1.1	10 ± 1.16	10.8 ± 1.28	0.041	0.117	0.115	0.516	N>G>F
Hymenoptera	328 ± 237	376 ± 233	438 ± 277	0.000	0.009	0.000	0.953	N>G>F
Other Insects	36.16 ± 8.71	39.8 ± 20	32.4 ± 11.7	0.371	0.001	0.060	0.932	G>F>N
Other Arthropods	0.68 ± 0.289	1.46± 0.609	1.16± 0.462	0.002	0.008	0.021	0.748	G>N>F

The pattern of relative abundance (catch per order expressed as proportion of the total catch) showed that the absolute catch of spiders(2.1%), beetle(2.4%) and other insects (9.5%) were higher in fenced grassland followed by grazed and natural grassland. Total insects

(98.2%) were including Hymenoptera comprised higher proportion of arthropods in the natural grassland followed by under grazing grassland and the lowest proportion in the fenced grasland land (Table 3.2).**Table**

Table 3.2: Relative abundance of each group of arthropods

Taxon	**Fenced (F)**	**Grazed (G)**	**Natural (N)**
Abundance	**proportion**	**proportion**	**Proportion**
Total	100.0	100.0	100.0
Aranaea	2.1	1.8	1.6
Total insects	97.6	97.7	98.2
Coleoptera	2.4	2.3	2.2
Hymenoptera	85.9	86.4	89.2
Other Insects	9.5	9.1	6.6
Other Arthropods	0.2	0.3	0.2

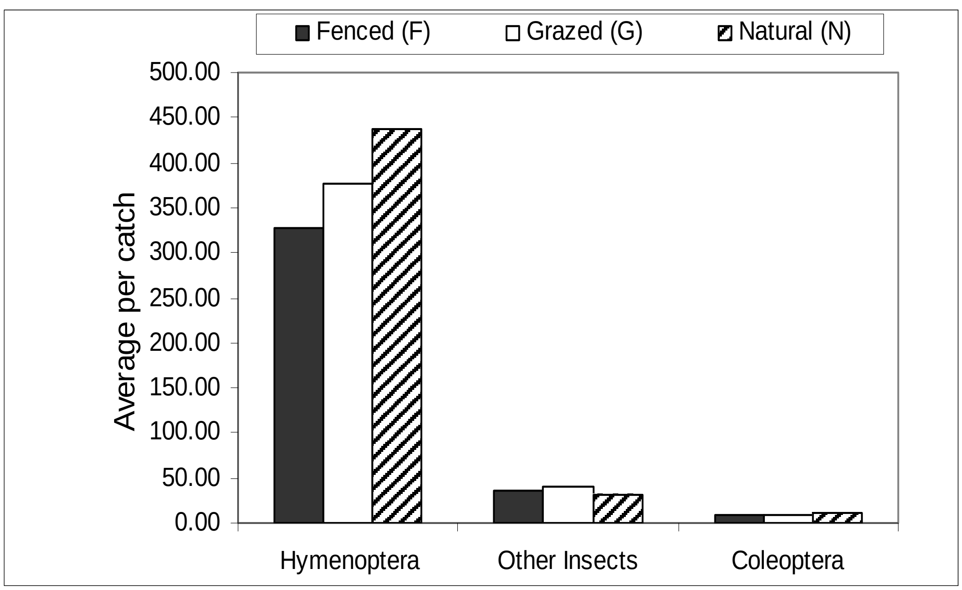

Figure 3.1: Abundance of Hymenoptera, other insects and Coleoptera in the three sites.

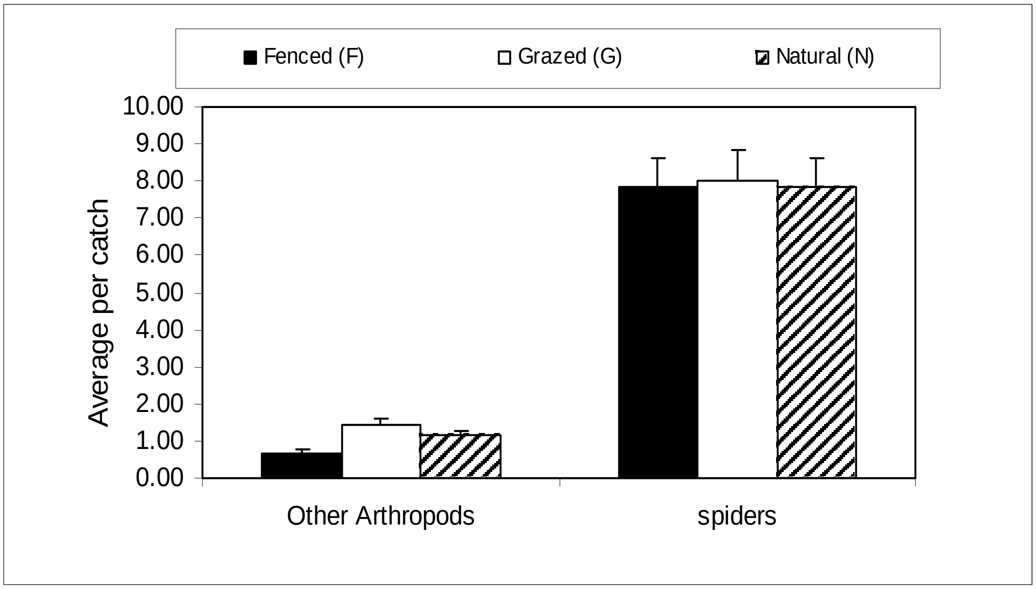

Figure 3.2: Abundance of the other arthropods and spiders in the three sites.

3.1.1 Species composition:

3.1.1.1 Coleoptera (beetls):

In the period of this study, insects captured belonging to Coleoptera can be classified into 6 families (Figure 3.3) and 16 species (Table 3.3) of coleoptera. More than ninety percent of the catch was represented by four families: Carabidae, Tenebrionidae, Elatrridae and Histeridae.

Beetles belonging to Carabidae were caught in higher number in grazed land than in the othergrass lands. On the other hands, more individual insects belonging to Histeridae and Elatrridae were caught in higher numbers in natural grassland than the other grassland sites. Tenebrionidae were also caught in highest number in the fenced land. (Figure 3.3)

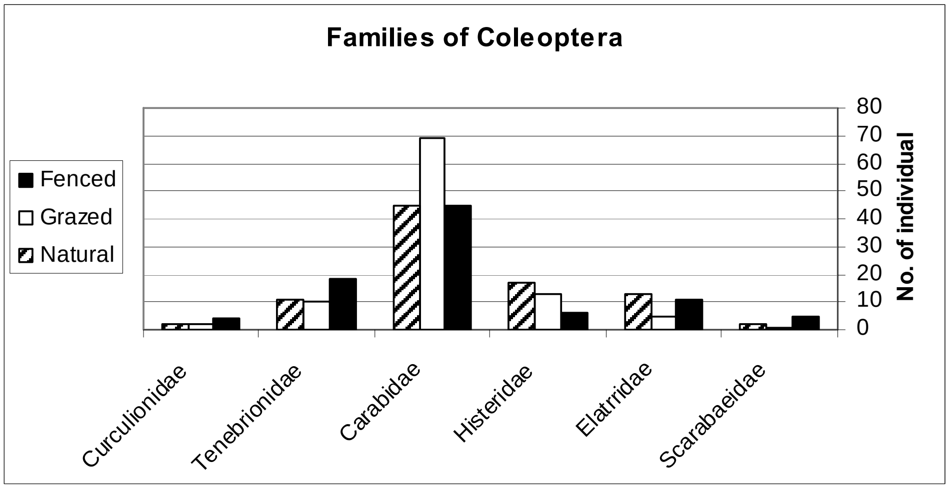

Figure 3.3: Abundance of the families Coleoptera in the three sites.

Seven species(*Scarites procerus eurytes, Carabus impressus, carb 1, scar 1, Margarinotus graecus, Zophosis punctata, Conicleonus nigrosuturatus*) can found in the three sites, two species (*Drasterius bimaculatus, Tanyproctus saulcyi*) can found in both fenced and natural land, two species(*Ela 1, Cur 1*) can found in both fenced and grazed land three species(*his 1, carb 2, car 3*) in the natural and grazed lands one species(*scar 2)*can found only in the fenced land and one(*Ela 2*) can found in the natural grass land (Table 3.4).

Table 3.3: The families and species of Coleoptera with present or absent species in the three sites(√ mean present, - mean absent)

		Presence		
Family	**Species**	**Fenced**	**grazed**	**Natural**
Scarabaeidae				
	Tanyproctus saulcyi	√	-	√
	scar 1	√	√	√
	scar 2	√	-	-
Elatrridae				
	Drasterius bimaculatus	√	-	√
	Ela 1	√	√	-
	Ela 2	-	-	√
Histeridae				
	Margarinotus graecus	√	√	√
	his 1	-	√	-
Carabidae				
	Scarites procerus eurytes	√	√	√
	Carabus impressus	√	√	√
	carb 1	√	√	√
	carb 2	-	√	√
	car 3	-	√	√
Tenebrionidae				
	Zophosis punctata	√	√	√
Curculionidae				
	Conicleonus nigrosuturatus	√	√	√
	Cur 1	√	√	-

Beetls were caught in relativly lower than expected numbers in our samples, probably because we have only sampled a portion of the full beetle diversity at sites. Pitfall trapping inherently limits our collection to active, ground-dwelling species, although there is an incidental by-catch of families more generally associated with other microhabitats (e.g., Scolytidae, Cerambycidae) (Greenslade 1964, 1973).

Table 3.4: Abundance of the families and species Coleoptera in the three sites.

	grazed	fenced	natural
Scarabaeidae			
• *Tanyproctus saulcyi*	0	2	1
• *scar 1*	1	2	1
• *scar 2*	0	1	0
Elatrridae			
• *Drasterius bimaculatus*	0	7	6
• *Ela 1*	5	4	0
• *Ela 2*	0	0	7
Histeridae			
• *Margarinotus graecus*	9	6	17
• *his 1*	4	0	0
Carabidae			
• *Scarites procerus eurytes*	14	9	2
• *Carabus impressus*	29	23	21
• *carb 1*	5	13	2
• *carb 2*	1	0	2
• *car 3*	20	0	18
Tenebrionidae			
• *Zophosis punctata*	10	18	11
Curculionidae			
• *Conicleonus nigrosuturatus*	1	3	2
• Cur 1	1	1	0

3.1.1.2 Hymenoptera:

Hymenoptera caught in this study can be classified into 8 species in 4 families individual belonging to(Formicidae, Sphegidae, Cephidea and Apiddae).

Number of individuals belonging to the Formicidae caught, were higher in natural grassland followed by grazed land and the lowest in the fenced land. Individual of (Cephidea and Apiddae) were only caught in the natural grass land. Members of Sphegidae were however caught in the both natural and fenced land (Table 3.4).

Table 3.5: The families and species of Hymenoptera in three sites.

family	Species	Individual numbers		
		Fenced	Grazed	Natural
Formicidae	Catagliphus bicolor	9	65	161
	Form 2	907	2795	3508
	Form 3	0	0	25
	Form 4	2	26	202
	Form 5	1	25	0
Sphegidae	Philanthus trianguulum	1	0	11
Cephidea	Cephus tabidus	0	0	1
Apiddae	Apis mellifera	0	0	3

Catagliphus bicolor and undentified species (*form 2,form 4*) were present in the three sites, with higher numbers in the natural grassland followed by grazed land and the lowest in the fenced land.

Cephus tabidus,Apis mellifera and unidentifid speceis (*Form 3*) present only in the natural grass land. The unidentifid species (*Form* 5) was however present in the grazed and fenced land. *Philanthus trianguulum* was caught in higher number in the natural grass land followed by fenced land.(Table 3.6)

Table 3.6: The families and species of Hymenoptera with present or absent species in the three sites(√ mean present, - mean absent).

Species	**Grazed**	**Fenced**	**Natural**
tabidus Cephus	-	-	√
mellifera Apis		-	√
form 3	-	-	√
form 2	√	√	√
form 4	√	√	√
Catagliphus bicolor	√	√	√
Philanthus trianguulum	-	√	√
form 5	√	√	-

Results show that natural grassland supports higher numbers of families and higher ppulation levels of Hymenoptera. This may be attributed a richer vegetation cover in the natural grassland than in other the grazed or recently fencedgrass land. Hymenoptera are responding to some combination of these factors. More vegetation cover would mean more pollen and nectar producing flowers, which would be attractive to bees and masarid wasps (pollen collectors) as well as to predators such as ants and wasps, attracted to the shrubs by the flower visitors.

The grazed and fenced sites had fewer ant species than the natural grassland. It is noteworthy to point out that grazed site had however unique species compared to the natural grass land site.

The numbers of specimens per family or species were too small to permit comparisons of density between sites and over seasons to understand the effect of grazing on the diversity of arthropods.

3.2 Seasonal Variation in Arthropod Abundance:

The abundance of total arthropods varied significantly between the seasons ($P<0.05$) at the different study sites, with the highest abundance detected in summer and autumn and lowest abundance in winter. The fluctuation patterns were similar in the three sites (Figure 3.4)

The abundance of arthropods increased slightly through spring reaching a maximum abundance in summer, followed by decrease in autumn, and reached lower value in winter then increased gradually to the spring 07.

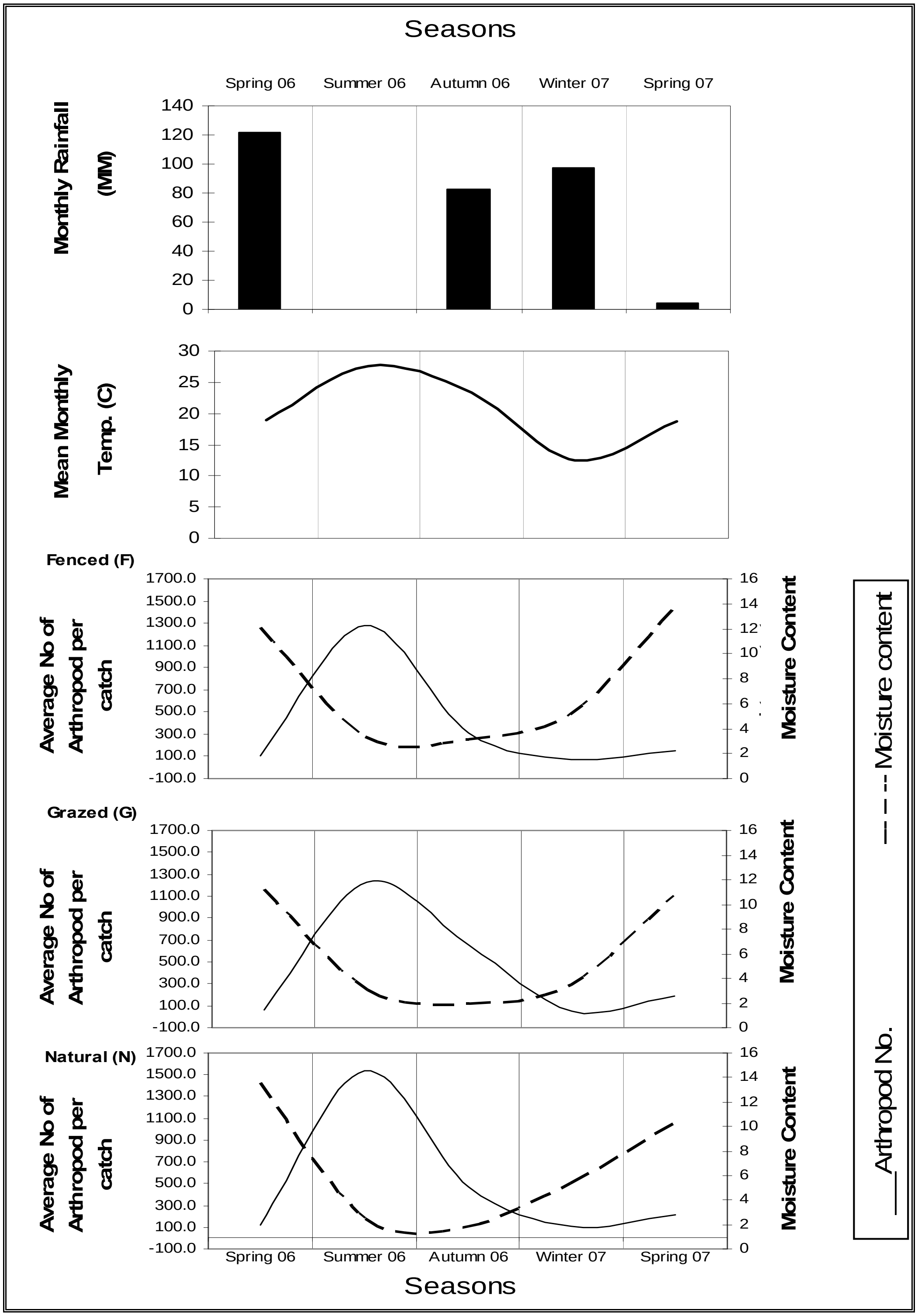

Figure 3.4: Seasonal Variation of Arthropod and edaphic environmental factors in the three study sites.

Significant differences were also detected between seasons for total insects and Hymenoptera in the three sites (P<0.05) except the total insects on the grazed grassland (P=0.095) this related to presence of other insects (Diptera, colombolla, Hemiptera….etc). The seasonal fluctation pattern of Hymenoptera and total insects was similar to that of total arthropods pattern because the hymenoptera form higher proportion (>97%) of insects and (>85%) of total arthropods. This pattern was also similar on each site for both total insects and Hymenoptera Figure (3.5, 3.6).

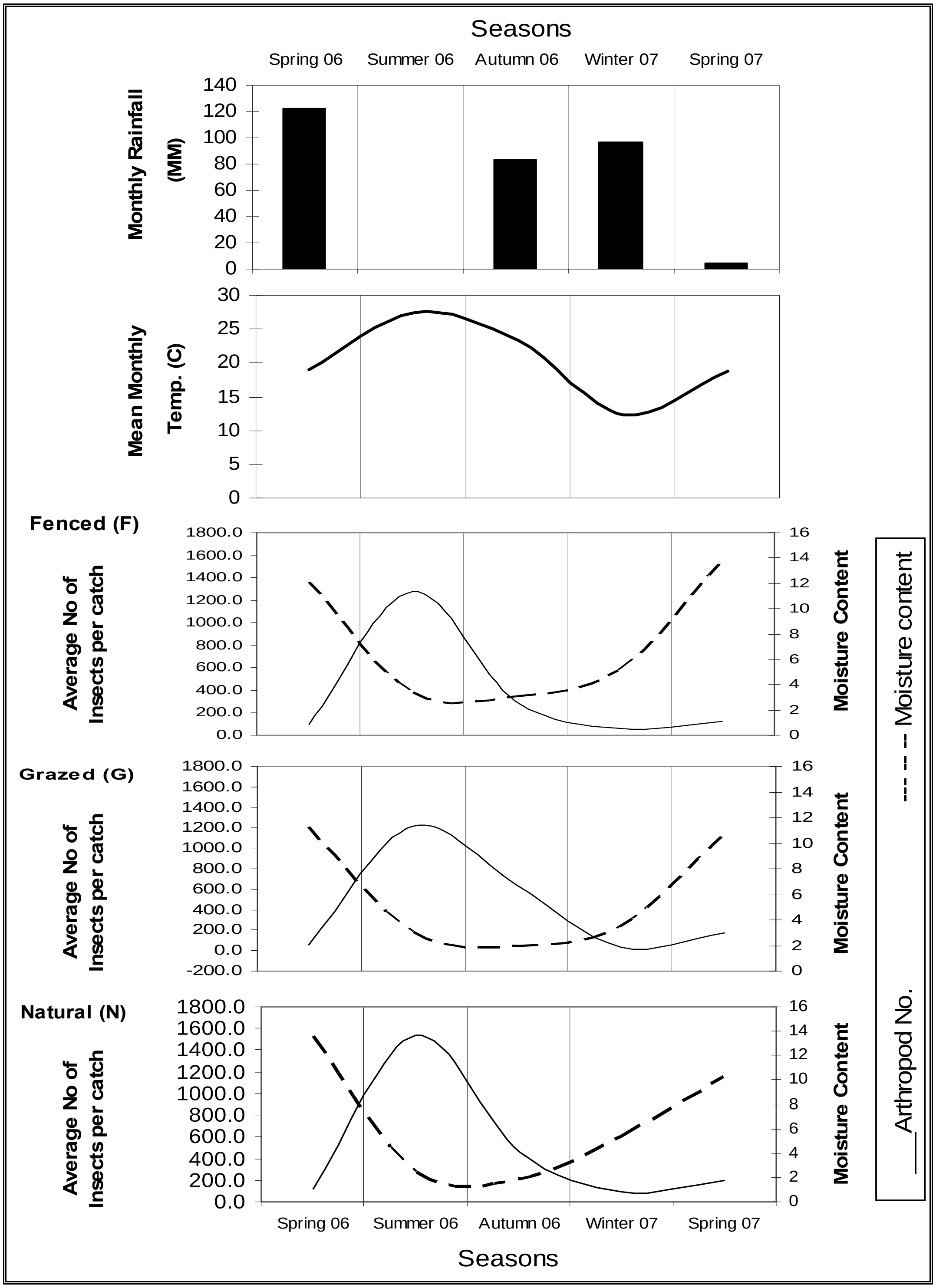

Figure 3.5: Seasonal Variation of Insects and edaphic environmental factors in the three study sites.

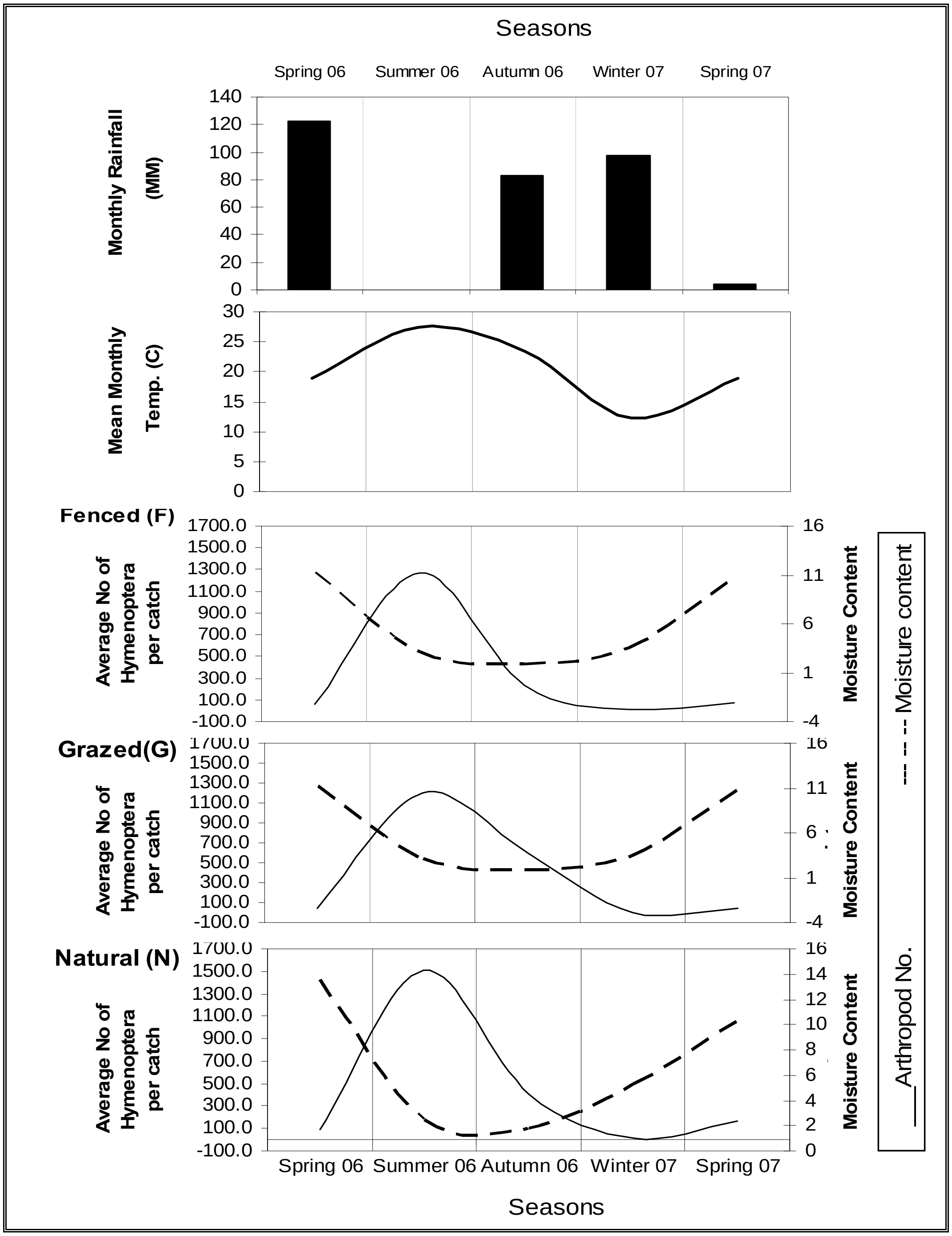

Figure 3.6: Seasonal Variation of Hymenoptera and edaphic environmental factors in the three study sites.

The differences of Coleoptera between seasons were not significant in both grazed and natural land (P>0.05), but it was significant in fenced land (P=0.041). Coleoptera generally increased during the summer and autumn and there was a slight reduction in abundance during winter.The pattern of natural grassland and recently fenced were similar and differed from the under grazing land. (Figure 3.7)

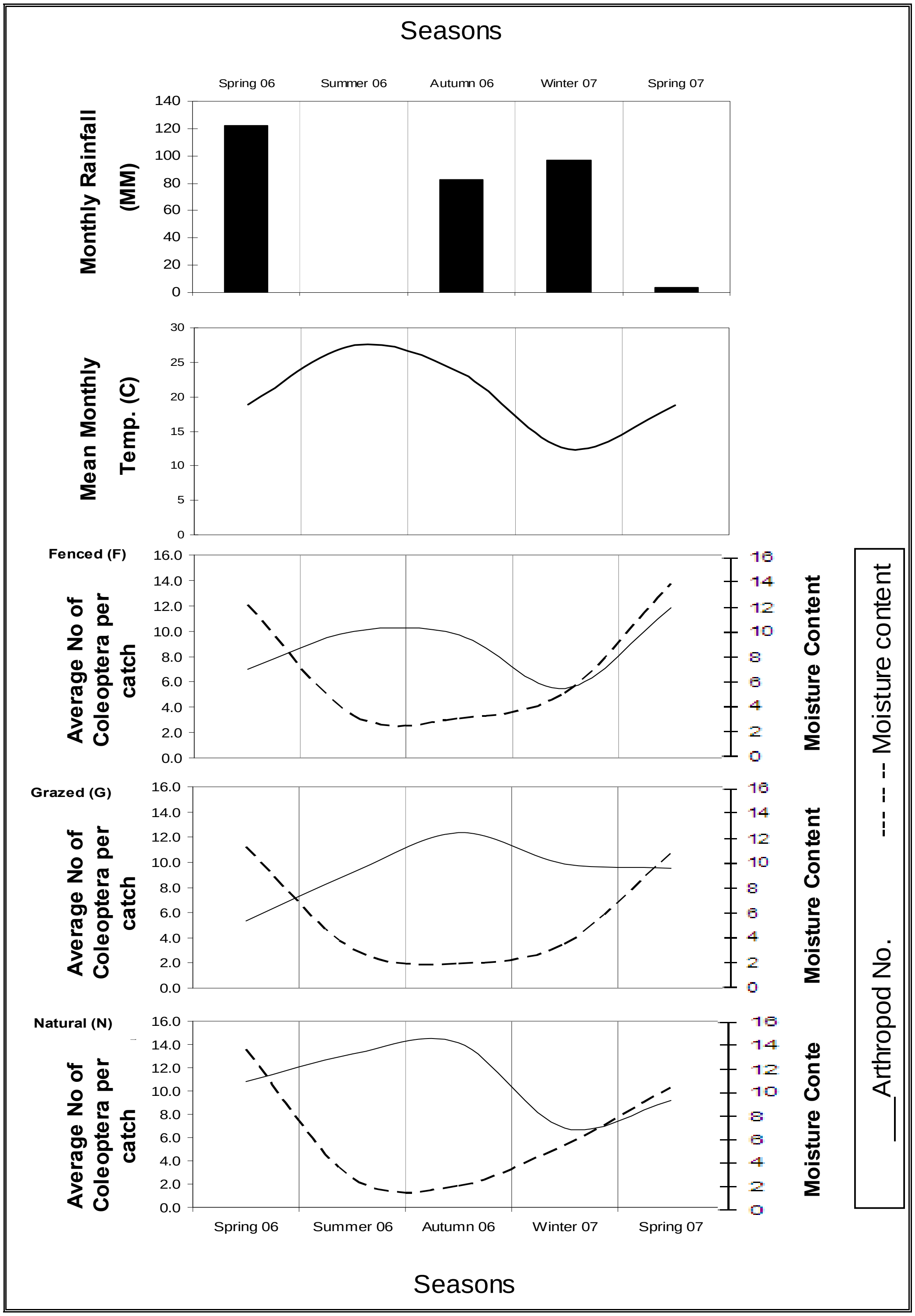

Figure 3.7: Seasonal Variation of Coleoptera and edaphic environmental factors in the three study sites.

Differences between seasons of population levels of other insecta were not significant in both recently fenced land and natural grassland ($P>0.05$), and significant in the under grazing land ($P=0.001$).The maximum abundance of other insects were detected in the spring 06 and in summer, but the minimum abundance detected in the other seasons (autumn, winter, spring07) this pattern were similar for the three sites. (Figure 3.8)

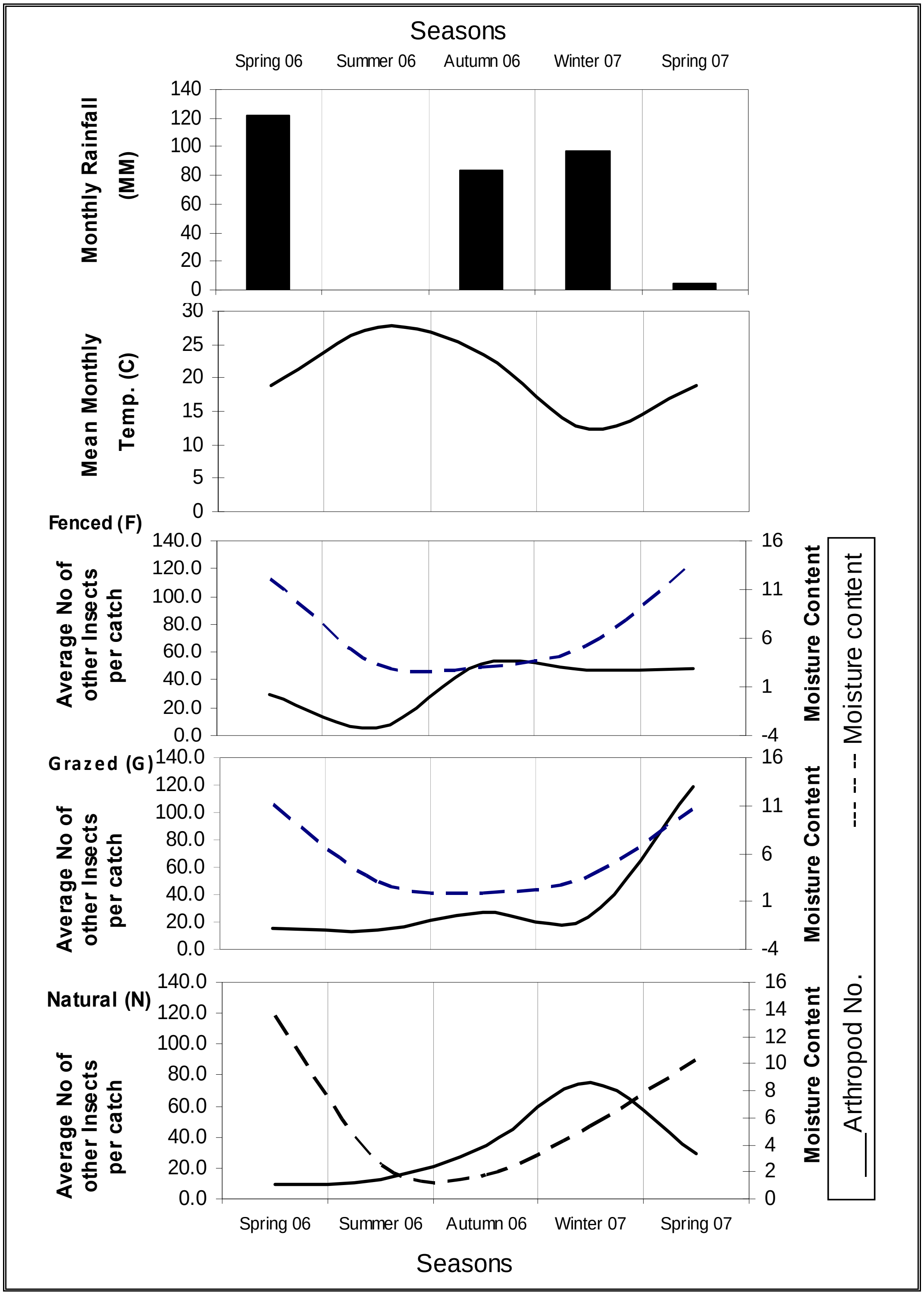

Figure 3.8: Seasonal Variation of other Insects and edaphic environmental factors in the three study sites.

Significant differences for spiders and other non- insects arthropods not insecta between the three sites ($p<0.05$), but no clear pattern were detected because the abundance of these groups were low.

3.2.1 Correlation of Arthropod Abundance with environmental factors:

Soil moisture and temperature were chosen as the two environmental correlation variables because they have been identified as the two most important determinants of insect phenology. (Uvarov, 1931).

To assess the effect of soil moisture and temperature on the abundance of arthropods, linear regression parameters were determined for the comparison of average number of each group for each season sample. There was no significant effect of moisture content of soil cores on the abundance of each group ($P>0.05$), with a weak negative correlation ($r^2<-0.5$) in each site except spiders and other arthropods. The effect of temperature on the arthropods group (total arthropods, total insects, and Hymenoptera) were significant ($P< 0.05$) on the grazed land only with appositive strong correlation ($r^2>0.5$) on the three sites. The other insects, spiders and other arthropods had a negative correlation(Appendix c). The effect of temperature on arthropods is however difficult to predict as the habitat in which they live is already harsh and highly variable (Coulson *et al*., 1996).

Theoretically, the increase in temperature should cause an increase in the length of the growth season, allowing for faster physiological development and a potential increase in food sources, leading to greater fitness and fecundity and, therefore, a larger population (Kennedy, 1994).

This may be related to the activity of hymenoptera in the summer because the hymenoptera were cold-blooded. Removal the grasses by the grazers cause the direct effect of temperature on the arthropods on the under grazed grassland increase the abundance of arthropods in autumn than the other sites.

The lack of correlation between soil moisture and arthropod abundance suggests that the arthropods may be able to tolerate wide range of moisture levels.

However higher abundance of arthropods including insects and Hymenoptera in the low and moderate soil moisture compared with the high soil moisture(Holway 1998b), and there were higher abundance of arthropods in the high temperature compared with the low temperature, ants are not tolerant of high temperatures and are restricted to habitats with relatively cool and moist conditions.

Several species show a delayed reaction to precipitation, their numbers increasing in the summer proportionally to precipitation the previous winter.

A relation between precipitation and arthropod abundance is consistent with precipitation causing increased plant productivity that

in turn allows greater consumer and predator abundance later in the season.

3.3 Conclusions and recommendations:

Grazing has a considerable impact on the biodiversity of grassland arthropods in Alfara' area. Some of the insect components, especially *Carbus impressus*, of the family Carabidae (order Coleoptera) are well adapted to grazing disturbance, and therefore can be used as bioindicators of habitat disturbance such as grazing.

References

References

Andow, D. A. (1991). **Vegetation diversity and arthropod population resonse**. Annual Review of Entomology 36: 561–586.

Borges, P. A. V. and Brown, V. K. (2001). **Phytophagous insects and web-building spiders in relation to pasture vegetation complexity**. Ecography 24: 68_/82.

Borradaile LA, Potts FA, Eastham LES, Saunders JT. (1961). **The Invertebrata**. 4th ed. Cambridge: Cambridge University.

Borror DJ, De Long DM, Triplehorn CA. (1981). **An Introduction to the Study of Insects**. 5th ed. New York, New York: Saunders College.

Brose, U. (2003). **Bottom-up control of carabid beetle communities in early successional wetlands: mediated by vegetation structure or plant diversity?** Oecologia 135: 407_/413.

Brown, W.R.; Gange, A.C. (1990). **Insect herbivore below ground**. Advances in Ecological Research, San Diego, v.20, p.1-58.

Byers, R.; Baker, G.; Davidson, R.; Hoebeke, E.; and Sanderson, M., (2000): **Richness and abundance of Carabidae and Staphylinadae (Coleoptera), in northeastern dairy pastures under intensive grazing**. Great Lakes Entomologist 33(2): 81-105.

Coleman, D.C. & Hendrix, P.F. (eds.). (2000). **Invertebrates as Webmasters in Ecosystems**. Wallingford, Oxon: CAB International.

Colwell, R.K. & Coddington, J.A. (1994). **Estimating terrestrial biodiversity through extrapolation**. Philosophical Transactions of the Royal Society of London Series B 345: 101-118.

Coulson J, Hodkinson ID, Webb NR, Block W, Bale JS, Strathdee AT, Worland MR, Wooley C. (1996). **Effects of experimental temperature elevation on high-arctic soil microarthropod populations**. Polar Biology **16**:147-153.

Day, P.R., (1965). **Particle fractionation and particle size analysis**. P. 546 – 566.

Dennis, P.,(2003): **Sensitivity of upland arthropod diversity to livestock grazing, vegetation structure and landform Food**, Agriculture & Environment Vol.1(2): 301-307.

Dennis, P.et al,(2004): **Consequences for biodiversity of reducing inputs to upland temperate pastures: Effects on beetles (Coleoptera) of cessation of nitrogen fertilizer application and reduction in stocking rates of sheep**. Grass and Forage Science 59(2): 121-135.

Dungey, H.S., Potts, B.M., Whitham, T.G. & Li, H.F. (2000). **Plant genetics affects arthropod community richness and composition: evidence from a synthetic eucalypt hybrid population**. Evolution, 54, 1938–1946.

Elton, C.S. (1958). **The Ecology of Invasions**. Methuen and Co., London.

Environment Quality Authority, (2004). Al-Fara'a Baseline Report.

Erwin, T.L. (1982). **Tropical forests: their richness in Coleoptera and other Arthropod species**. Coleopterists' Bulletin 36: 74-75.

Evans, D. M., Redpath, S. M., Evans, S. A., Elston, D. A. & Dennis, P. (2005): **Livestock grazing affects the egg size of an insectivorous passerine**. Biol. Lett. 1, 322–325.

FAO, (1974). **The Euphrates Pilot Irrigation Project. Methods of soil analysis, Gadeb Soil Laboratory (A laboratory manual)**. Food and Agriculture Organization, Rome, Italy.

Fleischner, T.L., (1994). **Ecological costs of livestock grazing in western North America**. Conservation Biology 8, 629–644.

Fuhlendorf, S.D., Briske, D.D., Smeins, F.E., (2001). **Herbaceous vegetation change in variable rangeland environments: the relative contribution of grazing and climatic variability**. Applied Vegetation Science 4, 177–188.

Gibson, C.W.D., Brown, V.K., Losito, L. and Gavin, G.C. (1992a). **The response of invertebrate assemblies to grazing**. Ecography 15: 166-176.

Greenslad P.J.M. (1964). **Pitfall rapping as a method for studying population of Carabidae (Coleoptera)** J. Anim. Ecol.33, 301-10.

Greenslad P.J.M. (1973). **Sampling ants with pitfall traps: digging-in effects**. Insects Sociaux 20, 343-53.

Haddad, N.M., Tilman, D., Haarstad, J., Ritchie, M. & Knops, J.M.H. (2001). **Contrasting effects of plant richness and composition on insect communities**: a field experiment. Am. Nat., 158, 17–35.

Hawksworth, D.L. and J.M. Ritchie. (1993). **Biodiversity and Biosystematic Priorities: Microorganisms and Invertebrates**. CAB International Wallingford UK. 70 pp. + annexes.

Hesse, P.R., (1971). **A Textbook of Soil Chemical Analysis**. John Murray, London.

Hill, C.J. (1995). **Linear strips of rain forest vegetation as potential dispersal corridors for rain forest insects**. Conservation Biology 9: 1559-1566.

Hinds, W. T.; Rickard, W. H. (1973). **Correlations between climatological fluctuations and a population of *Philolithus densicollis* (Horn.) (Coleoptera: Tenebrionidae).** Journal of Animal Ecology 42: 341-51.

Hochwender, C.G. & Fritz, R.S. (2004). **Plant genetic differences influence herbivore community structure: evidence from a hybrid willow system**. Oecologia, 138, 547–557.

Holloway, J.D. and N.E. Stork. (1991). **The dimensions of biodiversity: the use of invertebrates as indicators of human impact**. in: D.L.

Holway, D.A. (1998b). **Factors governing rate of invasion: a natural experiment using Argentine ants**. Oecologia 115:206–212.

Hutchinson, G.E. (1959). **Homage to Santa Rosalia or why are there so many kinds of animals?** Am. Nat., 93, 145–159.

Johnson, M.T.J. & Agrawal, A.A. (2005). **Plant genotype and the environment interact to shape a diverse arthropod community on Evening Primrose (Oenothera biennis)**. Ecology, 86, 874–875.

Kennedy AD. (1994). **Simulated climate change: a field manipulation study of polar microarthropod community response to global warming.** Ecography **17**: 131- 140.

Knops, J.M.H., Tilman, D., Haddad, N.M., Naeem, S., Mitchell, C.E., Haarstad, J. et al. (1999). **Effects of plant species richness on invasion dynamics, disease outbreaks, insect abundances and diversity**. Ecol. Lett., 2,286–293.

Koricheva, J., Mulder, C.P.H., Schmid, B., Joshi, J. & Huss-Danell, K. (2000). **Numerical responses of different trophic groups of invertebrates to manipulations of plant diversity in grasslands.** Oecologia, 125, 271–282.

Kremen, C., R.K. Colwell, T.L. Erwin, D.D. Murphy, R.F. Noss, M.A. Sanjayan. (1993). **Terrestrial arthropod assemblages: their use in conservation planning**. Conservation Biology 7(4): 796-808.

Kruess, A. and Tscharntke, T. (2002). **Contrasting responses of plant and insect diversity to variation in grazing intensity**. Biological Conservation106: 293-306

Lagerlof, J. and Wallin, H. (1993). **The abundance of arthropods along 2 field margins with different types of vegetation composition an experimental study.** Agricult. Ecosyst. Environ. 43: 141_/154.

Loreau, M. & Hector, A. (2001). **Partitioning selection and complementarity in biodiversity experiments**. Nature, 412, 72–76.

Marshall, S.A., R.S. Anderson, R.E. Roughley, V. Behan-Pelletier and H.V. Danks. (1994). **Terrestrial arthropod biodiversity: planning**

a study and recommended sampling techniques. Bulletin of the Entomological Society of Canada 26:(1), supplement, 33 pp.

McGeoch, M.A. (1998). **The selection, testing and application of terrestrial insects as bioindicators**. Biological Review 73:181-201.

Mclean, E. O., (1982). **Soil pH and lime requirement**. P. 199-224, In A. L. Page (ed.), Methods of soil analysis, Part 2: chemical and microbiological properties. Am. Soc. Agron., Madison, WI, USA.

Murdoch, W.W., Evans, F.C. & Peterson, C.H. (1972). **Diversity and pattern in plants and insects**. Ecology, 53, 819–829.

Mysterud, A. & Austrheim, G. (2005). **Ecological effects of sheep grazing in alpine habitats**. Short-term effects. Utmarksnæring i Norge 1-05, 1–91

Mysterud, A., Hansen, L. O., Peters, C. & Austrheim, G. (2005). **The short-term effect of sheep grazing on selected invertebrates (Diptera and Hemiptera) relative to other environmental factors in an alpine ecosystem**. J. Zool. 266, 411–418.

Niemalä, J.K., Langor, D. & Spence, J.R. (1993). **Effects of clear-cut harvesting on boreal ground-beetle assemblages (Coleoptera: Carabidae) in western Canada**. Conservation Biology 7:551-561.

Otway, S.J., Hector, A. & Lawton, J.H. (2005). **Resource dilution effects on specialist insect herbivores in a grassland biodiversity experiment.** J. Anim. Ecol., 74, 1–7.

Parker, J.D., Duffy, J.E. & Orth, R.J. (2001). Plant species diversity and composition: experimental effects on marine epifaunal assemblages. Mar. Ecol. Prog. Ser., 224, 55–67.

Power, A.G. (1988). Leafhopper response to genetically diverse maize stands. Entomol. Exp. Appl., 49, 213–219.

Reid, A.(2006). Effect of fertilizer and grazing on grassland invertebrates PhD Dissertation, School of Biological Science, The University of Sydney, NSW, Australia.

Root, R.B. (1973). **Organization of a plant-arthropod association in simple and diverse habitats: the fauna of collards (Brassica oleracea).** Ecol. Monogr., 43, 95–120.

Samways, M.J. (1994). **Insect Conservation Biology**. London: Chapman & Hall.

Schmitt, J. & Antonovics, J. (1986). **Experimental studies of the evolutionary significance of sexual reproduction: effect of neighbor relatedness and aphid infestation on seedling performance**. Evolution, 40, 830–836.

Siemann, E., Tilman, D., Haarstad, J. & Ritchie, M. (1998). **Experimental tests of the dependence of arthropod diversity on plant diversity**. Am. Nat., 152, 738–750.

Stinner, B.R.; House, G.J. (1990). **Arthropods and other invertebrates in conservation-tillage agriculture**. Annual Review of Entomology, Palo Alto, v.35, p.299-318.

Strnad, S.P.; Bergman, M.K. (1987). **Movement of firstinstar western corn rootworms (Coleoptera: Chrysomelidae) in soil**. Environmental Entomology, Lanham, v.16, p.975-978.

Thomas, C.F.G. & Jepson, P.C. (1997). **Field-scale effects of farming practices on linyphiid spider populations in grass and cereals.** Entomol. Exp. Appl. 84, 59-69.

Topping, C.J. & Sunderland, K. (1994). **Methods of quantifying spider density and migration in cereal crops.** Bull. Br. Arachnol. Soc. 9, 209-213.

Uvarov BP (1931). **Insects and climate.** Transactions of the Entomological Society. London, 79, 1±247.

Valone, T.J., Meyer, M., Brown, J.H., Chew, R.M., (2002). **Timescale of perennial grass recovery in desertified arid grasslands following livestock removal**. Conservation Biology 16, 995–1002.

Van Auken, O.W., (2000). **Shrub invasions of North American semiarid grasslands**. Annual Review of Ecology and Systematics 31, 197–215.

Wang, S.Q.& Zhou, C.H., (1999). **Estimating soil carbon reservoir of terrestrial ecosystem in china**. Geographical res. 18(4), 350-351.

Watkinson, A.R., Ormerod, S.J. (2001). **Grasslands, grazing and biodiversity: editors' introduction.** Journal of AppliedEcology 38: 233–237.

William G & Marcos. (1994). **The Quantitative Basis of Pest Management :Sampling and Measuring.** In: Robert &William eds.Introduction to Insect Pest Management.

Wilson, E.O. (1987). **The little things that run the world (the importance and conservation of invertebrates)**. Conservation Biology 1:344-346.

Wimp, G.M., Martinsen, G.D., Floate, K.D., Bangert, R.K. & Whitham, T.G. (2005). **Plant genetic determinants of arthropod community structure and diversity**. Evolution, 59, 61–69.

Wimp, G.M., Young, W.P., Woolbright, S.A., Martinsen, G.D., Keim, P. & Whitham, T.G. (2004). **Conserving plant genetic diversity for dependent animal communities**. Ecol. Lett., 7, 776– 780.

Winter, J.P.; Voroney, R.P.; Ainsworth, D. A. (1990). **Soil microarthropods in long-term no-tillage and conventional tillage corn production**. Canadian Journal of Soil Science, Ottawa, v.70, p.641-653.

APPENDICES

Appendix A

Table A1: Families and speceis of Coleoptera

																	Fenced	Grazed	Natural
		sp	win	aut	sum	sp		sp	win	aut	sum	sp		sp	win	aut	sum	sp	
Scarabaeidae																			
	Tanyproctus saulcyi	0	0	0	1	1	2	0	0	0	0	0	0	0	0	0	1	0	1
	scar 1	2	0	0	0	0	2	0	0	0	0	1	1	1	0	0	0	0	1
	scar 2	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
		2	1	0	1	1	5	0	0	0	0	1	1	1	0	0	1	0	2
							0						0						0
elatrridae							0						0						0
	Drasterius bimaculatus	0	0	4	2	1	7	0	0	0	0	0	0	2	1	3	0	0	6
	Ela 1	0	4	0	0	0	4	0	3	1	0	1	5	0	0	0	0	0	0
	Ela 2	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	7
		0	4	4	2	1	11	0	3	1	0	1	5	9	1	3	0	0	13
							0						0						0
Histeridae							0						0						0
	Margarinotus graecus	0	0	5	1	0	6	1	0	4	2	2	9	2	1	12	1	1	17
	his 1	0	0	0	0	0	0	1	0	3	0	0	4	0	0	0	0	0	0
		0	0	5	1	0	6	2	0	7	2	2	13	2	1	12	1	1	17

Tableb A2 : Families and speceis of Coleoptera

		Fenced						Grazed						Natural					
carabidae		sp	win	aut	su m	sp		sp	win	aut	su m	sp		sp	win	aut	su m	sp	
	Scarites procerus eurytes	2	0	3	1	3		0	0	3	3	8		0	0	2	0	0	
	spp palestinus	4	2	5	5	7		0	2	13	11	3		2	3	4	3	9	
	carb 1	0	0	0	0	13		2	0	0	0	3		0	0	2	0	0	
	carb 2	0	0	0	0	0		0	0	0	0	1		0	0	0	1	1	
	car 3	0	0	0	0	0		0	0	0	15	5		0	0	0	18	0	
		6	**2**	**8**	**6**	**23**	**45**	**2**	**2**	**16**	**29**	**20**	**69**	**2**	**3**	**8**	**22**	**10**	**45**
Tenebrionidae																			
	Zophosis punctata	1	10	3	0	4		1	9	0	0	0		0	9	0	2	0	
		1	10	3	0	4	18	1	9	0	0	0	10	0	9	0	2	0	11
curculionidae																			
	Conicleonus nigrosuturatus	0	0	2	1	0		0	0	1	0	0		0	0	2	0	0	
	Cur 1	0	0	0	1	0		0	0	0	1	0		0	0	0	0	0	
		0	**0**	**2**	**2**	**0**	**4**	**0**	**0**	**1**	**1**	**0**	**2**	**0**	**0**	**2**	**0**	**0**	**2**

Table A3 :Families and speceis of hymenoptera

fenced		sp	sum	aut	win	sp	
Formicidae	Cataglíphus bicolor	1	3	2	0	3	9
	form 2	9	6	861	3	28	907
	form 3	0	0	0	0	0	0
	form 4	1	1	0	0	0	2
	form 5	0	0	0	0	1	1
		11	10	863	3	32	919
Sphegidae	Philanthus trianguulum	0	1	0	0	0	1
Cephidea	Cephus tabidus	0	0	0	0	0	0
Apiddae	Apis mellifera	0	0	0	0	0	0
grazed							
Formicidae	Cataglíphus bicolor	20	12	15	14	4	65
	form 2	50	2019	695	9	22	2795
	form 3	0	0	0	0	0	0
	form 4	2	0	23	0	1	26
	form 5	0	15	7	3	0	25
		72	2046	740	26	27	2911
Sphegidae	Philanthus trianguulum	0	0	0	0	0	0
Cephidea	Cephus tabidus	0	0	0	0	0	0
Apiddae	Apis mellifera	0	0	0	0	0	0
natural							
Formicidae	Cataglíphus bicolor	10	6	41	0	104	161
	form 2	74	2437	882	6	109	3508
	form 3	0	25	0	0	0	25
	form 4	0	202	0	0	0	202
	form 5	0	0	0	0	0	0
		84	2670	923	6	213	3896
Sphegidae	Philanthus trianguulum	0	8	3	0	0	11
Cephidea	Cephus tabidus	0	0	1	0	0	1
Apiddae	Apis mellifera	0	3	0	0	0	3

Table A4: Number of arthropods for each trap (recently fenced land)

			2006			2006			2006			**###**			**2007**
Trap/plot	No		Spring			**Summer**			**Autumn**			**Winter**			**Spring**
T2R1 1	14	4	**9**	106	450	**278**	85	74	**79.5**	13	19	**16**	18	12	**15**
T2R1 2	130	100	**115**	107	550	**328.5**	430	56	**243**	8	15	**12**	47	20	**33.5**
T2R1 3	17	12	**14.5**	185	425	**305**	188	53	**120.5**	10	107	**59**	30	8	**19**
T2R1 4	53.66667	38.66667	**46.167**	250	250	**250**	8	32	**20**	10	19	**15**	11	20	**15.5**
			185			**1162**			**463**			**101**			**83**
T2R2 1	18	24	**21**	543	214	**378.5**	43	55	**49**	7	17	**12**	25	23	**24**
T2R2 2	15	6	**10.5**	179	247	**213**	36	20	**28**	10	23	**17**	27	151	**89**
T2R2 3	30	23	**26.5**	286	357	**321.5**	65	231	**148**	6	45	**26**	35	17	**26**
T2R2 4	22	17	**19.5**	257	257	**257**	35	37	**36**	8	12	**10**	31	10	**20.5**
			77.5			**1170**			**261**			**64**			**159.5**
T2R3 1	18	8	**13**	257	715	**486**	41	21	**31**	6	13	**9.5**	45	73	**59**
T2R3 2	12	10	**11**	74	836	**455**	15	32	**23.5**	8	17	**13**	102	53	**77.5**
T2R3 3	14	20	**17**	240	377	**308.5**	171	20	**95.5**	6	5	**5.5**	22	10	**16**
T2R3 4	14.66667	13	**13.833**	271	271	**271**	53	35	**44**	8	13	**11**	63	24	**43.5**
	59	51	**54.833**	842	2199	**1520.5**	280	108	**194**	28	48	**38**	232	160	**196**
			105.67			**1284**			**306**			**68**			**146.2**

Table A5 :Number of arthropods for each trap (grazed land)

			2006			2006			2006			**2007**			**2007**
			Spring			**Summer**			**Autumn**			**Winter**			**Spring**
T3R1 1	6	40	**23**	103	643	**373**	510	48	**279**	6	16	**11**	57	101	**79**
T3R1 2	8	27	**17.5**	214	750	**482**	19	715	**367**	5	9	**7**	27	57	**42**
T3R1 3	8	15	**11.5**	250	824	**537**	385	77	**231**	6	16	**11**	52	94	**73**
T3R1 4	7	28	**17.5**	561	561	**561**	530	39	**284.5**	3	18	**10.5**	21	47	**34**
			69.5			**1953**			**1161.5**			**39.5**			
T3R2 1	16	4	**10**	56	237	**146.5**	194	112	**153**	11	8	**9.5**	12	37	**24.5**
T3R2 2	8	8	**8**	89	261	**175**	11	39	**25**	14	14	**14**	6	6	**6**
T3R2 3	10	14	**12**	70	70	**70**	147	38	**92.5**	11	5	**8**	28	62	**45**
T3R2 4	12	9	**10.5**	250	250	**250**	123	37	**80**	10	7	**8.5**	49	43	**46**
			40.5			**641.5**			**350.5**			**40**			**121.5**
T3R3 1	7	26	**16.5**	55	736	**395.5**	139	54	**96.5**	9	9	**9**	37	79	**58**
T3R3 2	10	56	**33**	32	622	**327**	310	69	**189.5**	13	10	**11.5**	27	106	**66.5**
T3R3 3	6	25	**15.5**	67	340	**203.5**	51	65	**58**	26	25	**25.5**	71	101	**86**
T3R3 4	8	36	**22**	150	150	**150**	48	132	**90**	10	18	**14**	10	10	**10**
			87			**1076**			**434**			**60**			**220.5**
			65.667			**1223.5**			**648.67**			**46.5**			**190**

Table A6 :Number of arthropods for each trap (Natural grassland)

			2006			2006			2006			**2007**			**2007**
			Spring			**Summer**			**Autumn**			**Winter**			**Spring**
T4R1 1	26	8	**17**	159	193	**176**	41	17	**29**	10	16	**13**	25	16	**20.5**
T4R1 2	39	20	**29.5**	112	278	**195**	101	101	**101**	21	15	**18**	30	25	**27.5**
T4R1 3	32	20	**26**	194	1210	**702**	340	310	**325**	11	9	**10**	65	120	**92.5**
T4R1 4	33	16	**24.5**	321	321	**321**	94	72	**83**	10	51	**30.5**	21	33	**27**
			97			**1394**			**538**			**71.5**			**167.5**
T4R2 1	34	125	**79.5**	98	586	**342**	130	35	**82.5**	18	9	**13.5**	54	144	**99**
T4R2 2	43	44	**43.5**	154	121	**137.5**	420	97	**258.5**	18	47	**32.5**	61	81	**71**
T4R2 3	33	23	**28**	111	128	**119.5**	48	9	**28.5**	22	17	**19.5**	49	19	**34**
T4R2 4	37	64	**50.5**	423	423	**423**	12	43	**27.5**	14	23	**18.5**	26	28	**27**
			201.5			**1022**			**397**			**84**			**231**
T4R3 1	11	2	**6.5**	150	712	**431**	141	31	**86**	12	3	**7.5**	51	35	**43**
T4R3 2	2	3	**2.5**	342	693	**517.5**	154	47	**100.5**	120	102	**111**	35	56	**45.5**
T4R3 3	77	5	**41**	541	867	**704**	85	38	**61.5**	9	28	**18.5**	15	35	**25**
T4R3 4	30	3	**16.5**	557	557	**557**	154	271	**212.5**	18	37	**27.5**	223	58	**140.5**
			66.5			**2209.5**			**460.5**			**165**			**254**
			121.67			**1541.83**			**465.17**			**107**			**217.5**

Table A7 :Number f Coleoptera for the Three sites

	21-Apr	28-Apr		30-Jun	7-Sep		2-Nov	9-Nov		12-Jan	19-Jan		12-Apr	19-Apr	
	coleo	coleo		coleo	coleo		coleo	coleo		coleo	coleo		coleo	coleo	
T2R1	8	7	7.5	15	6	10.5	6	16	11	5	7	6	19	11	15
T2R2	7	5	6	13	3	8	11	14	12.5	7	3	5	9	12	10.5
T2R3	4	11	7.5	15	8	11.5	6	5	5.5	3	8	5.5	13	7	10
fenced			7.0			10.0			.7			5.5			11.8
T3R1	4	9	6.5	13	5	9	9	18	13.5	3	10	6.5	12	5	8.5
T3R2	9	4	6.5	15	4	9.5	10	12	11	10	4	7	5	11	8
T3R3	5	1	3	16	2	9	5	20	12.5	16	16	16	10	14	12
grazed			5.3			9.2			2.3			9.8			9.5
T4R1	16	3	9.5	20	4	12	12	16	14	18	8	13	3	8	5.5
T4R2	13	17	15	24	5	14.5	8	20	14	4	3	3.5	7	16	11.5
T4R3	12	4	8	24	2	13	12	17	14.5	6	2	4	6	15	10.5
natural			10.8			13.2			4.2			6.8			9.2

Table A8 :Number of spiders (araneae) for the Three sites

	21-Apr	28-Apr		30-Jun	7-Sep		2-Nov	9-Nov		12-Jan	19-Jan		12-Apr	19-Apr	
	arenea	arenea		arenea	arenea		arenea	arenea		arenea	arenea		arenea	arenea	
T2R1	5	1	3	7	5	6	7	2	4.5	2	4	3	27	13	20
T2R2	5	0	2.5	5	4	4.5	9	6	7.5	6	9	7.5	25	4	14.5
T2R3	11	5	8	9	7	8	9	6	7.5	8	3	5.5	23	9	16
fenced			5						7			5			7
T3R1	5	15	10	3	2	2.5	2	9	5.5	2	9	5.5	13	17	15
T3R2	1	12	6.5	4	4	4	6	11	8.5	6	9	7.5	16	13	14.5
T3R3	7	5	6	4	3	3.5	11	6	8.5	13	2	7.5	19	12	15.5
grazed			8						8			7			5
T4R1	5	8	6.5	0	0	0	13	6	9.5	13	12	12.5	23	11	17
T4R2	7	7	7	1	1	1	5	5	5	12	15	13.5	22	8	15
T4R3	5	4	4.5	4	3	3.5	3	4	3.5	10	4	7	10	14	12
natural			6						6			11			5

Table A9 :Number of Hymenoptera for the Three sites

	21-Apr	28-Apr		30-Jun	7-Sep		2-Nov	9-Nov		12-Jan	19-Jan		12-Apr	19-Apr	
	hym	hym		hym	hym		hym	hym		hym	hym		hym	hym	
T2R1	193	7	100	620	1663	1141.5	637	180	408.5	2	1	1.5	19	12	15.5
T2R2	68	60	64	1240	1061	1150.5	65	235	150	11	11	11	53	139	96
T2R3	32	31	31.5	811	2181	1496	242	66	154	11	15	13	87	99	93
fenced			65			1263			238			9			68
T3R1	11	65	38	1080	2770	1925	1418	827	1122.5	1	2	1.5	22	158	90
T3R2	7	7	7	409	809	609	435	161	298	0	4	2	9	44	26.5
T3R3	4	128	66	273	1841	1057	487	262	374.5	13	13	13	9	20	14.5
grazed			37			1197			598			6			44
T4R1	100	45	72.5	753	1983	1368	511	444	477.5	5	1	3	89	124	106.5
T4R2	119	205	162	752	1236	994	556	119	337.5	1	41	21	123	219	171
T4R3	99	0	49.5	1557	2802	2179.5	502	325	413.5	20	4	12	285	130	207.5
natural			95			1514			410			12			162

Table A10 :Number of the other insects for the Three sites

	21-Apr	28-Apr		30-Jun	7-Sep		2-Nov	9-Nov		12-Jan	19-Jan		12-Apr	19-Apr	
	other insects	other insects		other insects	other insects		other insects	other insects		other insects	other insects		other insects	other insects	
T2R1	9	140	74.5	5	1	3	60	17	38.5	30	148	89	40	22	31
T2R2	5	5	5	7	7	7	92	88	90	5	73	39	30	43	36.5
T2R3	12	4	8	7	3	5	23	31	27	6	20	13	107	45	76
fenced			9						52			47			4 8
T3R1	9	21	15	32	1	16.5	10	25	17.5	13	38	25.5	110	115	112.5
T3R2	29	12	20.5	37	0	18.5	19	42	30.5	30	16	23	64	77	70.5
T3R3	15	9	12	11	1	6	38	31	34.5	14	27	20.5	106	243	174.5
grazed			6			4			28			23			1 19
T4R1	9	8	8.5	13	15	14	39	34	36.5	15	68	41.5	22	48	35
T4R2	7	27	17	9	14	11.5	37	40	38.5	54	36	45	36	25	30.5
T4R3	3	5	4	5	22	13.5	17	41	29	122	156	139	22	23	22.5
natural			0			3			35			75			2 9

Table A11 :Number of other arthropods non insecta for the Three sites

	21-Apr	28-Apr		30-Jun	7-Sep		2-Nov	9-Nov		12-Jan	19-Jan		12-Apr	19-Apr	
	oter arthropod	oter arthropod		oter arthropod	oter arthropod		oter arthropod	oter arthropod		oter arthropod	oter arthropod		oter arthropod	oter arthropod	
T2R1	0	0	0	1	0	0.5	1	0	0.5	2	0	1	1	2	1.5
T2R2	0	0	0	0	0	0	2	0	1	2	1	1.5	1	3	2
T2R3	0	0	0	0	0	0	0	0	0	0	2	1	2	0	1
												1			
T3R1	0	0	0	0	0	0	5	0	2.5	1	0	0.5	0	4	2
T3R2	0	0	0	0	1	0.5	5	0	2.5	0	1	0.5	1	3	2
T3R3	0	0	0	0	1	0.5	7	1	4	2	4	3	1	7	4
												1			
T4R1	0	0	0	0	0	0	1	0	0.5	1	2	1.5	4	3	3.5
T4R2	1	0	0.5	0	2	1	4	0	2	1	1	1	2	4	3
T4R3	1	0	0.5	0	0	0	0	0	0	1	4	2.5	1	2	1.5
												2			

Appendix B

Table B1 :Monthly temprature

Albadan	temp.(C)	January	February	March	April	May	June	July	August	September	October	November	December
2006	mean monthly temp.	11.63478	13.92857	16.32581	18.93	23.98077	27.63478	27.4931	28.54815	27.66552	23.37097	17.33448	12.87097
	mean monthlyMax temp.	15.4087	18.78214	22.44194	25.18667	31.21923	34.7913	34.51379	35.87778	35.01724	29.47097	22.8069	17.0129
	mean monthlyMin temp.	8.547826	10.16786	11.7129	14.59	18.17308	22.16522	22.67586	23.66296	22.77586	19.27097	13.34483	8.977419
2007	mean monthly temp.	12.36129	13.72857										
	mean monthlyMax temp.	16.45806	18.03571		18.8								
	mean monthlyMin temp.	8.432258	10.17143										

Temprature

Table B2 :Rain fall for 2005/2006

سجل الأمطار للموسم (2005 / 2006)																																	مجموع الموسم الحالي		مجموع الموسم الماضي	
الشهر / اليوم		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	##	أيام	ملم	أيام	ملم
9	أيلول																																0	0	0	0
10	تشرين الأول																			3										2	1	1	4	7	1	4
11	تشرين الثاني			1			6	3								1				18	20												6	49	7	138
12	كانون الأول																35	16					1	13	50	25	5						7	145	8	60
1	كانون الثاني				1			14	4	5	10	29	7	3	2			9	15	10	2		1			12	12	8	3				18	147	12	210
2	شباط		3	8					44	71					1	12	25																7	164	11	254
3	آذار										19																						1	19	6	34
4	نيسان	22	57	1	3	10											3								26								7	122	2	10
5	أيار																																0	0	1	2
	المجموع																																**50**	**653**	**48**	**712**

TableB3: Rain fall for 2006/2007

		سجل الأمطار للموسم (2006 / 2007)																															مجموع الموسم الحالي		مجموع الموسم الماضي	
	الشهر / اليوم	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	أيام	ملم	أيام	ملم
9	أيلول																																0	0	0	0
10	تشرين الأول															19.0												16.0	45.0	3.0			4	83	4	7
11	تشرين الثاني	1.0			7.0	7.0										8.5							1.0										5	25	6	49
12	كانون الأول																										85.0	13.0				14.0	3	112	7	145
1	كانون الثاني					13.0	6.0	8.0					2.0								35.0	5.0							4.0	1.0	23.0		9	97	18	147
2	شباط		2.0	35.0	22.0	12.0	25.0			6.0	1.0			9.0	15.0	5.0			8.0							16.0	8.0	2.0					14	166	7	164
3	آذار	0.0												16.0	39.0	20.0	17.0	1.0									0.0					9.0	6	102	1	19
4	نيسان	1.0									1.0	1.0	1.0																				4	4	7	122
5	أيار																																0	0	0	0
	المجموع																																45	589	50	653

Tables B4: Soil moisture

oisture contents

Sample no: 2
Sampling date: 14-4-2006
Weight date: 18-4 -2006
Collecting by: Wasef
Site: Bathan
Reading date:

date	18- 4	22 - 4	10 - 5	4 - 6	w.c
T1					
1	50 gm	44	40	40	25
2	50 gm	40	40	40	25
T2					
1	50 gm	44	44	43.**5**	14.9
2	50 gm	45	44.5	44	13.6
T3					
1	50 gm	44.2	43.5	43	16.2
2	50 gm	44	44	44	13.6
T4					
1	50 gm	42	41	41	21.9
2	50 gm	42	42	41.5	20.5

Moisture contents

Sample no: 3
Sampling date: 21-4-2006
Weight date: 22-4-2006
Collecting by: Wasef
Site: Bathan
Reading date:

date	22 -4	10 - 5	4 – 6	w.c
T1				
1	50 gm	45.5	45	11
2	50 gm	46	45.5	9.8
T2				
1	50 gm	46	45	11
2	50 gm	46	46	8.7
T3				
1	50 gm	46.5	46.5	7.5
2	50 gm	46.5	46.5	7.5
T4				
1	50 gm	47.5	47.5	5.3
2	50 gm	47	47	6.4

Moisture contents

Sample no: 5
Sampling date: 19-5-2006
Weight date: 22-5-2006
Collecting by: Wasef
Site: Bathan
Reading date:

Tables B4: cont.

date	22 – 5	4 – 6	27-6	5-8	w.c
T1					
1	50 gm	49	49	48.5	2
2	50 gm	49	49	48.5	2
T2					
1	50 gm	48	48	48	4
2	50 gm	49	48.5	48	2
T3					
1	50 gm	49.5	49	48.5	1
2	50 gm	49.5	49	49	1
T4					
1	50 gm	49.5	49	49	1
2	50 gm	49	49	48.5	2

Moisture contents

Sample no 6
Sampling date: 6-6 -2006
Weight date: 27-6 -2006
Collecting by:
Site: Bathan

Reading date:

date	6 - 6	27 - 6	5 – 8	w.c
T1				
1	50 gm	47.5	47.5	5.3
2	50 gm	47	47	6.4
T2				
1	50 gm	48.5	48	4
2	50 gm	49	48	4
T3				
1	50 gm	46	46	8.7
2	50 gm	46	46	8.7
T4				
1	50 gm	49	49	2
2	50 gm	49	48	2

Moisture contents

Sample no: 7
Sampling date: 6-6 -2006
Weight date: 17-6 -2006
Collecting by:
Site: Bathan
Reading date:

Tables B4: cont

date	17 – 6	27 - 6	5 – 8	w.c
T1				
1	50 gm	48.5	48	4
2	50 gm	49.5	49	2
T2				
1	50 gm	49	48.5	3
2	50 gm	48.5	47	6.4
T3				
1	50 gm	49	45.5	9.8
2	50 gm	48	45.5	9.8
T4				
1	50 gm	49.5	47.5	5.3
2	50 gm	49.7	49	2

Moisture contents

Sample no: 8
Sampling date: 16-6 -2006
Weight date: 20-6 -2006
Collecting by:
Site: Bathan
Reading date:

date	8 - 5	10 - 5	4 – 6	w.c
T1				
1	50 gm	49.5	48.5	3
2	50 gm	49	49	2
T2				
1	50 gm	49	48	4
2	50 gm	49.5	48	4
T3				
1	50 gm	49.5	49	2
2	50 gm	49.5	48.5	3
T4				
1	50 gm	49	49	2
2	50 gm	49	47.5	5.3

Moisture contents

Sample no: 9
Sampling date: 7-7 -2006
Weight date: 11-7 -2006
Site: Bathan
Reading date:

date	7-7	5-8	w.c
T1			
1	50 gm	46.5	7.5
2	50 gm	48	4
T2			
1	50 gm	48.5	3
2	50 gm	47	6.4
T3			
1	50 gm	48	4
2	50 gm	47.5	5.3
T4			
1	50 gm	48.5	3
2	50 gm	48	4

Tables B4: cont

Moisture contents

Sample no: 10
Sampling date: 9-8-2006

Weight date: 4-9-2006
Collecting by:
Site: Bathan
Reading date:

date	9-8	4-9	w.c
T1			
1	50gm	49.5	1
2	50gm	49.5	1
T2			
1	50gm	48.5	3
2	50gm	49.5	1
T3			
1	50gm	49	2
2	50gm	49.5	1
T4			
1	50gm	49.5	1
2	50gm	49	2

Moisture contents

Sample no: 11
Sampling date: 10-9-2006
Weight date: 3-10-2006
Collecting by:
Site: Bathan
Reading date:

Date	10-9	3-10	w.c
T1			
1	50gm	48.5	3
2	50gm	47.5	5.3
T2			
1	50gm	47	6.4
2	50gm	47	6.4
T3			
1	50gm	48	4
2	50gm	48.5	3
T4			
1	50gm	47.5	5.3
2	50gm	47.5	5.3

Moisture contents

Sample no: 12
Sampling date: 12-10-2006
Weight date: 3-11-2006
Collecting by:
Site: Bathan
Reading date:

Date	12-10	3-11	w.c
T1			
1	50gm	49.2	1.6
2	50gm	47.3	5.7
T2			
1	50gm	49	2
2	50gm	49.5	1
T3			
1	50gm	49.9	0.2
2	50gm	49.8	0.4
T4			
1	50gm	49.7	0.6
2	50gm	49.8	0.4

Tables B4: cont

Moisture contents

Sample no: 13
Sampling date: 14-11 -2006
Weight date: 3-12-2006
Collecting by:
Site: Bathan
Reading date:

Date	14-11 -2006	27-10	w.c
T1			
1	50gm	47.5	5.3
2	50gm	48	4
T2			
1	50gm	48.5	3
2	50gm	47	6.4

Moisture contents

Sample no: 14
Sampling date: 24-11-2006
Weight date: 3-12-2006
Collecting by:
Site: Bathan
Reading date:

Date	12-10	3-12	w.c
T1			
1	50gm	47.9	4.4
2	50gm	47.6	5
T2			
1	50gm	47	6.4
2	50gm	48.5	3
T3			
1	50gm	48.9	2.5
2	50gm	47.8	4.6
T4			
1	50gm	49	2
2	50gm	47.9	4.4

Moisture contents

Sample no: 15
Sampling date: 2-12-2006
Weight date: 7-1-2007
Collecting by:
Site: Bathan
Reading date:

Date	2-12	7-1-07	w.c
T1			
1	50gm	46.5	7.5
2	50gm	48.2	3.7
T2			
1	50gm	47.6	5
2	50gm	47.5	5.3
T3			
1	50gm	48.3	3.5
2	50gm	48.3	3.5
T4			
1	50gm	46.7	7
2	50gm	48.2	3.7

Tables B4: cont

Sample no: 20
Sampling date: 13.4.07
Weight date: 25.4.07
Collecting by: Ammar
Site: Bathan
Reading date:

Date	13.4.07	4.07.	w.c
T1			
1	50gm	43.2	15.74
2	50gm	43.4	15.2
T2			
1	50gm	41.9	19.33
2	50gm	41.9	19.33
T3			
1	50gm	44	13.63
2	50gm	43.9	13.9
T4			
1	50gm	44.1	13.38
2	50gm	44.1	13.38

Sample no: 22
Sampling date: 19.4.07
Weight date: 3.5.07
Collecting by: Ammar
Site: Bathan
Reading date:

Date	19.4.07	3.5.07	w.c
T1			
1	50gm	45	11.1
2	50gm	44.9	11.36
T2			
1	50gm	46.3	7.9
2	50gm	46.2	8.2
T3			
1	50gm	46.4	7.75
2	50gm	46.5	7.52
T4			
1	50gm	46.6	7.3
2	50gm	46.7	7.06

Appendix C
Statistical analysis

Table C1 :One-Way Analysis of Variance(Hymenoptera)

Analysis of Variance between season on Fenced land

```
Source     DF        SS        MS        F        P
Factor      4   3361399    840350    63.58    0.000
Error      10    132165     13217
Total      14   3493564
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  ---+---------+---------+---------+---
spring06    3      65.2      34.3   (--*--)
summe06     3    1262.7     202.1                          (--*--)
autumn 0    3     237.5     148.1       (--*--)
winter 0    3       8.5       6.1  (--*--)
spring 0    3      68.2      45.6   (--*--)
                                   ---+---------+---------+---------+---
Pooled StDev =    115.0               0       500      1000      1500
```

Two Sample T-Test and Confidence Interval

```
Two sample T for spring06 vs summe06
          N      Mean     StDev   SE Mean
spring06  3      65.2      34.3        20
summe06   3      1263       202       117

95% CI for mu spring06 - mu summe06: ( -1526,  -869)
T-Test mu spring06 = mu summe06 (vs not =): T= -10.12  P=0.0005  DF=  4
Both use Pooled StDev =  145
```

Two Sample T-Test and Confidence Interval

```
Two sample T for spring06 vs autumn 06
          N      Mean     StDev   SE Mean
spring06  3      65.2      34.3        20
autumn 0  3       238       148        86

95% CI for mu spring06 - mu autumn 0: ( -416,  71)
T-Test mu spring06 = mu autumn 0 (vs not =): T= -1.96  P=0.12  DF=  4
Both use Pooled StDev =  107
```

Two Sample T-Test and Confidence Interval

```
Two sample T for spring06 vs winter 07
          N      Mean     StDev   SE Mean
spring06  3      65.2      34.3        20
winter 0  3      8.50      6.14       3.5

95% CI for mu spring06 - mu winter 0: ( 1,  112.5)
T-Test mu spring06 = mu winter 0 (vs not =): T= 2.82  P=0.048  DF=  4
Both use Pooled StDev = 24.6
```

Two Sample T-Test and Confidence Interval

```
Two sample T for spring06 vs spring 07
          N      Mean     StDev   SE Mean
spring06  3      65.2      34.3        20
spring 0  3      68.2      45.6        26

95% CI for mu spring06 - mu spring 0: ( -94,  88)
T-Test mu spring06 = mu spring 0 (vs not =): T= -0.09  P=0.93  DF=  4
Both use Pooled StDev = 40.4
```

Table C1 cont.

```
Two Sample T-Test and Confidence Interval

Two sample T for summe06 vs autumn 06
         N      Mean     StDev   SE Mean
summe06   3      1263       202       117
autumn 0  3       238       148        86

95% CI for mu summe06 - mu autumn 0: ( 623,  1427)
T-Test mu summe06 = mu autumn 0 (vs not =): T= 7.09  P=0.0021  DF=  4
Both use Pooled StDev =  177


Two Sample T-Test and Confidence Interval


Two sample T for summe06 vs winter 07
         N      Mean     StDev   SE Mean
summe06   3      1263       202       117
winter 0  3      8.50      6.14       3.5

95% CI for mu summe06 - mu winter 0: ( 930,  1578.3)
T-Test mu summe06 = mu winter 0 (vs not =): T= 10.74  P=0.0004  DF=  4
Both use Pooled StDev =  143


Two Sample T-Test and Confidence Interval


Two sample T for summe06 vs spring 07
         N      Mean     StDev   SE Mean
summe06   3      1263       202       117
spring 0  3      68.2      45.6        26

95% CI for mu summe06 - mu spring 0: ( 862,  1527)
T-Test mu summe06 = mu spring 0 (vs not =): T=  9.98  P=0.0006  DF=  4
Both use Pooled StDev =  147


Two Sample T-Test and Confidence Interval


Two sample T for autumn 06 vs winter 07
         N      Mean     StDev   SE Mean
autumn 0  3       238       148        86
winter 0  3      8.50      6.14       3.5

95% CI for mu autumn 0 - mu winter 0: ( -9,  466.6)
T-Test mu autumn 0 = mu winter 0 (vs not =): T= 2.68  P=0.055  DF=  4
Both use Pooled StDev =  105


Two Sample T-Test and Confidence Interval


Two sample T for autumn 06 vs spring 07
         N      Mean     StDev   SE Mean
autumn 0  3       238       148        86
spring 0  3      68.2      45.6        26

95% CI for mu autumn 0 - mu spring 0: ( -79,  418)
T-Test mu autumn 0 = mu spring 0 (vs not =): T= 1.89  P=0.13  DF=  4
Both use Pooled StDev =  110


Two Sample T-Test and Confidence Interval


Two sample T for winter 07 vs spring 07
         N      Mean     StDev   SE Mean
winter 0  3      8.50      6.14       3.5
spring 0  3      68.2      45.6        26

95% CI for mu winter 0 - mu spring 0: ( -133.5,  14)
T-Test mu winter 0 = mu spring 0 (vs not =): T= -2.24  P=0.088  DF=  4
Both use Pooled StDev = 32.6
```

Table C1 :cont.
One-Way Analysis of Variance between season on Grazed grassland

```
Analysis of Variance
Source     DF        SS        MS        F        P
Factor      4   3258328    814582     6.19    0.009
Error      10   1315499    131550
Total      14   4573827
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  --------+---------+---------+--------
spring06    3      37.0      29.5   (-------*------)
summe06     3    1197.0     669.1                     (-------*-------)
autumn 0    3     598.3     455.6             (-------*-------)
winter 0    3       5.5       6.5  (-------*-------)
spring 0    3      43.7      40.6   (-------*-------)
                                   --------+---------+---------+--------
Pooled StDev =    362.7                    0       600      1200
```

```
Two Sample T-Test and Confidence Interval


Two sample T for spring06 vs summe06
          N      Mean     StDev   SE Mean
spring06  3      37.0      29.5        17
summe06   3      1197       669       386

95% CI for mu spring06 - mu summe06: ( -2234,  -86)
T-Test mu spring06 = mu summe06 (vs not =): T= -3.00  P=0.040  DF=  4
Both use Pooled StDev =  474


Two Sample T-Test and Confidence Interval


Two sample T for spring06 vs autumn 06
          N      Mean     StDev   SE Mean
spring06  3      37.0      29.5        17
autumn 0  3       598       456       263

95% CI for mu spring06 - mu autumn 0: ( -1293,  170)
T-Test mu spring06 = mu autumn 0 (vs not =): T= -2.13  P=0.10  DF=  4
Both use Pooled StDev =  323


Two Sample T-Test and Confidence Interval


Two sample T for spring06 vs winter 07
          N      Mean     StDev   SE Mean
spring06  3      37.0      29.5        17
winter 0  3      5.50      6.50       3.8

95% CI for mu spring06 - mu winter 0: ( -17,  79.9)
T-Test mu spring06 = mu winter 0 (vs not =): T= 1.81  P=0.15  DF=  4
Both use Pooled StDev = 21.4


Two Sample T-Test and Confidence Interval


Two sample T for spring06 vs spring 07
          N      Mean     StDev   SE Mean
spring06  3      37.0      29.5        17
spring 0  3      43.7      40.6        23

95% CI for mu spring06 - mu spring 0: ( -87,  74)
T-Test mu spring06 = mu spring 0 (vs not =): T= -0.23  P=0.83  DF=  4
Both use Pooled StDev = 35.5


Two Sample T-Test and Confidence Interval
```

Table C1 cont.

```
Two sample T for summe06 vs autumn 06
         N      Mean     StDev   SE Mean
summe06   3      1197       669       386
autumn 0  3       598       456       263

95% CI for mu summe06 - mu autumn 0: ( -699,  1896)
T-Test mu summe06 = mu autumn 0 (vs not =): T= 1.28  P=0.27  DF=  4
Both use Pooled StDev =  572


Two Sample T-Test and Confidence Interval


Two sample T for summe06 vs winter 07
         N      Mean     StDev   SE Mean
summe06   3      1197       669       386
winter 0  3      5.50      6.50       3.8

95% CI for mu summe06 - mu winter 0: ( 119,  2264.1)
T-Test mu summe06 = mu winter 0 (vs not =): T= 3.08  P=0.037  DF=  4
Both use Pooled StDev =  473


Two Sample T-Test and Confidence Interval


Two sample T for summe06 vs spring 07
         N      Mean     StDev   SE Mean
summe06   3      1197       669       386
spring 0  3      43.7      40.6        23

95% CI for mu summe06 - mu spring 0: ( 79,  2228)
T-Test mu summe06 = mu spring 0 (vs not =): T= 2.98  P=0.041  DF=  4
Both use Pooled StDev =  474


Two Sample T-Test and Confidence Interval


Two sample T for autumn 06 vs winter 07
         N      Mean     StDev   SE Mean
autumn 0  3       598       456       263
winter 0  3      5.50      6.50       3.8

95% CI for mu autumn 0 - mu winter 0: ( -137,  1323.2)
T-Test mu autumn 0 = mu winter 0 (vs not =): T= 2.25  P=0.087  DF=  4
Both use Pooled StDev =  322


Two Sample T-Test and Confidence Interval


Two sample T for autumn 06 vs spring 07
         N      Mean     StDev   SE Mean
autumn 0  3       598       456       263
spring 0  3      43.7      40.6        23

95% CI for mu autumn 0 - mu spring 0: ( -178,  1288)
T-Test mu autumn 0 = mu spring 0 (vs not =): T= 2.10  P=0.10  DF=  4
Both use Pooled StDev =  323


Two Sample T-Test and Confidence Interval


Two sample T for winter 07 vs spring 07
         N      Mean     StDev   SE Mean
winter 0  3      5.50      6.50       3.8
spring 0  3      43.7      40.6        23

95% CI for mu winter 0 - mu spring 0: ( -104.0,  28)
T-Test mu winter 0 = mu spring 0 (vs not =): T= -1.61  P=0.18  DF=  4
Both use Pooled StDev = 29.1
```

Table C1 :cont.

One-Way Analysis of Variance between season on Naural grass land

```
Analysis of Variance
Source     DF        SS        MS        F        P
Factor      4   4601829   1150457    15.20    0.000
Error      10    756889     75689
Total      14   5358717
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  ------+---------+---------+---------+
spring06    3      94.7      59.4   (-----*----)
summe06     3    1513.8     606.1                          (-----*-----)
autumn 0    3     409.5      70.1        (-----*-----)
winter 0    3      12.0       9.0  (-----*-----)
spring 0    3     161.7      51.1    (-----*-----)
                                   ------+---------+---------+---------+
Pooled StDev =    275.1                 0       600      1200      1800
```

```
Two Sample T-Test and Confidence Interval


Two sample T for spring06 vs summe06
          N      Mean     StDev   SE Mean
spring06  3      94.7      59.4        34
summe06   3      1514       606       350

95% CI for mu spring06 - mu summe06: ( -2395,  -443)
T-Test mu spring06 = mu summe06 (vs not =): T= -4.04  P=0.016  DF=  4
Both use Pooled StDev =  431


Two Sample T-Test and Confidence Interval


Two sample T for spring06 vs autumn 06
          N      Mean     StDev   SE Mean
spring06  3      94.7      59.4        34
autumn 0  3     409.5      70.1        40

95% CI for mu spring06 - mu autumn 0: ( -462,  -168)
T-Test mu spring06 = mu autumn 0 (vs not =): T= -5.93  P=0.0040  DF=  4
Both use Pooled StDev = 65.0


Two Sample T-Test and Confidence Interval


Two sample T for spring06 vs winter 07
          N      Mean     StDev   SE Mean
spring06  3      94.7      59.4        34
winter 0  3     12.00      9.00       5.2

95% CI for mu spring06 - mu winter 0: ( -14,  179.0)
T-Test mu spring06 = mu winter 0 (vs not =): T= 2.38  P=0.076  DF=  4
Both use Pooled StDev = 42.5


Two Sample T-Test and Confidence Interval


Two sample T for spring06 vs spring 07
          N      Mean     StDev   SE Mean
spring06  3      94.7      59.4        34
spring 0  3     161.7      51.1        30

95% CI for mu spring06 - mu spring 0: ( -193,  59)
T-Test mu spring06 = mu spring 0 (vs not =): T= -1.48  P=0.21  DF=  4
Both use Pooled StDev = 55.4
Two Sample T-Test and Confidence Interval
Two sample T for summe06 vs autumn 06
          N      Mean     StDev   SE Mean
summe06   3      1514       606       350
autumn 0  3     409.5      70.1        40

95% CI for mu summe06 - mu autumn 0: ( 126,  2082)
T-Test mu summe06 = mu autumn 0 (vs not =): T= 3.14  P=0.035  DF=  4
Both use Pooled StDev =  431
```

Table C1 Cont.

```
Two Sample T-Test and Confidence Interval


Two sample T for summe06 vs winter 07
          N      Mean     StDev   SE Mean
summe06   3      1514       606       350
winter 0  3     12.00      9.00       5.2

95% CI for mu summe06 - mu winter 0: ( 530,  2473.5)
T-Test mu summe06 = mu winter 0 (vs not =): T= 4.29  P=0.013  DF=  4
Both use Pooled StDev =  429


Two Sample T-Test and Confidence Interval


Two sample T for summe06 vs spring 07
          N      Mean     StDev   SE Mean
summe06   3      1514       606       350
spring 0  3     161.7      51.1        30

95% CI for mu summe06 - mu spring 0: ( 377,  2327)
T-Test mu summe06 = mu spring 0 (vs not =): T= 3.85  P=0.018  DF=  4
Both use Pooled StDev =  430


Two Sample T-Test and Confidence Interval


Two sample T for autumn 06 vs winter 07
          N      Mean     StDev   SE Mean
autumn 0  3     409.5      70.1        40
winter 0  3     12.00      9.00       5.2

95% CI for mu autumn 0 - mu winter 0: ( 284,  510.8)
T-Test mu autumn 0 = mu winter 0 (vs not =): T= 9.74  P=0.0006  DF=  4
Both use Pooled StDev = 50.0


Two Sample T-Test and Confidence Interval


Two sample T for autumn 06 vs spring 07
          N      Mean     StDev   SE Mean
autumn 0  3     409.5      70.1        40
spring 0  3     161.7      51.1        30

95% CI for mu autumn 0 - mu spring 0: ( 109,  387)
T-Test mu autumn 0 = mu spring 0 (vs not =): T= 4.95  P=0.0078  DF=  4
Both use Pooled StDev = 61.3


Two Sample T-Test and Confidence Interval


Two sample T for winter 07 vs spring 07
          N      Mean     StDev   SE Mean
winter 0  3     12.00      9.00       5.2
spring 0  3     161.7      51.1        30

95% CI for mu winter 0 - mu spring 0: ( -232.9,  -66)
T-Test mu winter 0 = mu spring 0 (vs not =): T= -4.99  P=0.0075  DF=  4
Both use Pooled StDev = 36.7
```

Table C1 :cont.

One-Way Analysis of Variance between three sites for each season for hymenoptera

Analysis of Variance for **spring06**

```
Source     DF        SS        MS        F        P
C2          2      4989      2495     1.34    0.330
Error       6     11155      1859
Total       8     16144
                                  Individual 95% CIs For Mean
                                  Based on Pooled StDev
Level       N      Mean     StDev -----+---------+---------+---------+-
1           3     65.17     34.26       (-----------*-----------)
2           3     37.00     29.51 (-----------*------------)
3           3     94.67     59.44             (-----------*-----------)
                                  -----+---------+---------+---------+-
Pooled StDev =    43.12                0        50       100       150
```

One-Way Analysis of Variance

Analysis of Variance for **SUMMER 0**

```
Source     DF        SS        MS        F        P
C2          2    167780     83890     0.29    0.755
Error       6   1711641    285274
Total       8   1879421
                                  Individual 95% CIs For Mean
                                  Based on Pooled StDev
Level       N      Mean     StDev --+---------+---------+---------+----
1           3    1262.7     202.1   (--------------*--------------)
2           3    1197.0     669.1  (--------------*--------------)
3           3    1513.8     606.1        (--------------*--------------)
                                  --+---------+---------+---------+----
Pooled StDev =    534.1           500      1000      1500      2000
```

One-Way Analysis of Variance

Analysis of Variance for **Autumn 0**

```
Source     DF        SS        MS        F        P
C2          2    195443     97721     1.25    0.352
Error       6    468746     78124
Total       8    664188
                                  Individual 95% CIs For Mean
                                  Based on Pooled StDev
Level       N      Mean     StDev -----+---------+---------+---------+-
1           3     237.5     148.1  (----------*----------)
2           3     598.3     455.6            (----------*----------)
3           3     409.5      70.1      (-----------*----------)
                                  -----+---------+---------+---------+-
Pooled StDev =    279.5                0       350       700      1050
```

One-Way Analysis of Variance

Analysis of Variance for **Winter**

```
Source     DF        SS        MS        F        P
C2          2      63.5      31.8     0.59    0.583
Error       6     322.0      53.7
Total       8     385.5
                                  Individual 95% CIs For Mean
                                  Based on Pooled StDev
Level       N      Mean     StDev -------+---------+---------+---------
1           3     8.500     6.144      (------------*------------)
2           3     5.500     6.500  (------------*------------)
3           3    12.000     9.000          (------------*------------)
                                  -------+---------+---------+---------
Pooled StDev =    7.326                 0.0       8.0      16.0
```

One-Way Analysis of Variance

Analysis of Variance for **Spring 07**

```
Source     DF        SS        MS        F        P
C2          2     23267     11633     5.50    0.044
Error       6     12688      2115
Total       8     35955
                                  Individual 95% CIs For Mean
                                  Based on Pooled StDev
Level       N      Mean     StDev ----+---------+---------+---------+--
1           3     68.17     45.64     (---------*--------)
2           3     43.67     40.57  (--------*---------)
3           3    161.67     51.14                  (--------*--------)
                                  ----+---------+---------+---------+--
Pooled StDev =    45.99               0        70       140       210
```

Table C1 :cont.

```
Two Sample T-Test and Confidence Interval


Two sample T for T2 vs T3
    N      Mean     StDev   SE Mean
T2  3      68.2      45.6        26
T3  3      43.7      40.6        23

95% CI for mu T2 - mu T3: ( -73,  122)
T-Test mu T2 = mu T3 (vs not =): T= 0.69  P=0.53  DF=  4
Both use Pooled StDev = 43.2


Two Sample T-Test and Confidence Interval


Two sample T for T2 vs T4
    N      Mean     StDev   SE Mean
T2  3      68.2      45.6        26
T4  3     161.7      51.1        30

95% CI for mu T2 - mu T4: ( -203,  16)
T-Test mu T2 = mu T4 (vs not =): T= -2.36  P=0.077  DF=  4
Both use Pooled StDev = 48.5


Two Sample T-Test and Confidence Interval


Two sample T for T3 vs T4
    N      Mean     StDev   SE Mean
T3  3      43.7      40.6        23
T4  3     161.7      51.1        30

95% CI for mu T3 - mu T4: ( -223,  -13)
T-Test mu T3 = mu T4 (vs not =): T= -3.13  P=0.035  DF=  4
Both use Pooled StDev = 46.2
```

Table C2 :One-Way Analysis of Variance between seasons for coleoptera

Analysis of Variance between season on (Fenced)

```
Source     DF        SS        MS        F        P
Factor      4     76.57     19.14     3.77    0.041
Error      10     50.83      5.08
Total      14    127.40
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  ---+---------+---------+---------+---
spring 0    3     7.000     0.866       (-------*-------)
Summer06    3    10.000     1.803              (--------*-------)
Autumn 0    3     9.667     3.686              (--------*-------)
Winter0    3     5.500     0.500  (--------*-------)
Spring 0    3    11.833     2.754                     (-------*-------)
                                   ---+---------+---------+---------+---
Pooled StDev =    2.255              3.5       7.0      10.5      14.0

Two Sample T-Test and Confidence Interval


Two sample T for spring 06 vs Summer06
          N      Mean     StDev   SE Mean
spring 0  3     7.000     0.866      0.50
Summer06  3     10.00      1.80       1.0

95% CI for mu spring 0 - mu Summer06: ( -6.21,  0.2)
T-Test mu spring 0 = mu Summer06 (vs not =): T= -2.60  P=0.060  DF=  4
Both use Pooled StDev = 1.41


Two Sample T-Test and Confidence Interval
```

Table C2 Cont.

```
Two sample T for spring 06 vs Autumn 06
          N      Mean     StDev   SE Mean
spring 0  3     7.000     0.866      0.50
Autumn 0  3      9.67      3.69       2.1

95% CI for mu spring 0 - mu Autumn 0: ( -8.74,  3.4)
T-Test mu spring 0 = mu Autumn 0 (vs not =): T= -1.22  P=0.29  DF=  4
Both use Pooled StDev = 2.68


Two Sample T-Test and Confidence Interval


Two sample T for spring 06 vs Winter 07
          N      Mean     StDev   SE Mean
spring 0  3     7.000     0.866      0.50
Winter 0  3     5.500     0.500      0.29

95% CI for mu spring 0 - mu Winter 0: ( -0.10,  3.10)
T-Test mu spring 0 = mu Winter 0 (vs not =): T= 2.60  P=0.060  DF=  4
Both use Pooled StDev = 0.707


Two Sample T-Test and Confidence Interval


Two sample T for spring 06 vs Spring 07
          N      Mean     StDev   SE Mean
spring 0  3     7.000     0.866      0.50
Spring 0  3     11.83      2.75       1.6

95% CI for mu spring 0 - mu Spring 0: ( -9.46,  -0.2)
T-Test mu spring 0 = mu Spring 0 (vs not =): T= -2.90  P=0.044  DF=  4
Both use Pooled StDev = 2.04


Two Sample T-Test and Confidence Interval


Two sample T for Summer06 vs Autumn 06
          N      Mean     StDev   SE Mean
Summer06  3     10.00      1.80       1.0
Autumn 0  3      9.67      3.69       2.1

95% CI for mu Summer06 - mu Autumn 0: ( -6.2,  6.9)
T-Test mu Summer06 = mu Autumn 0 (vs not =): T= 0.14  P=0.89  DF=  4
Both use Pooled StDev = 2.90


Two Sample T-Test and Confidence Interval


Two sample T for Summer06 vs Winter 07
          N      Mean     StDev   SE Mean
Summer06  3     10.00      1.80       1.0
Winter 0  3     5.500     0.500      0.29

95% CI for mu Summer06 - mu Winter 0: ( 1.5,  7.50)
T-Test mu Summer06 = mu Winter 0 (vs not =): T= 4.17  P=0.014  DF=  4
Both use Pooled StDev = 1.32


Two Sample T-Test and Confidence Interval


Two sample T for Summer06 vs Spring 07
          N      Mean     StDev   SE Mean
Summer06  3     10.00      1.80       1.0
Spring 0  3     11.83      2.75       1.6

95% CI for mu Summer06 - mu Spring 0: ( -7.1,  3.4)
T-Test mu Summer06 = mu Spring 0 (vs not =): T= -0.96  P=0.39  DF=  4
Both use Pooled StDev = 2.33


Two Sample T-Test and Confidence Interval
```

Table C2 Cont.

```
Two sample T for Autumn 06 vs Winter 07
        N      Mean     StDev   SE Mean
Autumn 0  3      9.67      3.69       2.1
Winter 0  3     5.500     0.500      0.29

95% CI for mu Autumn 0 - mu Winter 0: ( -1.8,  10.13)
T-Test mu Autumn 0 = mu Winter 0 (vs not =): T= 1.94  P=0.12  DF=  4
Both use Pooled StDev = 2.63


Two Sample T-Test and Confidence Interval


Two sample T for Autumn 06 vs Spring 07
        N      Mean     StDev   SE Mean
Autumn 0  3      9.67      3.69       2.1
Spring 0  3     11.83      2.75       1.6

95% CI for mu Autumn 0 - mu Spring 0: ( -9.5,  5.2)
T-Test mu Autumn 0 = mu Spring 0 (vs not =): T= -0.82  P=0.46  DF=  4
Both use Pooled StDev = 3.25


Two Sample T-Test and Confidence Interval


Two sample T for Winter 07 vs Spring 07
        N      Mean     StDev   SE Mean
Winter 0  3     5.500     0.500      0.29
Spring 0  3     11.83      2.75       1.6

95% CI for mu Winter 0 - mu Spring 0: ( -10.82,  -1.8)
T-Test mu Winter 0 = mu Spring 0 (vs not =): T= -3.92  P=0.017  DF=  4
Both use Pooled StDev = 1.98
```

One-Way Analysis of Variance between season for Under grazing

```
Analysis of Variance
Source     DF        SS        MS        F        P
Factor      4     75.77     18.94     2.42    0.117
Error      10     78.17      7.82
Total      14    153.93
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  ------+---------+---------+---------+
spring 0    3     5.333     2.021  (--------*--------)
Summer06    3     9.167     0.289            (--------*--------)
Autumn 0    3    12.333     1.258                    (--------*--------)
Winter 0    3     9.833     5.346              (--------*--------)
Spring 0    3     9.500     2.179             (--------*--------)
                                   ------+---------+---------+---------+
Pooled StDev =    2.796
               4.0       8.0      12.0      16.0
```

One-Way Analysis of Variance between season for (Natural)

```
Analysis of Variance
Source     DF        SS        MS        F        P
Factor      4     106.0      26.5     2.45    0.115
Error      10     108.3      10.8
Total      14     214.3
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  -----+---------+---------+---------+-
spring 0    3    10.833     3.686          (--------*-------)
Summer06    3    13.167     1.258               (-------*--------)
Autumn 0    3    14.167     0.289                 (-------*--------)
Winter 0    3     6.833     5.346  (--------*-------)
Spring 0    3     9.167     3.215       (-------*--------)
                                   -----+---------+---------+---------+-
Pooled StDev =    3.291                5.0      10.0      15.0      20.0
```

Table C2 :cont.

One-Way Analysis of Variance between three sites on each season

Analysis of Variance for **spring 0**

```
Source     DF        SS        MS        F        P
C2          2     47.72     23.86     3.89    0.083
Error       6     36.83      6.14
Total       8     84.56
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  -----+---------+---------+---------+-
1           3     7.000     0.866       (---------*---------)
2           3     5.333     2.021  (---------*---------)
3           3    10.833     3.686                  (---------*---------)
                                   -----+---------+---------+---------+-
Pooled StDev =    2.478                3.5       7.0      10.5      14.0
```

One-Way Analysis of Variance

Analysis of Variance for **Summer 0**

```
Source     DF        SS        MS        F        P
C2          2     26.72     13.36     8.15    0.019
Error       6      9.83      1.64
Total       8     36.56
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  -+---------+---------+---------+-----
1           3    10.000     1.803      (------*------)
2           3     9.167     0.289  (-------*------)
3           3    13.167     1.258                  (-------*------)
                                   -+---------+---------+---------+-----
Pooled StDev =    1.280           7.5      10.0      12.5      15.0
```

Two Sample T-Test and Confidence Interval

```
Two sample T for t2 vs t3
    N      Mean     StDev   SE Mean
t2  3     10.00      1.80       1.0
t3  3     9.167     0.289      0.17

95% CI for mu t2 - mu t3: ( -2.1,  3.76)
T-Test mu t2 = mu t3 (vs not =): T= 0.79  P=0.47  DF=  4
Both use Pooled StDev = 1.29
```

Two Sample T-Test and Confidence Interval

```
Two sample T for t2 vs t4
    N      Mean     StDev   SE Mean
t2  3     10.00      1.80       1.0
t4  3     13.17      1.26      0.73

95% CI for mu t2 - mu t4: ( -6.7,  0.36)
T-Test mu t2 = mu t4 (vs not =): T= -2.49  P=0.067  DF=  4
Both use Pooled StDev = 1.55
```

Two Sample T-Test and Confidence Interval

```
Two sample T for t3 vs t4
    N      Mean     StDev   SE Mean
t3  3     9.167     0.289      0.17
t4  3     13.17      1.26      0.73

95% CI for mu t3 - mu t4: ( -6.07,  -1.93)
T-Test mu t3 = mu t4 (vs not =): T= -5.37  P=0.0058  DF=  4
Both use Pooled StDev = 0.913
```

Table C2 :cont.

```
One-Way Analysis of Variance

Analysis of Variance for Autumn
Source     DF        SS        MS        F        P
C2          2     30.72     15.36     3.02    0.124
Error       6     30.50      5.08
Total       8     61.22
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  ---------+---------+---------+-------
1           3     9.667     3.686   (---------*----------)
2           3    12.333     1.258          (----------*----------)
3           3    14.167     0.289                 (---------*----------)
                                   ---------+---------+---------+-------
Pooled StDev =    2.255                   9.0      12.0      15.0

One-Way Analysis of Variance

Analysis of Variance for Winter 06
Source     DF        SS        MS        F        P
C2          2      29.6      14.8     0.77    0.503
Error       6     114.8      19.1
Total       8     144.4
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  --+---------+---------+---------+----
1           3     5.500     0.500   (-----------*-----------)
2           3     9.833     5.346          (------------*-----------)
3           3     6.833     5.346     (------------*-----------)
                                   --+---------+---------+---------+----
Pooled StDev =    4.375            0.0       5.0      10.0      15.0

One-Way Analysis of Variance

Analysis of Variance for Spring 07
Source     DF        SS        MS        F        P
C2          2     12.67      6.33     0.84    0.477
Error       6     45.33      7.56
Total       8     58.00
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  ---+---------+---------+---------+---
1           3    11.833     2.754          (------------*------------)
2           3     9.500     2.179    (------------*------------)
3           3     9.167     3.215   (------------*------------)
                                   ---+---------+---------+---------+---
Pooled StDev =    2.749              6.0       9.0      12.0      15.0
```

Table C3 :One-Way Analysis of Variance between seasons for Araneae(spiders)

One-Way Analysis of Variance between seasons for(fenced)

```
Analysis of Variance
Source     DF        SS        MS        F        P
Factor      4    308.73     77.18    13.54    0.000
Error      10     57.00      5.70
Total      14    365.73
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  --------+---------+---------+--------
Spring06    3     4.500     3.041   (-----*-----)
Summer 0    3     6.167     1.756      (-----*-----)
Autumn 0    3     6.500     1.732       (-----*-----)
Winter 0    3     5.333     2.255     (-----*-----)
Spring 0    3    16.833     2.843                           (-----*-----)
                                   --------+---------+---------+--------
Pooled StDev =    2.387                  5.0      10.0      15.0

Two Sample T-Test and Confidence Interval
Two sample T for Spring06 vs Summer 06
          N      Mean     StDev   SE Mean
Spring06  3      4.50      3.04       1.8
Summer 0  3      6.17      1.76       1.0
95% CI for mu Spring06 - mu Summer 0: ( -7.3,  4.0)
T-Test mu Spring06 = mu Summer 0 (vs not =): T= -0.82  P=0.46  DF=  4
Both use Pooled StDev = 2.48
```

Table C3 cont.

```
Two Sample T-Test and Confidence Interval


Two sample T for Spring06 vs Autumn 06
          N      Mean     StDev   SE Mean
Spring06  3      4.50      3.04       1.8
Autumn 0  3      6.50      1.73       1.0

95% CI for mu Spring06 - mu Autumn 0: ( -7.6,  3.6)
T-Test mu Spring06 = mu Autumn 0 (vs not =): T= -0.99  P=0.38  DF=  4
Both use Pooled StDev = 2.47


Two Sample T-Test and Confidence Interval


Two sample T for Spring06 vs Winter 07
          N      Mean     StDev   SE Mean
Spring06  3      4.50      3.04       1.8
Winter 0  3      5.33      2.25       1.3

95% CI for mu Spring06 - mu Winter 0: ( -6.9,  5.2)
T-Test mu Spring06 = mu Winter 0 (vs not =): T= -0.38  P=0.72  DF=  4
Both use Pooled StDev = 2.68


Two Sample T-Test and Confidence Interval


Two sample T for Spring06 vs Spring 07
          N      Mean     StDev   SE Mean
Spring06  3      4.50      3.04       1.8
Spring 0  3     16.83      2.84       1.6

95% CI for mu Spring06 - mu Spring 0: ( -19.0,  -5.7)
T-Test mu Spring06 = mu Spring 0 (vs not =): T= -5.13  P=0.0068  DF=  4
Both use Pooled StDev = 2.94


Two Sample T-Test and Confidence Interval


Two sample T for Summer 06 vs Autumn 06
          N      Mean     StDev   SE Mean
Summer 0  3      6.17      1.76       1.0
Autumn 0  3      6.50      1.73       1.0

95% CI for mu Summer 0 - mu Autumn 0: ( -4.3,  3.6)
T-Test mu Summer 0 = mu Autumn 0 (vs not =): T= -0.23  P=0.83  DF=  4
Both use Pooled StDev = 1.74


Two Sample T-Test and Confidence Interval


Two sample T for Summer 06 vs Winter 07
          N      Mean     StDev   SE Mean
Summer 0  3      6.17      1.76       1.0
Winter 0  3      5.33      2.25       1.3

95% CI for mu Summer 0 - mu Winter 0: ( -3.7,  5.4)
T-Test mu Summer 0 = mu Winter 0 (vs not =): T= 0.51  P=0.64  DF=  4
Both use Pooled StDev = 2.02


Two Sample T-Test and Confidence Interval


Two sample T for Summer 06 vs Spring 07
          N      Mean     StDev   SE Mean
Summer 0  3      6.17      1.76       1.0
Spring 0  3     16.83      2.84       1.6

95% CI for mu Summer 0 - mu Spring 0: ( -16.0,  -5.3)
T-Test mu Summer 0 = mu Spring 0 (vs not =): T= -5.53  P=0.0052  DF=  4
Both use Pooled StDev = 2.36
```

Table C3 cont.

```
Two Sample T-Test and Confidence Interval


Two sample T for Autumn 06 vs Winter 07
         N      Mean     StDev   SE Mean
Autumn 0  3      6.50      1.73       1.0
Winter 0  3      5.33      2.25       1.3

95% CI for mu Autumn 0 - mu Winter 0: ( -3.4,  5.7)
T-Test mu Autumn 0 = mu Winter 0 (vs not =): T= 0.71  P=0.52  DF=  4
Both use Pooled StDev = 2.01


Two Sample T-Test and Confidence Interval


Two sample T for Autumn 06 vs Spring 07
         N      Mean     StDev   SE Mean
Autumn 0  3      6.50      1.73       1.0
Spring 0  3     16.83      2.84       1.6

95% CI for mu Autumn 0 - mu Spring 0: ( -15.7,  -5.0)
T-Test mu Autumn 0 = mu Spring 0 (vs not =): T= -5.38  P=0.0058  DF=  4
Both use Pooled StDev = 2.35


Two Sample T-Test and Confidence Interval


Two sample T for Winter 07 vs Spring 07
         N      Mean     StDev   SE Mean
Winter 0  3      5.33      2.25       1.3
Spring 0  3     16.83      2.84       1.6

95% CI for mu Winter 0 - mu Spring 0: ( -17.3,  -5.7)
T-Test mu Winter 0 = mu Spring 0 (vs not =): T= -5.49  P=0.0054  DF=  4
Both use Pooled StDev = 2.57
```

One-Way Analysis of Variance between seasons for under grazing

```
Analysis of Variance
Source     DF        SS        MS        F        P
Factor      4    217.90     54.47    27.47    0.000
Error      10     19.83      1.98
Total      14    237.73
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  -------+---------+---------+---------
Spring06    3     7.500     2.179          (---*---)
Summer 0    3     3.333     0.764  (---*--)
Autumn 0    3     7.500     1.732          (---*---)
Winter 0    3     6.833     1.155         (---*--)
Spring 0    3    15.000     0.500                         (---*---)
                                   -------+---------+---------+---------
Pooled StDev =    1.408                  5.0      10.0      15.0

Two Sample T-Test and Confidence Interval


Two sample T for Spring06 vs Summer 06
         N      Mean     StDev   SE Mean
Spring06  3      7.50      2.18       1.3
Summer 0  3     3.333     0.764      0.44

95% CI for mu Spring06 - mu Summer 0: ( 0.5,  7.87)
T-Test mu Spring06 = mu Summer 0 (vs not =): T= 3.12  P=0.035  DF=  4
Both use Pooled StDev = 1.63


Two Sample T-Test and Confidence Interval
```

Table C3 cont.

```
Two sample T for Spring06 vs Autumn 06
          N      Mean     StDev   SE Mean
Spring06  3      7.50      2.18       1.3
Autumn 0  3      7.50      1.73       1.0

95% CI for mu Spring06 - mu Autumn 0: ( -4.5,  4.5)
T-Test mu Spring06 = mu Autumn 0 (vs not =): T= 0.00  P=1.0  DF=  4
Both use Pooled StDev = 1.97


Two Sample T-Test and Confidence Interval


Two sample T for Spring06 vs Winter 07
          N      Mean     StDev   SE Mean
Spring06  3      7.50      2.18       1.3
Winter 0  3      6.83      1.15      0.67

95% CI for mu Spring06 - mu Winter 0: ( -3.3,  4.62)
T-Test mu Spring06 = mu Winter 0 (vs not =): T= 0.47  P=0.66  DF=  4
Both use Pooled StDev = 1.74


Two Sample T-Test and Confidence Interval


Two sample T for Spring06 vs Spring 07
          N      Mean     StDev   SE Mean
Spring06  3      7.50      2.18       1.3
Spring 0  3    15.000     0.500      0.29

95% CI for mu Spring06 - mu Spring 0: ( -11.1,  -3.92)
T-Test mu Spring06 = mu Spring 0 (vs not =): T= -5.81  P=0.0044  DF=  4
Both use Pooled StDev = 1.58


Two Sample T-Test and Confidence Interval


Two sample T for Summer 06 vs Autumn 06
          N      Mean     StDev   SE Mean
Summer 0  3     3.333     0.764      0.44
Autumn 0  3      7.50      1.73       1.0

95% CI for mu Summer 0 - mu Autumn 0: ( -7.20,  -1.1)
T-Test mu Summer 0 = mu Autumn 0 (vs not =): T= -3.81  P=0.019  DF=  4
Both use Pooled StDev = 1.34


Two Sample T-Test and Confidence Interval


Two sample T for Summer 06 vs Winter 07
          N      Mean     StDev   SE Mean
Summer 0  3     3.333     0.764      0.44
Winter 0  3      6.83      1.15      0.67

95% CI for mu Summer 0 - mu Winter 0: ( -5.72,  -1.28)
T-Test mu Summer 0 = mu Winter 0 (vs not =): T= -4.38  P=0.012  DF=  4
Both use Pooled StDev = 0.979


Two Sample T-Test and Confidence Interval


Two sample T for Summer 06 vs Spring 07
          N      Mean     StDev   SE Mean
Summer 0  3     3.333     0.764      0.44
Spring 0  3    15.000     0.500      0.29

95% CI for mu Summer 0 - mu Spring 0: ( -13.13,  -10.20)
T-Test mu Summer 0 = mu Spring 0 (vs not =): T= -22.14  P=0.0000  DF=  4
Both use Pooled StDev = 0.645


Two Sample T-Test and Confidence Interval
Two sample T for Autumn 06 vs Winter 07
          N      Mean     StDev   SE Mean
Autumn 0  3      7.50      1.73       1.0
Winter 0  3      6.83      1.15      0.67
```

Table C3 cont.

```
95% CI for mu Autumn 0 - mu Winter 0: ( -2.7,  4.00)
T-Test mu Autumn 0 = mu Winter 0 (vs not =): T= 0.55  P=0.61  DF=  4
Both use Pooled StDev = 1.47


Two Sample T-Test and Confidence Interval


Two sample T for Autumn 06 vs Spring 07
          N      Mean     StDev   SE Mean
Autumn 0  3      7.50      1.73       1.0
Spring 0  3    15.000     0.500      0.29

95% CI for mu Autumn 0 - mu Spring 0: ( -10.4,  -4.61)
T-Test mu Autumn 0 = mu Spring 0 (vs not =): T= -7.21  P=0.0020  DF=  4
Both use Pooled StDev = 1.27


Two Sample T-Test and Confidence Interval


Two sample T for Winter 07 vs Spring 07
          N      Mean     StDev   SE Mean
Winter 0  3      6.83      1.15      0.67
Spring 0  3    15.000     0.500      0.29

95% CI for mu Winter 0 - mu Spring 0: ( -10.18,  -6.15)
T-Test mu Winter 0 = mu Spring 0 (vs not =): T= -11.24  P=0.0004  DF=  4
Both use Pooled StDev = 0.890
```

One-Way Analysis of Variance between seasons for(Natural)

```
Analysis of Variance
Source     DF        SS        MS        F        P
Factor      4    310.67     77.67    11.65    0.001
Error      10     66.67      6.67
Total      14    377.33
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  ----+---------+---------+---------+--
Spring06    3     6.000     1.323          (-----*-----)
Summer 0    3     1.500     1.803   (----*-----)
Autumn 0    3     6.000     3.122          (-----*-----)
Winter 0    3    11.000     3.500                   (----*-----)
Spring 0    3    14.667     2.517                         (----*-----)
                                   ----+---------+---------+---------+--
Pooled StDev =    2.582                0.0       6.0      12.0      18.0

Two Sample T-Test and Confidence Interval


Two sample T for Spring06 vs Summer 06
          N      Mean     StDev   SE Mean
Spring06  3      6.00      1.32      0.76
Summer 0  3      1.50      1.80       1.0

95% CI for mu Spring06 - mu Summer 0: ( 0.92,  8.1)
T-Test mu Spring06 = mu Summer 0 (vs not =): T= 3.49  P=0.025  DF=  4
Both use Pooled StDev = 1.58


Two Sample T-Test and Confidence Interval


Two sample T for Spring06 vs Autumn 06
          N      Mean     StDev   SE Mean
Spring06  3      6.00      1.32      0.76
Autumn 0  3      6.00      3.12       1.8

95% CI for mu Spring06 - mu Autumn 0: ( -5.44,  5.4)
T-Test mu Spring06 = mu Autumn 0 (vs not =): T= 0.00  P=1.0  DF=  4
Both use Pooled StDev = 2.40


Two Sample T-Test and Confidence Interval
```

Table C3 cont.

```
Two sample T for Spring06 vs Winter 07
          N      Mean     StDev   SE Mean
Spring06  3      6.00      1.32      0.76
Winter 0  3     11.00      3.50       2.0

95% CI for mu Spring06 - mu Winter 0: ( -11.00,  1.0)
T-Test mu Spring06 = mu Winter 0 (vs not =): T= -2.31  P=0.082  DF=  4
Both use Pooled StDev = 2.65


Two Sample T-Test and Confidence Interval


Two sample T for Spring06 vs Spring 07
          N      Mean     StDev   SE Mean
Spring06  3      6.00      1.32      0.76
Spring 0  3     14.67      2.52       1.5

95% CI for mu Spring06 - mu Spring 0: ( -13.22,  -4.1)
T-Test mu Spring06 = mu Spring 0 (vs not =): T= -5.28  P=0.0062  DF=  4
Both use Pooled StDev = 2.01


Two Sample T-Test and Confidence Interval


Two sample T for Summer 06 vs Autumn 06
          N      Mean     StDev   SE Mean
Summer 0  3      1.50      1.80       1.0
Autumn 0  3      6.00      3.12       1.8

95% CI for mu Summer 0 - mu Autumn 0: ( -10.3,  1.3)
T-Test mu Summer 0 = mu Autumn 0 (vs not =): T= -2.16  P=0.097  DF=  4
Both use Pooled StDev = 2.55


Two Sample T-Test and Confidence Interval


Two sample T for Summer 06 vs Winter 07
          N      Mean     StDev   SE Mean
Summer 0  3      1.50      1.80       1.0
Winter 0  3     11.00      3.50       2.0

95% CI for mu Summer 0 - mu Winter 0: ( -15.8,  -3.2)
T-Test mu Summer 0 = mu Winter 0 (vs not =): T= -4.18  P=0.014  DF=  4
Both use Pooled StDev = 2.78


Two Sample T-Test and Confidence Interval


Two sample T for Summer 06 vs Spring 07
          N      Mean     StDev   SE Mean
Summer 0  3      1.50      1.80       1.0
Spring 0  3     14.67      2.52       1.5

95% CI for mu Summer 0 - mu Spring 0: ( -18.1,  -8.2)
T-Test mu Summer 0 = mu Spring 0 (vs not =): T= -7.37  P=0.0018  DF=  4
Both use Pooled StDev = 2.19


Two Sample T-Test and Confidence Interval


Two sample T for Autumn 06 vs Winter 07
          N      Mean     StDev   SE Mean
Autumn 0  3      6.00      3.12       1.8
Winter 0  3     11.00      3.50       2.0

95% CI for mu Autumn 0 - mu Winter 0: ( -12.5,  2.5)
T-Test mu Autumn 0 = mu Winter 0 (vs not =): T= -1.85  P=0.14  DF=  4
Both use Pooled StDev = 3.32
```

Table C3 cont.

```
Two Sample T-Test and Confidence Interval

Two sample T for Autumn 06 vs Spring 07
         N      Mean     StDev   SE Mean
Autumn 0  3      6.00      3.12       1.8
Spring 0  3     14.67      2.52       1.5

95% CI for mu Autumn 0 - mu Spring 0: ( -15.1,  -2.2)
T-Test mu Autumn 0 = mu Spring 0 (vs not =): T= -3.74  P=0.020  DF=  4
Both use Pooled StDev = 2.84


Two Sample T-Test and Confidence Interval


Two sample T for Winter 07 vs Spring 07
         N      Mean     StDev   SE Mean
Winter 0  3     11.00      3.50       2.0
Spring 0  3     14.67      2.52       1.5

95% CI for mu Winter 0 - mu Spring 0: ( -10.6,  3.2)
T-Test mu Winter 0 = mu Spring 0 (vs not =): T= -1.47  P=0.21  DF=  4
Both use Pooled StDev = 3.05
```

One-Way Analysis of Variance between thee sites for each season

```
Analysis of Variance for Spring06
Source     DF        SS        MS        F        P
C2          2     13.50      6.75     1.29    0.343
Error       6     31.50      5.25
Total       8     45.00
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  ------+---------+---------+---------+
1           3     4.500     3.041  (----------*----------)
2           3     7.500     2.179            (----------*----------)
3           3     6.000     1.323       (----------*----------)
                                   ------+---------+---------+---------+
Pooled StDev =    2.291                 3.0       6.0       9.0      12.0

One-Way Analysis of Variance

Analysis of Variance for Summer 0
Source     DF        SS        MS        F        P
C2          2     33.17     16.58     7.19    0.025
Error       6     13.83      2.31
Total       8     47.00
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  ---+---------+---------+---------+---
1           3     6.167     1.756                    (--------*-------)
2           3     3.333     0.764          (-------*--------)
3           3     1.500     1.803  (--------*--------)
                                   ---+---------+---------+---------+---
Pooled StDev =    1.518              0.0       2.5       5.0       7.5

Two Sample T-Test and Confidence Interval


Two sample T for T2 vs T3
    N      Mean     StDev   SE Mean
T2  3      6.17      1.76       1.0
T3  3     3.333     0.764      0.44

95% CI for mu T2 - mu T3: ( -0.2,  5.90)
T-Test mu T2 = mu T3 (vs not =): T= 2.56  P=0.062  DF=  4
Both use Pooled StDev = 1.35


Two Sample T-Test and Confidence Interval
```

Table C3 cont.

```
Two sample T for T2 vs T4
    N      Mean     StDev   SE Mean
T2  3      6.17      1.76       1.0
T4  3      1.50      1.80       1.0

95% CI for mu T2 - mu T4: ( 0.6,  8.7)
T-Test mu T2 = mu T4 (vs not =): T= 3.21  P=0.033  DF=  4
Both use Pooled StDev = 1.78


Two Sample T-Test and Confidence Interval


Two sample T for T3 vs T4
    N      Mean     StDev   SE Mean
T3  3     3.333     0.764      0.44
T4  3      1.50      1.80       1.0

95% CI for mu T3 - mu T4: ( -1.31,  5.0)
T-Test mu T3 = mu T4 (vs not =): T= 1.62  P=0.18  DF=  4
Both use Pooled StDev = 1.38


One-Way Analysis of Variance

Analysis of Variance for Autumn 0
Source     DF        SS        MS        F        P
C2          2      3.50      1.75     0.33    0.729
Error       6     31.50      5.25
Total       8     35.00
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  ---------+---------+---------+-------
1           3     6.500     1.732    (------------*------------)
2           3     7.500     1.732        (------------*------------)
3           3     6.000     3.122  (------------*------------)
                                   ---------+---------+---------+-------
Pooled StDev =    2.291                   5.0       7.5      10.0

One-Way Analysis of Variance

Analysis of Variance for Winter 0
Source     DF        SS        MS        F        P
C2          2     51.72     25.86     4.16    0.074
Error       6     37.33      6.22
Total       8     89.06
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  -----+---------+---------+---------+-
1           3     5.333     2.255  (---------*---------)
2           3     6.833     1.155      (---------*---------)
3           3    11.000     3.500                  (---------*---------)
                                   -----+---------+---------+---------+-
Pooled StDev =    2.494                3.5       7.0      10.5      14.0

One-Way Analysis of Variance

Analysis of Variance for Spring 0
Source     DF        SS        MS        F        P
C2          2      8.17      4.08     0.84    0.479
Error       6     29.33      4.89
Total       8     37.50
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  ----+---------+---------+---------+--
1           3    16.833     2.843           (-----------*------------)
2           3    15.000     0.500    (-----------*-----------)
3           3    14.667     2.517  (------------*-----------)
                                   ----+---------+---------+---------+--
Pooled StDev =    2.211             12.5      15.0      17.5      20.0
Worksheet size: 100000 cells
```

Table C4 :One-Way Analysis of Variance between season for(other insects)

Analysis of Variance for (fenced)

```
Source     DF        SS        MS        F        P
Factor      4      4558      1139     1.19    0.371
Error      10      9535       954
Total      14     14093
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  ----------+---------+---------+------
Spring06    3     29.17     39.29        (----------*-----------)
Summer06    3      5.00      2.00  (----------*-----------)
Autumn 0    3     51.83     33.55              (-----------*----------)
Winter 0    3     47.00     38.63             (----------*-----------)
Spring 0    3     47.83     24.55             (-----------*----------)
                                   ----------+---------+---------+------
Pooled StDev =    30.88                      0        35        70
```

One-Way Analysis of Variance

Analysis of Variance for(Grazed)

```
Source     DF        SS        MS        F        P
Factor      4     23970      5992    10.38    0.001
Error      10      5773       577
Total      14     29742
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  ----+---------+---------+---------+--
Spring06    3     15.83      4.31   (-----*-----)
Summer06    3     13.67      6.71   (-----*-----)
Autumn 0    3     27.50      8.89     (------*-----)
Winter 0    3     23.00      2.50    (------*-----)
Spring 0    3    119.17     52.32                      (-----*-----)
                                   ----+---------+---------+---------+--
Pooled StDev =    24.03                0        50       100       150
```

Two Sample T-Test and Confidence Interval

```
Two sample T for Spring06 vs Summer06
          N      Mean     StDev   SE Mean
Spring06  3     15.83      4.31       2.5
Summer06  3     13.67      6.71       3.9

95% CI for mu Spring06 - mu Summer06: ( -10.6,  15.0)
T-Test mu Spring06 = mu Summer06 (vs not =): T= 0.47  P=0.66  DF=  4
Both use Pooled StDev = 5.64
```

Two Sample T-Test and Confidence Interval

```
Two sample T for Spring06 vs Autumn 06
          N      Mean     StDev   SE Mean
Spring06  3     15.83      4.31       2.5
Autumn 0  3     27.50      8.89       5.1
95% CI for mu Spring06 - mu Autumn 0: ( -27.5,  4.2)
T-Test mu Spring06 = mu Autumn 0 (vs not =): T= -2.05  P=0.11  DF=  4
Both use Pooled StDev = 6.99
```

Two Sample T-Test and Confidence Interval

```
Two sample T for Spring06 vs Winter 07
          N      Mean     StDev   SE Mean
Spring06  3     15.83      4.31       2.5
Winter 0  3     23.00      2.50       1.4

95% CI for mu Spring06 - mu Winter 0: ( -15.2,  0.8)
T-Test mu Spring06 = mu Winter 0 (vs not =): T= -2.49  P=0.067  DF=  4
Both use Pooled StDev = 3.52
```

Two Sample T-Test and Confidence Interval

```
Two sample T for Spring06 vs Spring 07
          N      Mean     StDev   SE Mean
Spring06  3     15.83      4.31       2.5
Spring 0  3     119.2      52.3        30

95% CI for mu Spring06 - mu Spring 0: ( -187.5,  -19)
T-Test mu Spring06 = mu Spring 0 (vs not =): T= -3.41  P=0.027  DF=  4
Both use Pooled StDev = 37.1
```

Table C4 Cont.

```
Two Sample T-Test and Confidence Interval
Two sample T for Summer06 vs Autumn 06
          N      Mean     StDev   SE Mean
Summer06  3     13.67      6.71       3.9
Autumn 0  3     27.50      8.89       5.1

95% CI for mu Summer06 - mu Autumn 0: ( -31.7,  4.0)
T-Test mu Summer06 = mu Autumn 0 (vs not =): T= -2.15  P=0.098  DF=  4
Both use Pooled StDev = 7.88


Two Sample T-Test and Confidence Interval


Two sample T for Summer06 vs Winter 07
          N      Mean     StDev   SE Mean
Summer06  3     13.67      6.71       3.9
Winter 0  3     23.00      2.50       1.4

95% CI for mu Summer06 - mu Winter 0: ( -20.8,  2.2)
T-Test mu Summer06 = mu Winter 0 (vs not =): T= -2.26  P=0.087  DF=  4
Both use Pooled StDev = 5.07


Two Sample T-Test and Confidence Interval


Two sample T for Summer06 vs Spring 07
          N      Mean     StDev   SE Mean
Summer06  3     13.67      6.71       3.9
Spring 0  3     119.2      52.3        30

95% CI for mu Summer06 - mu Spring 0: ( -190.1,  -21)
T-Test mu Summer06 = mu Spring 0 (vs not =): T= -3.46  P=0.026  DF=  4
Both use Pooled StDev = 37.3


Two Sample T-Test and Confidence Interval


Two sample T for Autumn 06 vs Winter 07
          N      Mean     StDev   SE Mean
Autumn 0  3     27.50      8.89       5.1
Winter 0  3     23.00      2.50       1.4

95% CI for mu Autumn 0 - mu Winter 0: ( -10.3,  19.3)
T-Test mu Autumn 0 = mu Winter 0 (vs not =): T= 0.84  P=0.45  DF=  4
Both use Pooled StDev = 6.53


Two Sample T-Test and Confidence Interval


Two sample T for Autumn 06 vs Spring 07
          N      Mean     StDev   SE Mean
Autumn 0  3     27.50      8.89       5.1
Spring 0  3     119.2      52.3        30

95% CI for mu Autumn 0 - mu Spring 0: ( -176.7,  -7)
T-Test mu Autumn 0 = mu Spring 0 (vs not =): T= -2.99  P=0.040  DF=  4
Both use Pooled StDev = 37.5


Two Sample T-Test and Confidence Interval


Two sample T for Winter 07 vs Spring 07
          N      Mean     StDev   SE Mean
Winter 0  3     23.00      2.50       1.4
Spring 0  3     119.2      52.3        30

95% CI for mu Winter 0 - mu Spring 0: ( -180.1,  -12)
T-Test mu Winter 0 = mu Spring 0 (vs not =): T= -3.18  P=0.034  DF=  4
Both use Pooled StDev = 37.0
```

Table C4 Cont.

One-Way Analysis of Variance(Natural)

```
Analysis of Variance
Source     DF        SS        MS        F        P
Factor      4      8187      2047     3.23    0.060
Error      10      6339       634
Total      14     14527
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  ------+---------+---------+---------+
Spring06    3      9.83      6.60  (-------*--------)
Summer06    3     13.00      1.32   (-------*-------)
Autumn 0    3     34.67      5.01         (-------*-------)
Winter 0    3     75.17     55.31                   (-------*-------)
Spring 0    3     29.33      6.33       (-------*-------)
                                   ------+---------+---------+---------+
Pooled StDev =    25.18                  0        40        80       120
```

One-Way Analysis of Variance btween three sites for each season

```
Analysis of Variance for Spring06
Source     DF        SS        MS        F        P
C2          2       588       294     0.55    0.604
Error       6      3212       535
Total       8      3799
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  ----------+---------+---------+------
1           3     29.17     39.29           (------------*------------)
2           3     15.83      4.31     (------------*------------)
3           3      9.83      6.60   (------------*------------)
                                   ----------+---------+---------+------
Pooled StDev =    23.14                      0        25        50
```

One-Way Analysis of Variance

```
Analysis of Variance for Summer06
Source     DF        SS        MS        F        P
C2          2     139.6      69.8     4.12    0.075
Error       6     101.7      16.9
Total       8     241.2
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  --+---------+---------+---------+----
1           3     5.000     2.000   (--------*---------)
2           3    13.667     6.714               (---------*--------)
3           3    13.000     1.323              (---------*--------)
                                   --+---------+---------+---------+----
Pooled StDev =    4.116            0.0       6.0      12.0      18.0
```

One-Way Analysis of Variance

```
Analysis of Variance for Autumn06
Source     DF        SS        MS        F        P
C2          2       938       469     1.14    0.379
Error       6      2459       410
Total       8      3397
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  -+---------+---------+---------+-----
1           3     51.83     33.55            (-----------*----------)
2           3     27.50      8.89   (----------*----------)
3           3     34.67      5.01     (-----------*----------)
                                   -+---------+---------+---------+-----
Pooled StDev =    20.25             0        25        50        75
```

Table C4 Cont.

```
One-Way Analysis of Variance

Analysis of Variance for Winter 0
Source     DF        SS        MS        F        P
C2          2      4091      2045     1.35    0.329
Error       6      9115      1519
Total       8     13205
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  -------+---------+---------+---------
1           3     47.00     38.63       (----------*----------)
2           3     23.00      2.50   (----------*----------)
3           3     75.17     55.31            (----------*----------)
                                   -------+---------+---------+---------
Pooled StDev =    38.98                   0        50       100

One-Way Analysis of Variance

Analysis of Variance for Spring 0
Source     DF        SS        MS        F        P
C2          2     13501      6750     5.99    0.037
Error       6      6760      1127
Total       8     20261
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  ----+---------+---------+---------+--
1           3     47.83     24.55      (---------*--------)
2           3    119.17     52.32                    (---------*--------)
3           3     29.33      6.33  (---------*--------)
                                   ----+---------+---------+---------+--
Pooled StDev =    33.57                0        50       100       150

Two Sample T-Test and Confidence Interval


Two sample T for T2 vs T3
    N      Mean     StDev   SE Mean
T2  3      80.7      81.3        47
T3  3      86.3      22.8        13

95% CI for mu T2 - mu T3: ( -141,  130)
T-Test mu T2 = mu T3 (vs not =): T= -0.12  P=0.91  DF=  4
Both use Pooled StDev = 59.7


Two Sample T-Test and Confidence Interval


Two sample T for T2 vs T4
    N      Mean     StDev   SE Mean
T2  3      80.7      81.3        47
T4  3     29.33      6.33       3.7

95% CI for mu T2 - mu T4: ( -79,  182.1)
T-Test mu T2 = mu T4 (vs not =): T= 1.09  P=0.34  DF=  4
Both use Pooled StDev = 57.7


Two Sample T-Test and Confidence Interval


Two sample T for T3 vs T4
    N      Mean     StDev   SE Mean
T3  3      86.3      22.8        13
T4  3     29.33      6.33       3.7

95% CI for mu T3 - mu T4: ( 19,  95.0)
T-Test mu T3 = mu T4 (vs not =): T= 4.17  P=0.014  DF=  4
Both use Pooled StDev = 16.8
```

Table C5: One-Way Analysis of Variance between seasons for (other arthropods)

Analysis of Variance (Fenced)

```
Source     DF        SS        MS        F        P
Factor      4     5.000     1.250     9.38    0.002
Error      10     1.333     0.133
Total      14     6.333
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  -------+---------+---------+---------
spring06    3    0.0000    0.0000  (------*------)
summer06    3    0.1667    0.2887     (-----*------)
autumn 0    3    0.5000    0.5000       (------*------)
winter 0    3    1.1667    0.2887                 (------*-----)
spring 0    3    1.5000    0.5000                      (-----*------)
                                   -------+---------+---------+---------
Pooled StDev =   0.3651                  0.00      0.70      1.40

* NOTE  * All values in column are identical.
```

One-Way Analysis of Variance (Grazed)

```
Analysis of Variance Source     DF        SS        MS        F        P
Factor      4    21.733     5.433     6.39    0.008
Error      10     8.500     0.850
Total      14    30.233
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  --------+---------+---------+--------
spring06    3    0.0000    0.0000  (-------*-------)
summer06    3    0.3333    0.2887    (-------*-------)
autumn 0    3    3.0000    0.8660                    (-------*-------)
winter 0    3    1.3333    1.4434         (-------*-------)
spring 0    3    2.6667    1.1547                  (-------*-------)
                                   --------+---------+---------+--------
Pooled StDev =   0.9220                   0.0       1.5       3.0
```

One-Way Analysis of Variance (Natural)

```
Analysis of Variance
Source     DF        SS        MS        F        P
Factor      4    12.000     3.000     4.74    0.021
Error      10     6.333     0.633
Total      14    18.333
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  ------+---------+---------+---------+
spring06    3    0.3333    0.2887  (--------*-------)
summer06    3    0.3333    0.5774  (--------*-------)
autumn 0    3    0.8333    1.0408      (--------*-------)
winter 0    3    1.6667    0.7638             (--------*-------)
spring 0    3    2.6667    1.0408                      (-------*--------)
                                   ------+---------+---------+---------+
Pooled StDev =   0.7958                 0.0       1.2       2.4       3.6

Two Sample T-Test and Confidence Interval


Two sample T for spring06 vs summer06
         N      Mean     StDev   SE Mean
spring06  3     0.333     0.289      0.17
summer06  3     0.333     0.577      0.33

95% CI for mu spring06 - mu summer06: ( -1.03,  1.03)
T-Test mu spring06 = mu summer06 (vs not =): T= 0.00  P=1.0  DF=  4
Both use Pooled StDev = 0.456
Two Sample T-Test and Confidence Interval

Two sample T for spring06 vs autumn 06
         N      Mean     StDev   SE Mean
spring06  3     0.333     0.289      0.17
autumn 0  3      0.83      1.04      0.60
95% CI for mu spring06 - mu autumn 0: ( -2.23,  1.23)
T-Test mu spring06 = mu autumn 0 (vs not =): T= -0.80  P=0.47  DF=  4
Both use Pooled StDev = 0.764
```

Table C5 Cont.

```
Two Sample T-Test and Confidence Interval


Two sample T for spring06 vs winter 07
          N      Mean     StDev   SE Mean
spring06  3     0.333     0.289      0.17
winter 0  3     1.667     0.764      0.44

95% CI for mu spring06 - mu winter 0: ( -2.64,  -0.02)
T-Test mu spring06 = mu winter 0 (vs not =): T= -2.83  P=0.047  DF=  4
Both use Pooled StDev = 0.577


Two Sample T-Test and Confidence Interval


Two sample T for spring06 vs spring 07
          N      Mean     StDev   SE Mean
spring06  3     0.333     0.289      0.17
spring 0  3      2.67      1.04      0.60

95% CI for mu spring06 - mu spring 0: ( -4.06,  -0.60)
T-Test mu spring06 = mu spring 0 (vs not =): T= -3.74  P=0.020  DF=  4
Both use Pooled StDev = 0.764


Two Sample T-Test and Confidence Interval


Two sample T for summer06 vs autumn 06
          N      Mean     StDev   SE Mean
summer06  3     0.333     0.577      0.33
autumn 0  3      0.83      1.04      0.60

95% CI for mu summer06 - mu autumn 0: ( -2.41,  1.41)
T-Test mu summer06 = mu autumn 0 (vs not =): T= -0.73  P=0.51  DF=  4
Both use Pooled StDev = 0.842


Two Sample T-Test and Confidence Interval


Two sample T for summer06 vs winter 07
          N      Mean     StDev   SE Mean
summer06  3     0.333     0.577      0.33
winter 0  3     1.667     0.764      0.44

95% CI for mu summer06 - mu winter 0: ( -2.87,  0.20)
T-Test mu summer06 = mu winter 0 (vs not =): T= -2.41  P=0.073  DF=  4
Both use Pooled StDev = 0.677


Two Sample T-Test and Confidence Interval


Two sample T for summer06 vs spring 07
          N      Mean     StDev   SE Mean
summer06  3     0.333     0.577      0.33
spring 0  3      2.67      1.04      0.60

95% CI for mu summer06 - mu spring 0: ( -4.24,  -0.43)
T-Test mu summer06 = mu spring 0 (vs not =): T= -3.40  P=0.027  DF=  4
Both use Pooled StDev = 0.842


Two Sample T-Test and Confidence Interval


Two sample T for autumn 06 vs winter 07
          N      Mean     StDev   SE Mean
autumn 0  3      0.83      1.04      0.60
winter 0  3     1.667     0.764      0.44

95% CI for mu autumn 0 - mu winter 0: ( -2.90,  1.24)
T-Test mu autumn 0 = mu winter 0 (vs not =): T= -1.12  P=0.33  DF=  4
Both use Pooled StDev = 0.913
Two Sample T-Test and Confidence Interval
```

Table C5 Cont.

```
Two sample T for autumn 06 vs spring 07
          N      Mean     StDev   SE Mean
autumn 0  3      0.83      1.04      0.60
spring 0  3      2.67      1.04      0.60

95% CI for mu autumn 0 - mu spring 0: ( -4.19,  0.53)
T-Test mu autumn 0 = mu spring 0 (vs not =): T= -2.16  P=0.097  DF=  4
Both use Pooled StDev = 1.04


Two Sample T-Test and Confidence Interval


Two sample T for winter 07 vs spring 07
          N      Mean     StDev   SE Mean
winter 0  3     1.667     0.764      0.44
spring 0  3      2.67      1.04      0.60

95% CI for mu winter 0 - mu spring 0: ( -3.07,  1.07)
T-Test mu winter 0 = mu spring 0 (vs not =): T= -1.34  P=0.25  DF=  4
Both use Pooled StDev = 0.913
```

One-Way Analysis Variance of between the three sites for each seasons

```
Analysis of Variance for spring06
Source     DF        SS        MS        F        P
C2          2    0.2222    0.1111     4.00    0.079
Error       6    0.1667    0.0278
Total       8    0.3889
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  ----------+---------+---------+------
1           3    0.0000    0.0000   (--------*--------)
2           3    0.0000    0.0000   (--------*--------)
3           3    0.3333    0.2887               (--------*---------)
                                   ----------+---------+---------+------
Pooled StDev =   0.1667                    0.00      0.25      0.50
One-Way Analysis of Variance
Analysis of Variance for Summer06
Source     DF        SS        MS        F        P
C2          2     0.056     0.028     0.17    0.850
Error       6     1.000     0.167
Total       8     1.056
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  -+---------+---------+---------+-----
1           3    0.1667    0.2887   (-------------*--------------)
2           3    0.3333    0.2887       (-------------*--------------)
3           3    0.3333    0.5774       (-------------*--------------)
                                   -+---------+---------+---------+-----
Pooled StDev =   0.4082          -0.40     -0.00      0.40      0.80

One-Way Analysis of Variance

Analysis of Variance for Autumn06
Source     DF        SS        MS        F        P
C2          2    11.056     5.528     7.96    0.021
Error       6     4.167     0.694
Total       8    15.222
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  -----+---------+---------+---------+-
1           3    0.5000    0.5000  (-------*-------)
2           3    3.0000    0.8660                   (-------*-------)
3           3    0.8333    1.0408     (-------*------)
                                   -----+---------+---------+---------+-
Pooled StDev =   0.8333               0.0       1.5       3.0       4.5

Two Sample T-Test and Confidence Interval
Two sample T for T2 vs T3
    N      Mean     StDev   SE Mean
T2  3     0.500     0.500      0.29
T3  3     3.000     0.866      0.50
95% CI for mu T2 - mu T3: ( -4.10,  -0.90)
T-Test mu T2 = mu T3 (vs not =): T= -4.33  P=0.012  DF=  4
Both use Pooled StDev = 0.707
```

Table C5 Cont.

```
Two Sample T-Test and Confidence Interval

Two sample T for T2 vs T4
    N      Mean     StDev   SE Mean
T2  3     0.500     0.500      0.29
T4  3      0.83      1.04      0.60

95% CI for mu T2 - mu T4: ( -2.18,  1.52)
T-Test mu T2 = mu T4 (vs not =): T= -0.50  P=0.64  DF=  4
Both use Pooled StDev = 0.816


Two Sample T-Test and Confidence Interval


Two sample T for T3 vs T4
    N      Mean     StDev   SE Mean
T3  3     3.000     0.866      0.50
T4  3      0.83      1.04      0.60

95% CI for mu T3 - mu T4: ( -0.00,  4.34)
T-Test mu T3 = mu T4 (vs not =): T= 2.77  P=0.050  DF=  4
Both use Pooled StDev = 0.957


One-Way Analysis of Variance

Analysis of Variance for Winter 0
Source     DF        SS        MS        F        P
C2          2     0.389     0.194     0.21    0.815
Error       6     5.500     0.917
Total       8     5.889
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  --+---------+---------+---------+----
1           3    1.1667    0.2887  (-------------*------------)
2           3    1.3333    1.4434    (------------*-------------)
3           3    1.6667    0.7638       (-------------*------------)
                                   --+---------+---------+---------+----
Pooled StDev =   0.9574            0.0       1.0       2.0       3.0

One-Way Analysis of Variance

Analysis of Variance for Spring 0
Source     DF        SS        MS        F        P
C2          2     2.722     1.361     1.53    0.290
Error       6     5.333     0.889
Total       8     8.056
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  ---------+---------+---------+-------
1           3    1.5000    0.5000  (----------*-----------)
2           3    2.6667    1.1547            (----------*----------)
3           3    2.6667    1.0408            (----------*----------)
                                   ---------+---------+---------+-------
Pooled StDev =   0.9428                   1.2       2.4       3.6
```

Table C6 :One-Way Analysis of Variance between seasons for(total arthropod)

Analysis of Variance (Fenced)

```
Source     DF        SS        MS        F        P
Factor      4   3151534    787883    52.47    0.000
Error      10    150170     15017
Total      14   3301704
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  --+---------+---------+---------+----
Spring06    3     106.2      53.0   (--*--)
Summer06    3    1284.3     218.3                          (--*--)
Autumn 0    3     306.3     142.6       (--*--)
Winter 0    3      67.5      31.4  (--*---)
Spring 0    3     146.2      57.7    (--*--)
                                   --+---------+---------+---------+----
Pooled StDev =    122.5              0       500      1000      1500

Two Sample T-Test and Confidence Interval
```

Table C6 Cont.

```
Two sample T for Spring06 vs Summer06
         N      Mean     StDev   SE Mean
Spring06  3     106.2      53.0        31
Summer06  3      1284       218       126

95% CI for mu Spring06 - mu Summer06: ( -1538,  -818)
T-Test mu Spring06 = mu Summer06 (vs not =): T= -9.08  P=0.0008  DF=  4
Both use Pooled StDev =  159
```

Two Sample T-Test and Confidence Interval

```
Two sample T for Spring06 vs Autumn 06
         N      Mean     StDev   SE Mean
Spring06  3     106.2      53.0        31
Autumn 0  3       306       143        82

95% CI for mu Spring06 - mu Autumn 0: ( -444,  44)
T-Test mu Spring06 = mu Autumn 0 (vs not =): T= -2.28  P=0.085  DF=  4
Both use Pooled StDev =  108
```

Two Sample T-Test and Confidence Interval

```
Two sample T for Spring06 vs Winter 07
         N      Mean     StDev   SE Mean
Spring06  3     106.2      53.0        31
Winter 0  3      67.5      31.4        18

95% CI for mu Spring06 - mu Winter 0: ( -60,  137)
T-Test mu Spring06 = mu Winter 0 (vs not =): T= 1.09  P=0.34  DF=  4
Both use Pooled StDev = 43.5
```

Two Sample T-Test and Confidence Interval

```
Two sample T for Spring06 vs Spring 07
         N      Mean     StDev   SE Mean
Spring06  3     106.2      53.0        31
Spring 0  3     146.2      57.7        33

95% CI for mu Spring06 - mu Spring 0: ( -165,  86)
T-Test mu Spring06 = mu Spring 0 (vs not =): T= -0.88  P=0.43  DF=  4
Both use Pooled StDev = 55.4
```

Two Sample T-Test and Confidence Interval

```
Two sample T for Summer06 vs Autumn 06
         N      Mean     StDev   SE Mean
Summer06  3      1284       218       126
Autumn 0  3       306       143        82

95% CI for mu Summer06 - mu Autumn 0: ( 560,  1396)
T-Test mu Summer06 = mu Autumn 0 (vs not =): T= 6.50  P=0.0029  DF=  4
Both use Pooled StDev =  184
```

Two Sample T-Test and Confidence Interval

```
Two sample T for Summer06 vs Winter 07
         N      Mean     StDev   SE Mean
Summer06  3      1284       218       126
Winter 0  3      67.5      31.4        18

95% CI for mu Summer06 - mu Winter 0: ( 863,  1570)
T-Test mu Summer06 = mu Winter 0 (vs not =): T= 9.56  P=0.0007  DF=  4
Both use Pooled StDev =  156
```

Two Sample T-Test and Confidence Interval

Table C6 Cont.

```
Two sample T for Summer06 vs Spring 07          N      Mean     StDev   SE Mean
Summer06  3      1284       218       126
Spring 0  3     146.2      57.7        33

95% CI for mu Summer06 - mu Spring 0: ( 776,  1500)
T-Test mu Summer06 = mu Spring 0 (vs not =): T= 8.73  P=0.0009  DF=  4
Both use Pooled StDev =  160


Two Sample T-Test and Confidence Interval


Two sample T for Autumn 06 vs Winter 07
          N      Mean     StDev   SE Mean
Autumn 0  3       306       143        82
Winter 0  3      67.5      31.4        18

95% CI for mu Autumn 0 - mu Winter 0: ( 5,  473)
T-Test mu Autumn 0 = mu Winter 0 (vs not =): T= 2.83  P=0.047  DF=  4
Both use Pooled StDev =  103


Two Sample T-Test and Confidence Interval


Two sample T for Autumn 06 vs Spring 07
          N      Mean     StDev   SE Mean
Autumn 0  3       306       143        82
Spring 0  3     146.2      57.7        33

95% CI for mu Autumn 0 - mu Spring 0: ( -86,  407)
T-Test mu Autumn 0 = mu Spring 0 (vs not =): T= 1.80  P=0.15  DF=  4
Both use Pooled StDev =  109


Two Sample T-Test and Confidence Interval


Two sample T for Winter 07 vs Spring 07
          N      Mean     StDev   SE Mean
Winter 0  3      67.5      31.4        18
Spring 0  3     146.2      57.7        33

95% CI for mu Winter 0 - mu Spring 0: ( -184,  27)
T-Test mu Winter 0 = mu Spring 0 (vs not =): T= -2.08  P=0.11  DF=  4
Both use Pooled StDev = 46.4
```

One-Way Analysis of Variance(Grazed)

```
Analysis of Variance
Source     DF        SS        MS        F        P
Factor      4   3046679    761670     5.54    0.013
Error      10   1374741    137474
Total      14   4421420
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  --------+---------+---------+--------
Spring06    3      66.0      16.4   (-------*-------)
Summer06    3    1224.3     697.2                     (-------*-------)
Autumn 0    3     648.7     446.1             (-------*-------)
Winter 0    3      46.8       9.8   (-------*-------)
Spring 0    3     190.0      43.6     (-------*-------)
                                   --------+---------+---------+--------
Pooled StDev =    370.8                    0       600      1200

Two Sample T-Test and Confidence Interval


Two sample T for Spring06 vs Summer06
          N      Mean     StDev   SE Mean
Spring06  3      66.0      16.4       9.5
Summer06  3      1224       697       403

95% CI for mu Spring06 - mu Summer06: ( -2276.3,  -40)
T-Test mu Spring06 = mu Summer06 (vs not =): T= -2.88  P=0.045  DF=  4
Both use Pooled StDev =  493
```

Table C6 Cont.

```
Two Sample T-Test and Confidence Interval
Two sample T for Spring06 vs Autumn 06
          N      Mean     StDev   SE Mean
Spring06  3      66.0      16.4       9.5
Autumn 0  3       649       446       258

95% CI for mu Spring06 - mu Autumn 0: ( -1298.2,  133)
T-Test mu Spring06 = mu Autumn 0 (vs not =): T= -2.26  P=0.087  DF=  4
Both use Pooled StDev =  316


Two Sample T-Test and Confidence Interval


Two sample T for Spring06 vs Winter 07
          N      Mean     StDev   SE Mean
Spring06  3      66.0      16.4       9.5
Winter 0  3     46.83      9.83       5.7

95% CI for mu Spring06 - mu Winter 0: ( -11.4,  49.8)
T-Test mu Spring06 = mu Winter 0 (vs not =): T= 1.74  P=0.16  DF=  4
Both use Pooled StDev = 13.5


Two Sample T-Test and Confidence Interval


Two sample T for Spring06 vs Spring 07
          N      Mean     StDev   SE Mean
Spring06  3      66.0      16.4       9.5
Spring 0  3     190.0      43.6        25

95% CI for mu Spring06 - mu Spring 0: ( -198.6,  -49)
T-Test mu Spring06 = mu Spring 0 (vs not =): T= -4.61  P=0.0099  DF=  4
Both use Pooled StDev = 32.9


Two Sample T-Test and Confidence Interval


Two sample T for Summer06 vs Autumn 06
          N      Mean     StDev   SE Mean
Summer06  3      1224       697       403
Autumn 0  3       649       446       258

95% CI for mu Summer06 - mu Autumn 0: ( -751,  1902)
T-Test mu Summer06 = mu Autumn 0 (vs not =): T= 1.20  P=0.29  DF=  4
Both use Pooled StDev =  585


Two Sample T-Test and Confidence Interval


Two sample T for Summer06 vs Winter 07
          N      Mean     StDev   SE Mean
Summer06  3      1224       697       403
Winter 0  3     46.83      9.83       5.7

95% CI for mu Summer06 - mu Winter 0: ( 60,  2295.3)
T-Test mu Summer06 = mu Winter 0 (vs not =): T= 2.92  P=0.043  DF=  4
Both use Pooled StDev =  493


Two Sample T-Test and Confidence Interval


Two sample T for Summer06 vs Spring 07
          N      Mean     StDev   SE Mean
Summer06  3      1224       697       403
Spring 0  3     190.0      43.6        25

95% CI for mu Summer06 - mu Spring 0: ( -85,  2154)
T-Test mu Summer06 = mu Spring 0 (vs not =): T= 2.56  P=0.062  DF=  4
Both use Pooled StDev =  494


Two Sample T-Test and Confidence Interval
```

Table C6 Cont.

```
Two sample T for Autumn 06 vs Winter 07
         N      Mean     StDev   SE Mean
Autumn 0  3       649       446       258
Winter 0  3     46.83      9.83       5.7

95% CI for mu Autumn 0 - mu Winter 0: ( -113,  1317.1)
T-Test mu Autumn 0 = mu Winter 0 (vs not =): T= 2.34  P=0.080  DF=  4
Both use Pooled StDev =  316


Two Sample T-Test and Confidence Interval


Two sample T for Autumn 06 vs Spring 07
         N      Mean     StDev   SE Mean
Autumn 0  3       649       446       258
Spring 0  3     190.0      43.6        25

95% CI for mu Autumn 0 - mu Spring 0: ( -260,  1177)
T-Test mu Autumn 0 = mu Spring 0 (vs not =): T= 1.77  P=0.15  DF=  4
Both use Pooled StDev =  317


Two Sample T-Test and Confidence Interval


Two sample T for Winter 07 vs Spring 07
         N      Mean     StDev   SE Mean
Winter 0  3     46.83      9.83       5.7
Spring 0  3     190.0      43.6        25

95% CI for mu Winter 0 - mu Spring 0: ( -214.8,  -72)
T-Test mu Winter 0 = mu Spring 0 (vs not =): T= -5.55  P=0.0052  DF=  4
Both use Pooled StDev = 31.6
```

One-Way Analysis of Variance (Natural)

```
Analysis of Variance
Source     DF        SS        MS        F        P
Factor      4   4393273   1098318    20.66    0.000
Error      10    531551     53155
Total      14   4924824
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  ----+---------+---------+---------+--
Spring06    3     122.3      50.4   (----*----)
Summer06    3    1542.3     506.2                        (----*----)
Autumn 0    3     464.7      49.9         (----*----)
Winter 0    3     106.7      50.5   (----*----)
Spring 0    3     217.5      44.8     (----*----)
                                   ----+---------+---------+---------+--
Pooled StDev =    230.6                0       600      1200      1800

Two Sample T-Test and Confidence Interval


Two sample T for Spring06 vs Summer06
         N      Mean     StDev   SE Mean
Spring06  3     122.3      50.4        29
Summer06  3      1542       506       292

95% CI for mu Spring06 - mu Summer06: ( -2235,  -605)
T-Test mu Spring06 = mu Summer06 (vs not =): T= -4.84  P=0.0084  DF=  4
Both use Pooled StDev =  360


Two Sample T-Test and Confidence Interval


Two sample T for Spring06 vs Autumn 06
         N      Mean     StDev   SE Mean
Spring06  3     122.3      50.4        29
Autumn 0  3     464.7      49.9        29

95% CI for mu Spring06 - mu Autumn 0: ( -456,  -229)
T-Test mu Spring06 = mu Autumn 0 (vs not =): T= -8.37  P=0.0011  DF=  4
Both use Pooled StDev = 50.1
```

Table C6 Cont.

```
Two Sample T-Test and Confidence Interval


Two sample T for Spring06 vs Winter 07
          N      Mean     StDev   SE Mean
Spring06  3     122.3      50.4        29
Winter 0  3     106.7      50.5        29

95% CI for mu Spring06 - mu Winter 0: ( -99,  130)
T-Test mu Spring06 = mu Winter 0 (vs not =): T= 0.38  P=0.72  DF=  4
Both use Pooled StDev = 50.4


Two Sample T-Test and Confidence Interval


Two sample T for Spring06 vs Spring 07
          N      Mean     StDev   SE Mean
Spring06  3     122.3      50.4        29
Spring 0  3     217.5      44.8        26

95% CI for mu Spring06 - mu Spring 0: ( -203,  13)
T-Test mu Spring06 = mu Spring 0 (vs not =): T= -2.45  P=0.071  DF=  4
Both use Pooled StDev = 47.7


Two Sample T-Test and Confidence Interval


Two sample T for Summer06 vs Autumn 06
          N      Mean     StDev   SE Mean
Summer06  3      1542       506       292
Autumn 0  3     464.7      49.9        29

95% CI for mu Summer06 - mu Autumn 0: ( 262,  1893)
T-Test mu Summer06 = mu Autumn 0 (vs not =): T= 3.67  P=0.021  DF=  4
Both use Pooled StDev =  360


Two Sample T-Test and Confidence Interval


Two sample T for Summer06 vs Winter 07
          N      Mean     StDev   SE Mean
Summer06  3      1542       506       292
Winter 0  3     106.7      50.5        29

95% CI for mu Summer06 - mu Winter 0: ( 620,  2251)
T-Test mu Summer06 = mu Winter 0 (vs not =): T= 4.89  P=0.0081  DF=  4
Both use Pooled StDev =  360


Two Sample T-Test and Confidence Interval


Two sample T for Summer06 vs Spring 07
          N      Mean     StDev   SE Mean
Summer06  3      1542       506       292
Spring 0  3     217.5      44.8        26

95% CI for mu Summer06 - mu Spring 0: ( 510,  2139)
T-Test mu Summer06 = mu Spring 0 (vs not =): T= 4.52  P=0.011  DF=  4
Both use Pooled StDev =  359

Two Sample T-Test and Confidence Interval


Two sample T for Autumn 06 vs Winter 07
          N      Mean     StDev   SE Mean
Autumn 0  3     464.7      49.9        29
Winter 0  3     106.7      50.5        29

95% CI for mu Autumn 0 - mu Winter 0: ( 244,  472)
T-Test mu Autumn 0 = mu Winter 0 (vs not =): T= 8.74  P=0.0009  DF=  4
Both use Pooled StDev = 50.2


Two Sample T-Test and Confidence Interval
```

Table C6 Cont.

Two sample T for Autumn 06 vs Spring 07

	N	Mean	StDev	SE Mean
Autumn 0	3	464.7	49.9	29
Spring 0	3	217.5	44.8	26

95% CI for mu Autumn 0 - mu Spring 0: (140, 355)
T-Test mu Autumn 0 = mu Spring 0 (vs not =): T= 6.39 P=0.0031 DF= 4
Both use Pooled StDev = 47.4

Two Sample T-Test and Confidence Interval

Two sample T for Winter 07 vs Spring 07

	N	Mean	StDev	SE Mean
Winter 0	3	106.7	50.5	29
Spring 0	3	217.5	44.8	26

95% CI for mu Winter 0 - mu Spring 0: (-219, -3)
T-Test mu Winter 0 = mu Spring 0 (vs not =): T= -2.84 P=0.047 DF= 4
Both use Pooled StDev = 47.7

One-Way Analysis of Variance between three sites on each season

Analysis of Variance for **Spring06**

Source	DF	SS	MS	F	P
C2	2	5051	2525	1.35	0.328
Error	6	11217	1869		
Total	8	16268			

```
                                    Individual 95% CIs For Mean
                                    Based on Pooled StDev
Level       N      Mean     StDev   ----------+---------+---------+------
1           3    106.22     52.95            (-----------*-----------)
2           3     66.00     16.37    (-----------*-----------)
3           3    122.33     50.36               (-----------*------------)
                                    ----------+---------+---------+------
Pooled StDev =    43.24                      50       100       150
```

One-Way Analysis of Variance

Analysis of Variance for **Summer 0**

Source	DF	SS	MS	F	P
C2	2	171288	85644	0.33	0.734
Error	6	1579910	263318		
Total	8	1751198			

```
                                    Individual 95% CIs For Mean
                                    Based on Pooled StDev
Level       N      Mean     StDev   -+---------+---------+---------+-----
1           3    1284.3     218.3     (--------------*-------------)
2           3    1224.3     697.2    (-------------*-------------)
3           3    1542.3     506.2          (--------------*-------------)
                                    -+---------+---------+---------+-----
Pooled StDev =    513.1            500      1000      1500      2000
```

One-Way Analysis of Variance

Analysis of Variance for **Autumn 0**

Source	DF	SS	MS	F	P
C2	2	176118	88059	1.19	0.367
Error	6	443610	73935		
Total	8	619728			

```
                                    Individual 95% CIs For Mean
                                    Based on Pooled StDev
Level       N      Mean     StDev   ---+---------+---------+---------+---
1           3     306.3     142.6    (----------*----------)
2           3     648.7     446.1              (----------*----------)
3           3     464.7      49.9        (----------*----------)
                                    ---+---------+---------+---------+---
Pooled StDev =    271.9                0       350       700      1050
```

Table C6 Cont.

```
One-Way Analysis of Varian
Analysis of Variance for Winter 0
Source     DF        SS        MS        F        P
C2          2      5541      2771     2.29    0.182
Error       6      7260      1210
Total       8     12801
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  -+---------+---------+---------+-----
1           3     67.50     31.40       (---------*--------)
2           3     46.83      9.83   (--------*---------)
3           3    106.67     50.47               (--------*---------)
                                   -+---------+---------+---------+-----
Pooled StDev =    34.78             0        50       100       150
One-Way Analysis of Variance
Analysis of Variance for Spring 0
Source     DF        SS        MS        F        P
C2          2      7766      3883     1.61    0.275
Error       6     14466      2411
Total       8     22232
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  --------+---------+---------+--------
1           3    146.17     57.67   (----------*-----------)
2           3    190.00     43.59          (-----------*----------)
3           3    217.50     44.80               (----------*-----------)
                                   --------+---------+---------+--------
Pooled StDev =    49.10                   120       180       240
```

One-Way Analysis of Varianceof total insects on fenced

```
Analysis of Variance
Source     DF        SS        MS        F        P
Factor      4   1055151    263788     3.11    0.026
Error      40   3394101     84853
Total      44   4449252
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  --------+---------+---------+--------
Sp 06       9      33.8      36.4   (-------*-------)
Su 06       9     425.9     635.7                   (-------*-------)
Au 06       9      99.7     129.6      (-------*-------)
Wn 07       9      20.3      28.0   (-------*-------)
Sp 07       9      42.6      35.8    (-------*-------)
                                   --------+---------+---------+--------
Pooled StDev =    291.3                     0       250       500
```

One-Way Analysis of Varianceof total insect on the grazing

```
Analysis of Variance
Source     DF        SS        MS        F        P
Factor      4   1025118    256279     2.13    0.095
Error      40   4823026    120576
Total      44   5848144
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  ---------+---------+---------+-------
Sp 06       9      19.4      20.5  (---------*--------)
Su 06       9     406.6     680.7                 (--------*---------)
Au 06       9     212.7     368.2          (---------*--------)
Wn 07       9      12.8       9.0  (---------*--------)
Sp 07       9      57.4      58.8    (--------*---------)
                                   ---------+---------+---------+-------
Pooled StDev =    347.2                      0       250       500
```

One-Way Analysis of Variance of total insects of the natural graass land

```
Analysis of Variance
Source     DF        SS        MS        F        P
Factor      4   1484342    371085     2.64    0.048
Error      40   5629133    140728
Total      44   7113474
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  --------+---------+---------+--------
Sp 06       9      38.4      51.7   (-------*--------)
Su 06       9     513.3     809.3                   (-------*--------)
Au 06       9     152.8     195.9       (-------*--------)
Wn 07       9      31.3      43.3   (-------*-------)
Sp 07       9      66.7      76.2    (-------*--------)
                                   --------+---------+---------+--------
Pooled StDev =    375.1                     0       300       600
Saving worksheet in file: C:\Documents and Settings\M.s\Desktop\MTBWIN\vvvvv.MTW
```

Table C6 Cont.
Analysis of abundance between three sites

```
ne-Way Analysis of Variance coleoptera

Analysis of Variance
Source     DF        SS        MS        F        P
Factor      2      9.73      4.87     0.70    0.516
Error      12     83.60      6.97
Total      14     93.33
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  --------+---------+---------+--------
fenced      5     9.000     2.449  (------------*------------)
under gr    5     9.200     2.588   (------------*------------)
grass la    5    10.800     2.864          (------------*------------)
                                   --------+---------+---------+--------
Pooled StDev =    2.639                  8.0      10.0      12.0

One-Way Analysis of Variance hymenoptera

Analysis of Variance
Source     DF        SS        MS        F        P
Factor      2     30423     15211     0.05    0.953
Error      12   3740082    311673
Total      14   3770504
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  -------+---------+---------+---------
fenced      5     328.6     529.4   (---------------*---------------)
under gr    5     376.4     520.9    (---------------*---------------)
grass la    5     438.6     619.2      (---------------*---------------)
                                   -------+---------+---------+---------
Pooled StDev =    558.3                   0       350       700

One-Way Analysis of Variance other insecta

Analysis of Variance
Source     DF        SS        MS        F        P
Factor      2       144        72     0.07    0.932
Error      12     12168      1014
Total      14     12312
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  ----------+---------+---------+------
fenced      5     36.20     19.56     (---------------*---------------)
under gr    5     40.00     44.51      (---------------*---------------)
grass la    5     32.40     26.03   (---------------*---------------)
                                   ----------+---------+---------+------
Pooled StDev =    31.84                     20        40        60
Saving worksheet in file: C:\Documents and Settings\M.s\Desktop\MTBWIN\eeee.MTW

One-Way Analysis of Variance areaneae (spiders)

Analysis of Variance
Source     DF        SS        MS        F        P
Factor      2       0.1       0.1     0.00    0.997
Error      12     280.8      23.4
Total      14     280.9
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  ----------+---------+---------+------
C1          5     8.000     5.099   (---------------*--------------)
C2          5     8.200     4.324    (---------------*---------------)
C3          5     8.000     5.050   (---------------*--------------)
                                   ----------+---------+---------+------
Pooled StDev =    4.837                    6.0       9.0      12.0

One-Way Analysis of Variance of other arthropods

Analysis of Variance
Source     DF        SS        MS        F        P
Factor      2      0.93      0.47     0.30    0.748
Error      12     18.80      1.57
Total      14     19.73
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  -----+---------+---------+---------+-
fenced      5     0.800     0.837   (-----------*-----------)
under gr    5     1.400     1.517         (-----------*-----------)
grass la    5     1.200     1.304       (-----------*-----------)
                                   -----+---------+---------+---------+-
Pooled StDev =    1.252               0.0       1.0       2.0       3.0
```

Table C6 Cont.

```
One-Way Analysis of Variance 9total insects0

Analysis of Variance
Source     DF        SS        MS        F        P
Factor      2     29283     14641     0.05    0.952
Error      12   3564691    297058
Total      14   3593974
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  -----+---------+---------+---------+-
Fenced (    5     373.4     513.6  (---------------*--------------)
Grazed (    5     425.4     506.2    (--------------*--------------)
Natural     5     481.6     609.2      (--------------*--------------)
                                   -----+---------+---------+---------+-
Pooled StDev =    545.0                 0       350       700      1050
```

One-Way Analysis of Variance Total arthropods

```
Analysis of Variance
Source     DF        SS        MS        F        P
Factor      2     29598     14799     0.05    0.951
Error      12   3528318    294026
Total      14   3557916
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  -----+---------+---------+---------+-
Fenced      5     382.0     512.3   (--------------*--------------)
Grazed      5     435.2     503.7    (--------------*---------------)
natural     5     490.8     604.9      (--------------*--------------)
                                   -----+---------+---------+---------+-
Pooled StDev =    542.2                 0       350       700      1050
```

Table C7 : Regression Analysis fenced area

```
Regression Analysis

The regression equation is
coleop = 11.2 - 0.0353 rain

Predictor       Coef       StDev          T        P
Constant      11.159       1.189       9.39    0.003
rain        -0.03528     0.01505      -2.34    0.101

S = 1.681       R-Sq = 64.7%     R-Sq(adj) = 52.9%

Analysis of Variance

Source       DF          SS          MS         F        P
Regression    1      15.524      15.524      5.49    0.101
Error         3       8.476       2.825
Total         4      24.000

Regression Analysis


The regression equation is
hymeno = 681 - 5.75 rain

Predictor       Coef       StDev          T        P
Constant       680.6       343.7       1.98    0.142
rain          -5.751       4.351      -1.32    0.278

S = 485.9       R-Sq = 36.8%     R-Sq(adj) = 15.7%

Analysis of Variance

Source       DF          SS          MS         F        P
Regression    1      412494      412494      1.75    0.278
Error         3      708359      236120
Total         4     1120853
```

Table C7 cont.

Regression Analysis

The regression equation is
other insect = 28.7 + 0.123 rain

Predictor	Coef	StDev	T	P
Constant	28.70	14.97	1.92	0.151
rain	0.1225	0.1895	0.65	0.564

S = 21.16 R-Sq = 12.2% R-Sq(adj) = 0.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	187.2	187.2	0.42	0.564
Error	3	1343.6	447.9		
Total	4	1530.8			

Regression Analysis

The regression equation is
other arthropod = 1.08 - 0.00455 rain

Predictor	Coef	StDev	T	P
Constant	1.0787	0.6510	1.66	0.196
rain	-0.004555	0.008242	-0.55	0.619

S = 0.9204 R-Sq = 9.2% R-Sq(adj) = 0.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	0.2587	0.2587	0.31	0.619
Error	3	2.5413	0.8471		
Total	4	2.8000			

Regression Analysis

The regression equation is
araneae = 11.5 - 0.0565 rain

Predictor	Coef	StDev	T	P
Constant	11.455	3.274	3.50	0.040
rain	-0.05645	0.04144	-1.36	0.266

S = 4.628 R-Sq = 38.2% R-Sq(adj) = 17.6%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	39.74	39.74	1.86	0.266
Error	3	64.26	21.42		
Total	4	104.00			

Regression Analysis

The regression equation is
coleop = 3.91 + 0.252 temp

Predictor	Coef	StDev	T	P
Constant	3.908	4.236	0.92	0.424
temp	0.2520	0.2034	1.24	0.303

S = 2.300 R-Sq = 33.9% R-Sq(adj) = 11.8%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	8.124	8.124	1.54	0.303
Error	3	15.876	5.292		
Total	4	24.000			

Table C7 cont.

Regression Analysis

The regression equation is
hymeno = - 1207 + 76.0 temp

Predictor	Coef	StDev	T	P
Constant	-1207.1	657.0	-1.84	0.163
temp	76.00	31.54	2.41	0.095

S = 356.8 R-Sq = 65.9% R-Sq(adj) = 54.6%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	739004	739004	5.81	0.095
Error	3	381849	127283		
Total	4	1120853			

Regression Analysis

The regression equation is
other insect = 78.7 - 2.10 temp

Predictor	Coef	StDev	T	P
Constant	78.65	33.04	2.38	0.098
temp	-2.101	1.586	-1.32	0.277

S = 17.94 R-Sq = 36.9% R-Sq(adj) = 15.9%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	564.8	564.8	1.75	0.277
Error	3	966.0	322.0		
Total	4	1530.8			

Regression Analysis

The regression equation is
other arthropod = 1.97 - 0.0580 temp

Predictor	Coef	StDev	T	P
Constant	1.972	1.636	1.21	0.314
temp	-0.05803	0.07857	-0.74	0.514

S = 0.8887 R-Sq = 15.4% R-Sq(adj) = 0.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	0.4308	0.4308	0.55	0.514
Error	3	2.3692	0.7897		
Total	4	2.8000			

Table C7 Cont.

Regression Analysis

The regression equation is
araneae = 8.5 - 0.025 temp

Predictor	Coef	StDev	T	P
Constant	8.50	10.84	0.78	0.490
temp	-0.0249	0.5203	-0.05	0.965

S = 5.886   R-Sq = 0.1%   R-Sq(adj) = 0.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	0.08	0.08	0.00	0.965
Error	3	103.92	34.64		
Total	4	104.00			

Regression Analysis

The regression equation is
coleop = 8.41 + 0.079 moisture

Predictor	Coef	StDev	T	P
Constant	8.411	2.420	3.48	0.040
moisture	0.0788	0.2776	0.28	0.795

S = 2.791   R-Sq = 2.6%   R-Sq(adj) = 0.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	0.628	0.628	0.08	0.795
Error	3	23.372	7.791		
Total	4	24.000			

Regression Analysis

The regression equation is
hymeno = 738 - 54.8 moisture

Predictor	Coef	StDev	T	P
Constant	737.8	452.5	1.63	0.201
moisture	-54.79	51.90	-1.06	0.369

S = 521.9   R-Sq = 27.1%   R-Sq(adj) = 2.8%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	303582	303582	1.11	0.369
Error	3	817271	272424		
Total	4	1120853			

Regression Analysis

The regression equation is
other insect = 30.7 + 0.74 moisture

Predictor	Coef	StDev	T	P
Constant	30.67	19.23	1.60	0.209
moisture	0.740	2.205	0.34	0.759

S = 22.18   R-Sq = 3.6%   R-Sq(adj) = 0.0%

Table C7 Cont.

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	55.4	55.4	0.11	0.759
Error	3	1475.4	491.8		
Total	4	1530.8			

Regression Analysis

The regression equation is
other arthropod = 0.375 + 0.0569 moisture

Predictor	Coef	StDev	T	P
Constant	0.3747	0.7870	0.48	0.666
moisture	0.05694	0.09027	0.63	0.573

S = 0.9078 R-Sq = 11.7% R-Sq(adj) = 0.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	0.3279	0.3279	0.40	0.573
Error	3	2.4721	0.8240		
Total	4	2.8000			

Regression Analysis

The regression equation is
araneae = 3.44 + 0.611 moisture

Predictor	Coef	StDev	T	P
Constant	3.435	4.073	0.84	0.461
moisture	0.6113	0.4672	1.31	0.282

S = 4.698 R-Sq = 36.3% R-Sq(adj) = 15.1%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	37.78	37.78	1.71	0.282
Error	3	66.22	22.07		
Total	4	104.00			

under grazing

Regression Analysis

The regression equation is
coleop = 10.2 - 0.0160 rain

Predictor	Coef	StDev	T	P
Constant	10.178	1.985	5.13	0.014
rain	-0.01597	0.02513	-0.64	0.570

S = 2.806 R-Sq = 11.9% R-Sq(adj) = 0.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	3.182	3.182	0.40	0.570
Error	3	23.618	7.873		
Total	4	26.800			

Table C7 Cont.

Regression Analysis

The regression equation is
hymeno = 672 - 4.83 rain

Predictor	Coef	StDev	T	P
Constant	672.2	363.9	1.85	0.162
rain	-4.833	4.607	-1.05	0.371

S = 514.5   R-Sq = 26.8%   R-Sq(adj) = 2.5%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	291301	291301	1.10	0.371
Error	3	794068	264689		
Total	4	1085369			

Regression Analysis

The regression equation is
other insect = 65.8 - 0.422 rain

Predictor	Coef	StDev	T	P
Constant	65.80	30.86	2.13	0.123
rain	-0.4215	0.3907	-1.08	0.360

S = 43.63   R-Sq = 28.0%   R-Sq(adj) = 3.9%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	2216	2216	1.16	0.360
Error	3	5710	1903		
Total	4	7926			

Regression Analysis

The regression equation is
other arthropod = 1.75 - 0.0056 rain

Predictor	Coef	StDev	T	P
Constant	1.745	1.212	1.44	0.245
rain	-0.00565	0.01534	-0.37	0.737

S = 1.713   R-Sq = 4.3%   R-Sq(adj) = 0.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	0.397	0.397	0.14	0.737
Error	3	8.803	2.934		
Total	4	9.200			

Regression Analysis

The regression equation is
araneae = 8.84 - 0.0104 rain

Predictor	Coef	StDev	T	P
Constant	8.839	3.500	2.53	0.086
rain	-0.01044	0.04431	-0.24	0.829

S = 4.948   R-Sq = 1.8%   R-Sq(adj) = 0.0%

Table C7 Cont.

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	1.36	1.36	0.06	0.829
Error	3	73.44	24.48		
Total	4	74.80			

Regression Analysis

The regression equation is
coleop = 8.34 + 0.043 temp

Predictor	Coef	StDev	T	P
Constant	8.335	5.480	1.52	0.226
temp	0.0428	0.2631	0.16	0.881

S = 2.976   R-Sq = 0.9%   R-Sq(adj) = 0.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	0.234	0.234	0.03	0.881
Error	3	26.566	8.855		
Total	4	26.800			

Regression Analysis

The regression equation is
hymeno = - 1279 + 82.0 temp

Predictor	Coef	StDev	T	P
Constant	-1279.5	505.6	-2.53	0.085
temp	81.95	24.27	3.38	0.043

S = 274.5   R-Sq = 79.2%   R-Sq(adj) = 72.2%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	859256	859256	11.40	0.043
Error	3	226113	75371		
Total	4	1085369			

Regression Analysis

The regression equation is
other insect = 67.8 - 1.37 temp

Predictor	Coef	StDev	T	P
Constant	67.75	93.20	0.73	0.520
temp	-1.373	4.474	-0.31	0.779

S = 50.61   R-Sq = 3.0%   R-Sq(adj) = 0.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	241	241	0.09	0.779
Error	3	7685	2562		
Total	4	7926			

Regression Analysis

Table C7 Cont.

The regression equation is
other arthropod = 1.79 - 0.019 temp

Predictor	Coef	StDev	T	P
Constant	1.786	3.217	0.56	0.618
temp	-0.0191	0.1544	-0.12	0.909

S = 1.747 R-Sq = 0.5% R-Sq(adj) = 0.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	0.047	0.047	0.02	0.909
Error	3	9.153	3.051		
Total	4	9.200			

Regression Analysis

The regression equation is
araneae = 14.3 - 0.301 temp

Predictor	Coef	StDev	T	P
Constant	14.281	8.453	1.69	0.190
temp	-0.3010	0.4058	-0.74	0.512

S = 4.590 R-Sq = 15.5% R-Sq(adj) = 0.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	11.59	11.59	0.55	0.512
Error	3	63.21	21.07		
Total	4	74.80			

Regression Analysis

The regression equation is
coleop = 11.5 - 0.384 moisture

Predictor	Coef	StDev	T	P
Constant	11.534	1.812	6.37	0.008
moisture	-0.3839	0.2487	-1.54	0.220

S = 2.231 R-Sq = 44.3% R-Sq(adj) = 25.7%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	11.863	11.863	2.38	0.220
Error	3	14.937	4.979		
Total	4	26.800			

Regression Analysis

The regression equation is
coleop = 11.5 - 0.384 moisture

Predictor	Coef	StDev	T	P
Constant	11.534	1.812	6.37	0.008
moisture	-0.3839	0.2487	-1.54	0.220

S = 2.231 R-Sq = 44.3% R-Sq(adj) = 25.7%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	11.863	11.863	2.38	0.220
Error	3	14.937	4.979		
Total	4	26.800			

Table C7 Cont.

Regression Analysis

The regression equation is
hymeno = 807 - 70.9 moisture

Predictor	Coef	StDev	T	P
Constant	807.2	386.9	2.09	0.128
moisture	-70.85	53.11	-1.33	0.274

S = 476.5 R-Sq = 37.2% R-Sq(adj) = 16.3%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	404184	404184	1.78	0.274
Error	3	681185	227062		
Total	4	1085369			

Regression Analysis

The regression equation is
other insect = 8.7 + 5.14 moisture

Predictor	Coef	StDev	T	P
Constant	8.74	35.69	0.24	0.822
moisture	5.142	4.899	1.05	0.371

S = 43.96 R-Sq = 26.9% R-Sq(adj) = 2.5%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	2128	2128	1.10	0.371
Error	3	5798	1933		
Total	4	7926			

Regression Analysis

The regression equation is
other arthropod = 1.49 - 0.015 moisture

Predictor	Coef	StDev	T	P
Constant	1.489	1.420	1.05	0.371
moisture	-0.0147	0.1950	-0.08	0.945

S = 1.750 R-Sq = 0.2% R-Sq(adj) = 0.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	0.017	0.017	0.01	0.945
Error	3	9.183	3.061		
Total	4	9.200			

Regression Analysis

The regression equation is
araneae = 4.43 + 0.620 moisture

Predictor	Coef	StDev	T	P
Constant	4.428	3.103	1.43	0.249
moisture	0.6204	0.4259	1.46	0.241

S = 3.822 R-Sq = 41.4% R-Sq(adj) = 21.9%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	30.98	30.98	2.12	0.241
Error	3	43.82	14.61		
Total	4	74.80			

Table C7 cont.

Natural grass land

Regression Analysis

The regression equation is
coleop = 11.2 - 0.0069 rain

Predictor	Coef	StDev	T	P
Constant	11.221	2.318	4.84	0.017
rain	-0.00688	0.02934	-0.23	0.830

S = 3.277 R-Sq = 1.8% R-Sq(adj) = 0.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	0.59	0.59	0.05	0.830
Error	3	32.21	10.74		
Total	4	32.80			

Regression Analysis

The regression equation is
hymeno = 864 - 6.96 rain

Predictor	Coef	StDev	T	P
Constant	864.5	393.8	2.20	0.116
rain	-6.959	4.986	-1.40	0.257

S = 556.8 R-Sq = 39.4% R-Sq(adj) = 19.2%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	603867	603867	1.95	0.257
Error	3	929993	309998		
Total	4	1533859			

Regression Analysis

The regression equation is
other insect = 24.5 + 0.128 rain

Predictor	Coef	StDev	T	P
Constant	24.54	20.44	1.20	0.316
rain	0.1284	0.2588	0.50	0.654

S = 28.90 R-Sq = 7.6% R-Sq(adj) = 0.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	205.7	205.7	0.25	0.654
Error	3	2505.5	835.2		
Total	4	2711.2			

Regression Analysis

Table C7 Cont.

The regression equation is
other arthropod = 1.58 - 0.0063 rain

Predictor	Coef	StDev	T	P
Constant	1.584	1.026	1.54	0.220
rain	-0.00627	0.01299	-0.48	0.662

S = 1.450 R-Sq = 7.2% R-Sq(adj) = 0.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	0.490	0.490	0.23	0.662
Error	3	6.310	2.103		
Total	4	6.800			

Regression Analysis

The regression equation is
araneae = 8.45 - 0.0073 rain

Predictor	Coef	StDev	T	P
Constant	8.447	4.111	2.05	0.132
rain	-0.00730	0.05204	-0.14	0.897

S = 5.812 R-Sq = 0.7% R-Sq(adj) = 0.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	0.66	0.66	0.02	0.897
Error	3	101.34	33.78		
Total	4	102.00			

Regression Analysis

The regression equation is
coleop = 1.61 + 0.455 temp

Predictor	Coef	StDev	T	P
Constant	1.608	2.673	0.60	0.590
temp	0.4549	0.1283	3.55	0.038

S = 1.451 R-Sq = 80.7% R-Sq(adj) = 74.3%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	26.480	26.480	12.57	0.038
Error	3	6.320	2.107		
Total	4	32.800			

Regression Analysis

The regression equation is
hymeno = - 1442 + 93.1 temp

Predictor	Coef	StDev	T	P
Constant	-1442.3	693.3	-2.08	0.129
temp	93.09	33.28	2.80	0.068

S = 376.5 R-Sq = 72.3% R-Sq(adj) = 63.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	1108683	1108683	7.82	0.068
Error	3	425176	141725		
Total	4	1533859			

Table C7 Cont.

Regression Analysis

The regression equation is
other insect = 101 - 3.38 temp

Predictor	Coef	StDev	T	P
Constant	100.68	37.59	2.68	0.075
temp	-3.379	1.805	-1.87	0.158

S = 20.41 R-Sq = 53.9% R-Sq(adj) = 38.5%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	1461.2	1461.2	3.51	0.158
Error	3	1250.0	416.7		
Total	4	2711.2			

Regression Analysis

The regression equation is
other arthropod = 3.83 - 0.130 temp

Predictor	Coef	StDev	T	P
Constant	3.827	2.289	1.67	0.193
temp	-0.1300	0.1099	-1.18	0.322

S = 1.243 R-Sq = 31.8% R-Sq(adj) = 9.1%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	2.163	2.163	1.40	0.322
Error	3	4.637	1.546		
Total	4	6.800			

Regression Analysis

The regression equation is
araneae = 20.8 - 0.632 temp

Predictor	Coef	StDev	T	P
Constant	20.770	7.585	2.74	0.071
temp	-0.6320	0.3641	-1.74	0.181

S = 4.119 R-Sq = 50.1% R-Sq(adj) = 33.5%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	51.10	51.10	3.01	0.181
Error	3	50.90	16.97		
Total	4	102.00			

Regression Analysis

The regression equation is
coleop = 12.4 - 0.241 moisture

Predictor	Coef	StDev	T	P
Constant	12.416	2.387	5.20	0.014
moisture	-0.2413	0.2951	-0.82	0.473

S = 2.990 R-Sq = 18.2% R-Sq(adj) = 0.0%

Table C7 Cont.

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	5.978	5.978	0.67	0.473
Error	3	26.822	8.941		
Total	4	32.800			

Regression Analysis

The regression equation is
hymeno = 904 - 69.5 moisture

Predictor	Coef	StDev	T	P
Constant	904.4	469.4	1.93	0.150
moisture	-69.55	58.04	-1.20	0.317

S = 588.0   R-Sq = 32.4%   R-Sq(adj) = 9.8%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	496453	496453	1.44	0.317
Error	3	1037406	345802		
Total	4	1533859			

Regression Analysis

The regression equation is
other insect = 42.4 - 1.50 moisture

Predictor	Coef	StDev	T	P
Constant	42.44	22.95	1.85	0.162
moisture	-1.499	2.838	-0.53	0.634

S = 28.76   R-Sq = 8.5%   R-Sq(adj) = 0.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	230.6	230.6	0.28	0.634
Error	3	2480.6	826.9		
Total	4	2711.2			

Regression Analysis

The regression equation is
other arthropod = 0.99 + 0.031 moisture

Predictor	Coef	StDev	T	P
Constant	0.992	1.193	0.83	0.467
moisture	0.0310	0.1475	0.21	0.847

S = 1.495   R-Sq = 1.5%   R-Sq(adj) = 0.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	0.099	0.099	0.04	0.847
Error	3	6.701	2.234		
Total	4	6.800			

Table C7 Cont.

Regression Analysis

The regression equation is
araneae = 5.24 + 0.412 moisture

Predictor	Coef	StDev	T	P
Constant	5.240	4.238	1.24	0.304
moisture	0.4120	0.5241	0.79	0.489

S = 5.310   R-Sq = 17.1%   R-Sq(adj) = 0.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	17.42	17.42	0.62	0.489
Error	3	84.58	28.19		
Total	4	102.00			

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Regression Analysis

Regression Analysis natural land (temp)

The regression equation is
total arth = - 1316 + 89.4 Mean monthly temp C

Predictor	Coef	StDev	T	P
Constant	-1315.8	706.2	-1.86	0.159
Mean mon	89.40	33.90	2.64	0.078

S = 383.5   R-Sq = 69.9%   R-Sq(adj) = 59.8%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	1022504	1022504	6.95	0.078
Error	3	441212	147071		
Total	4	1463717			

Regression Analysis

The regression equation is
total insect = - 1340 + 90.2 Mean monthly temp C

Predictor	Coef	StDev	T	P
Constant	-1340.0	708.9	-1.89	0.155
Mean mon	90.15	34.03	2.65	0.077

S = 384.9   R-Sq = 70.1%   R-Sq(adj) = 60.1%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	1039823	1039823	7.02	0.077
Error	3	444526	148175		
Total	4	1484349			

Table C7 cont.

Regression Analysis grazing land (temp)

The regression equation is
total arth = - 1189 + 80.4 Mean monthly temp C

Predictor	Coef	StDev	T	P
Constant	-1189.0	461.5	-2.58	0.082
Mean mon	80.37	22.16	3.63	0.036

S = 250.6 R-Sq = 81.4% R-Sq(adj) = 75.2%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	826336	826336	13.16	0.036
Error	3	188403	62801		
Total	4	1014740			

Regression Analysis

The regression equation is
total insect = - 1205 + 80.7 Mean monthly temp C

Predictor	Coef	StDev	T	P
Constant	-1204.5	466.7	-2.58	0.082
Mean mon	80.66	22.40	3.60	0.037

S = 253.4 R-Sq = 81.2% R-Sq(adj) = 74.9%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	832446	832446	12.96	0.037
Error	3	192651	64217		
Total	4	1025097			

Regression Analysis fenced land (temp)

The regression equation is
total arth = - 1115 + 74.1 Mean monthly temp C

Predictor	Coef	StDev	T	P
Constant	-1114.5	627.6	-1.78	0.174
Mean mon	74.06	30.13	2.46	0.091

S = 340.8 R-Sq = 66.8% R-Sq(adj) = 55.8%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	701745	701745	6.04	0.091
Error	3	348433	116144		
Total	4	1050178			

Regression Analysis

The regression equation is
total insect = - 1125 + 74.2 Mean monthly temp C

Predictor	Coef	StDev	T	P
Constant	-1125.3	630.3	-1.79	0.172
Mean mon	74.17	30.26	2.45	0.092

S = 342.3 R-Sq = 66.7% R-Sq(adj) = 55.6%

Table C7 Cont.

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	703826	703826	6.01	0.092
Error	3	351419	117140		
Total	4	1055245			

Regression Analysis natural land (moist)

The regression equation is
total arthropods = 966 - 71.0 soil moisture

Predictor	Coef	StDev	T	P
Constant	966.3	449.1	2.15	0.121
soil moi	-71.00	55.55	-1.28	0.291

S = 562.0   R-Sq = 35.3%   R-Sq(adj) = 13.7%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	516094	516094	1.63	0.291
Error	3	947623	315874		
Total	4	1463717			

Regression Analysis

The regression equation is
total insects = 960 - 71.5 soil moisture

Predictor	Coef	StDev	T	P
Constant	960.4	452.4	2.12	0.124
soil moi	-71.46	55.95	-1.28	0.291

S = 566.1   R-Sq = 35.2%   R-Sq(adj) = 13.6%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	522846	522846	1.63	0.291
Error	3	961503	320501		
Total	4	1484349			

Regression Analysis grazing land(moist)

The regression equation is
total arthropods = 833 - 65.6 soil moisture

Predictor	Coef	StDev	T	P
Constant	833.5	383.3	2.17	0.118
soil moi	-65.55	52.62	-1.25	0.301

S = 472.1   R-Sq = 34.1%   R-Sq(adj) = 12.1%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	345981	345981	1.55	0.301
Error	3	668759	222920		
Total	4	1014740			

Table C7 Cont.

Regression Analysis

The regression equation is
total insects = 827 - 66.1 soil moisture

Predictor	Coef	StDev	T	P
Constant	827.3	384.6	2.15	0.121
soil moi	-66.10	52.80	-1.25	0.299

S = 473.7   R-Sq = 34.3%   R-Sq(adj) = 12.4%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	351810	351810	1.57	0.299
Error	3	673287	224429		
Total	4	1025097			

Regression Analysis fenced land (moist)

The regression equation is
total arthropods = 780 - 53.3 soil moisture

Predictor	Coef	StDev	T	P
Constant	779.7	437.3	1.78	0.173
soil moi	-53.27	50.16	-1.06	0.366

S = 504.4   R-Sq = 27.3%   R-Sq(adj) = 3.1%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	286898	286898	1.13	0.366
Error	3	763281	254427		
Total	4	1050178			

Regression Analysis

The regression equation is
total insects = 776 - 53.9 soil moisture

Predictor	Coef	StDev	T	P
Constant	775.8	436.8	1.78	0.174
soil moi	-53.89	50.10	-1.08	0.361

S = 503.8   R-Sq = 27.8%   R-Sq(adj) = 3.8%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	293704	293704	1.16	0.361
Error	3	761541	253847		
Total	4	1055245			

Descriptive Statistics(coleoptera)

Variable	N	Mean	Median	Tr Mean	StDev	SE Mean
fenced	5	9.00	10.00	9.00	2.45	1.10

Variable	Min	Max	Q1	Q3
fenced	6.00	12.00	6.50	11.00

Descriptive Statistics(coleoptera)

Variable	N	Mean	Median	Tr Mean	StDev	SE Mean
grazed	5	9.20	10.00	9.20	2.59	1.16

Variable	Min	Max	Q1	Q3
grazed	5.00	12.00	7.00	11.00

Table C7 Cont.

Descriptive Statistics(coleoptera)

Variable	N	Mean	Median	Tr Mean	StDev	SE Mean
natural	5	10.80	11.00	10.80	2.86	1.28

Variable	Min	Max	Q1	Q3
natural	7.00	14.00	8.00	13.50

Descriptive Statistics(araneae)

Variable	N	Mean	Median	Tr Mean	StDev	SE Mean
fenced	5	7.86	6.20	7.86	5.06	2.26
grazed	5	8.02	7.50	8.02	4.27	1.91
natural	5	7.84	6.00	7.84	5.10	2.28

Variable	Min	Max	Q1	Q3
fenced	4.50	16.80	4.90	11.65
grazed	3.30	15.00	5.05	11.25
natural	1.50	14.70	3.75	12.85

Descriptive Statistics(hymenoptera)

Variable	N	Mean	Median	Tr Mean	StDev	SE Mean
fenced	5	328	68	328	529	237
grazed	5	376	44	376	521	233
natural	5	438	162	438	619	277

Variable	Min	Max	Q1	Q3
fenced	9	1263	37	750
grazed	6	1197	21	898
natural	12	1514	53	962

Descriptive Statistics(other insects)

Variable	N	Mean	Median	Tr Mean	StDev	SE Mean
fenced	5	36.16	47.00	36.16	19.47	8.71
grazed	5	39.8	23.0	39.8	44.7	20.0
natural	5	32.4	29.3	32.4	26.1	11.7

Variable	Min	Max	Q1	Q3
fenced	5.00	51.80	17.10	49.80
grazed	13.7	119.2	14.8	73.3
natural	9.8	75.2	11.4	55.0

Descriptive Statistics(other arthropods)

Variable	N	Mean	Median	Tr Mean	StDev	SE Mean
fenced	5	0.680	0.500	0.680	0.646	0.289
grazed	5	1.460	1.300	1.460	1.361	0.609
natural	5	1.160	0.800	1.160	1.033	0.462

Variable	Min	Max	Q1	Q3
fenced	0.000	1.500	0.100	1.350
grazed	0.000	3.000	0.150	2.850
natural	0.300	2.700	0.300	2.200

Descriptive Statistics(total arthropods)

Variable	N	Mean	Median	Tr Mean	StDev	SE Mean
fenced	5	382	146	382	512	229
grazed	5	435	190	435	504	225
natural	5	491	218	491	605	271

Variable	Min	Max	Q1	Q3
fenced	68	1284	87	795
grazed	46	1223	56	936
natural	107	1542	114	1004

Table C7 Cont.

Descriptive Statistics(total insects)

Variable	N	Mean	Median	Tr Mean	StDev	SE Mean
fenced	5	373	128	373	514	230
grazed	5	425	172	425	506	226
natural	5	482	200	482	609	272

Variable	Min	Max	Q1	Q3
fenced	61	1278	81	788
grazed	38	1220	48	929
natural	94	1540	105	999

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Table C8 P- value for regression for all groups with moisture and the correlation

Taxon	Fenced (F) P-value	R^2	N	Grazed (G) P-value	R^2	N	Natural (N) P-value	R^2	N
Abundance									
Total	0.09	**0.82**	**5**	0.04	**0.90**	**5**	0.08	**0.84**	**5**
Aranaea	0.97	-0.03	**5**	0.51	-0.39	**5**	0.18	-0.71	**5**
Total insects	0.09	**0.82**	**5**	0.04	**0.90**	**5**	0.08	**0.84**	**5**
Coleoptera	0.3	0.58	**5**	0.88	**0.09**	**5**	0.04	**0.9**	**5**
Hymenoptera	0.1	**0.81**	**5**	0.04	**0.89**	**5**	0.07	**0.85**	**5**
Other Insects	0.28	-0.61	**5**	0.78	**-0.17**	**5**	0.16	**-0.73**	**5**
Other Arthropods	0.51	**-0.39**	**5**	0.91	**-0.07**	**5**	0.32	**-0.56**	**5**

Table C9 P- value for regression for all groups with temprature and the correlation.

Taxon	Fenced (F) P - value	R^2	N	Grazed (G) P - value	R^2	N	Natural (N) P - value	R^2	N
Abundance									
Total	0.37	**-0.52**	**5**	0.30	**-0.58**	**5**	0.29	**-0.6**	**5**
Aranaea	0.28	0.6	**5**	0.24	0.64	**5**	0.49	0.41	**5**
Total insects	0.36	**-0.53**	**5**	0.30	**-0.59**	**5**	0.29	**-0.6**	**5**
Coleoptera	0.8	0.16	**5**	0.22	**-0.67**	**5**	0.47	**-0.43**	**5**
Hymenoptera	0.37	**-0.52**	**5**	0.27	**-0.61**	**5**	0.32	**-0.57**	**5**
Other Insects	0.76	0.19	**5**	0.37	**0.52**	**5**	0.63	**-0.29**	**5**
Other Arthropods	0.57	0.34	**5**	0.95	**-0.04**	**5**	0.85	0.12	**5**

Appendex D
Fig.D1: Images of Coleoptera

Car 3

Carabus impressus

Carb1

Carb 2

Conicleonus nigrosuturatus

cur1

Drasterius bimaculatus

Ela 1

Fig. D1 cont.

Scar2

Scarites procerus eurytes

Zophosis punctata

Tanyproctus saulcyi

Ela 2

His 1

Margarinotus graecus

scar1

Fig. D2: Images of Hymenoptera

Apis mellifera

Cataqliphus bicolor

Form4

Form 2

Appendex E

Fig. E1: cluster analysis of species for hymenoptera

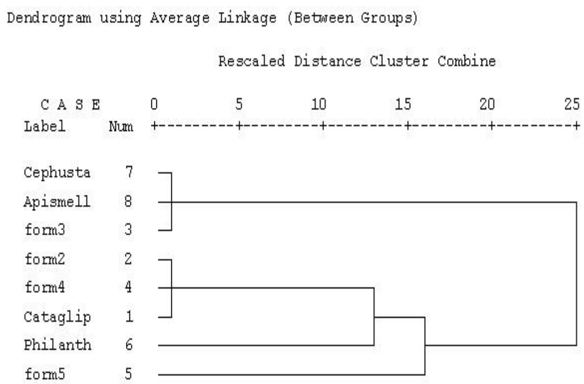
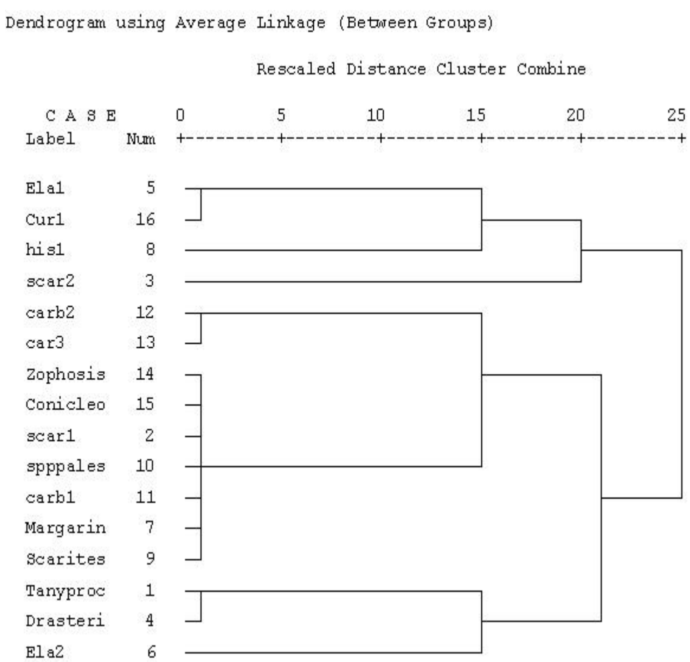


Fig. E2: cluster analysis of species for Coleoptera



جامعة النجاح الوطنية
كلية الدراسات العليا

دراسات في التنوع الحيوي لمفصليات الأرجل في انظمة عشبية بيئية مختلفة في منطقة الفارعة (فلسطين)

إعداد
واصف محمد ذيب علي

إشراف
أ. د. محمد سليم اشتيه

قدمت هذه الأطروحة استكمالاً لمتطلبات درجة الماجستير في العلوم البيئية، بكليــــة الدراســـات العليا في جامعة النجاح الوطنية، نابلس _ فلسطين.

2008

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الملخص

الخلفية: على الرغم من أهمية مفصليات الأرجل في الأنظمة البيئيـة العشـبية، إلا أن الدراسات التي أجريت لفحص تأثير الاضطرابات البيئية المختلفة على هذه المفصـليات قليلـة خاصة في منطقة وادي الفارعة في الضفة الغربية.

الأهداف: هدفت هذه الدراسة إلى معرفة اثر رعي الحيوانات علـى التنـوع الحيـوي لمفصليات الأرجل، بما في ذلك أعداد الأنواع، وفرتها، في النظم البيئية العشبية المتوسطية شبه جافه من وادى الفارعة من الضفة الغربية في فلسطين.

طريقة إجراء الدراسة: أجريت هذه الدراسة بالقرب من قرية طلوزه، و التي تقع فـي الجزء الشمالي الشرقي للضفة الغربية. بدأت هذه التجربة في العام 2006 م في منطقـة تبلـغ مساحتها حوالي 2000 دونم ذات نظام بيئي عشبي يستعمل بشكل رئـيس لرعـي الأغنـام و الماعز.

اختيرت لهذه الدراسة ثلاثة مواقع مساحة كل منها نحو 2000م2، على النحـو التـالي ارض مسيجة حديثا منع فيها الرعي من العام 2005م،أرض عشـبية طبيعيـةوأرض تسـتخدم للرعي منذ ما يزيد عن 25 عاماً.

استغرقت الدراسة 12 شهراً (ابتداء مـن نيسـان 2006م و لغايـة نيسـان 2007م)، واستخدم في صيد مفصليات الأرجل مصائد تسمى (Pitfall Traps) وذلك مـرة واحـدة فـي

منتصف كل فصل من فصول السنة كما تمت دراسة آثار العوامل البيئية (درجة حرارة الهواء، وكمية الأمطار، ورطوبة التربة) على جماعات وأنواع مفصليات الأرجل في منطقة الدراسة.

النتائج و المناقشة: تبين من خلال هذه الدراسة أن جماعات مفصليات الأرجل كانت حساسة لرعي الماشية حيث سجلت أعلى وفرة في الأرض الطبيعية تلتها الأرض الرعوية، والمنطقة المسيجة حديثا. غير أن أثر الرعي على هذه الجماعات يختلف من رتبة إلى أخرى، إذ أظهرت بعض الأنواع من رتبة الحشرات غمدية الأجنحة خاصة النوع الذي يسمى *Carabus impressus* والذي يتبع عائلة الخنافس الأرضية، وفرة اعلى في الأرض الرعوية عنها في المواقع التي لا تتعرض للرعي، في حين أن بعض الأنواع التابعة لعائلات من رتبة حشرات غشائية الاجنحة وجدت في الارض الطبيعية او المحمية مثل عائلة النحل وزنابير الساق المنشارية وزنابير الطين الحافرة، و التي لم تلاحظ في الأرض الرعوية نهائيا، في المقابل وجدت بعض الأنواع التابعة لعائلة النمل مثل (Form 5) في الأرض الرعوية فقط.

وقد بينت هذه الدراسة أيضا وجود نمط عام لتغيرات موسمية معنوية في أعداد مجتمعات مفصليات الأرجل في النظم البيئية العشبية في منطقة الدراسة، إذ وصلت أعداد مجتمعات مفصليات الأرجل أعلى مستوياتها أثناء الصيف حيث سجلت درجات الحرارة الأعلى ورطوبة التربة الأقل، ووصلت مجتمعات مفصليات الأرجل أقل مستوياتها في الشتاء كنتيجة لدرجة الحرارة المنخفضة ورطوبة التربة العالية،

الاستنتاجات: يؤثر الرعي بشكل واضح على التنوع الحيوي لمفصليات الأرجل في الأنظمة البيئية العشبية في منطقة وادي الفارعة في الضفة الغربية في فلسطين. وقد تكيفت بعض أنواع الحشرات من رتبة الحشرات الغمدية الأجنحة بصورة جيدة في الاراضي الرعوية ، و بخاصة خنفساء *Carbus impressus*، التي تتبع عائلة الخنافس الأرضية، ولذلك يمكن أن تستعمل هذه الخنفساء كمؤشر حيوي للإضطرابات البيئة (مثل الرعي) في الانظمة البيئية الرعوية.