IMPLICATIONS OF FOREST MANAGEMENT TECHNIQUES FOR BIODIVERSITY, SPECIES AND ECOSYSTEM DIVERSITY, AMONG LEPIDOPTERA IN PLANTED AND NATURALLY REGENERATED JACK PINE STANDS

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Brent Gordon Elliott

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IMPLICATIONS OF FOREST MANAGEMENT TECHNIQUES FOR BIODIVERSITY, SPECIES AND ECOSYSTEM DIVERSITY, AMONG LEPIDOPTERA IN PLANTED AND NATURALLY REGENERATED JACK PINE STANDS

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BRENT GORDON ELLIOTT

A Thesis/Practicum submitted to the Faculty of Graduate Studies of The University

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MASTER of SCIENCE

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Abstract

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Implications of Forest Management Techniques for Biodiversity, Species and Ecosystem Diversity, Among Lepidoptera in Planted and Naturally Regenerated Jack Pine Stands.

Major Professor: N. J. Holliday

In 1993 and 1994, butterflies and moths were collected in planted and naturally regenerated stands of jack pine, *Pinus banksiana* Lamb., of four different age classes, 5, 15, 25 and 40 years after establishment. Butterflies were collected by netting while walking a prescribed transect through each site, and with a single bait trap at the centre of each site. Bait consisted of a fermenting mixture of beer, rotting fruit and molasses. Moths were collected using a single battery powered ultraviolet light trap at the centre of each site. Species diversity (α) was measured using the log series α index. Ecosystem diversity was measured using Sorenson's coefficient and Kendall's τ rank correlation coefficient. Ordination analysis was conducted on both groups of Lepidoptera, vegetation species and environmental data: light intensity, coefficient of variation of light intensity, air temperature, tree density and coefficient of variation of tree density. Principal Components Analysis and Canonical Correspondence Analysis (CCA) were used to analyse the vegetation data. Correspondence Analysis and CCA were used to analyse the butterfly and moth data.

Ordination analysis of vegetation species indicates that young stands were dominated by members of the Graminaceae including *Koeleria gracilis* Pers. and *Poa compressa* L. Intermediate aged stands retained some Graminaceae but are dominated by the lichens *Cladina mitis* (Sandst.) Hale & Culb. and *Cladina rangiferina* (L.) Harm. The oldest stands were dominated by cool, dark adapted species including *Maianthemum canadense* Desf. and the moss *Pleurozium schreberi* (Brid.) Mitt.

Number of individuals for the butterflies was not significantly affected by any of stand age, regeneration type or the interaction of stand age with regeneration type in either 1993 or 1994. The number of species was significantly affected only by stand age in 1993. Species diversity of butterflies, as represented by the log series α index, were significantly affected by regeneration type and the interaction of regeneration type and stand age in one of the two years of the study. The same trend was observed in both years. Butterflies showed a preference for intermediate aged stands. Diversity was highest in the two intermediate age classes, but peaked in the 15 year age class for the planted stands, and in the 25 year age class, for the natural stands. This shift may be an effect of planting. Ordination analysis of the butterflies indicated that there was a shift from open-habitat preferring species, including *Cercyonis pegala* (Fabricius), to forest dwelling species, including *Enodia anthedon* (A. H. Clark), as degree of canopy closure increased. Butterflies are closely linked to their food plants and ordination analysis indicated that butterfly species were generally found near their hosts. Ordination analysis did not reveal any effects of planting on the assemblage of butterflies.

Measures of β diversity indicated that planted stands and naturally regenerated stands did not significantly differ for the butterflies. In one year the planted stands were significantly more similar, when determined using Kendall's τ rank correlation measure, but this pattern was not consistent.

Number of individuals for the moths was significantly affected by stand age in 1993 and by all of stand age, regeneration type and the interaction of stand age and regeneration type in 1994. The number of species was significantly affected by stand age in 1993 and by all of stand age, regeneration type and the interaction of stand age and regeneration type in 1994. Alpha diversity of moths was significantly affected by stand age in both years of the study. Neither regeneration type nor the interaction of regeneration type with stand age had a statistically significant effect on moth α diversity. The effect of stand age differed from that observed with the butterflies. For the moths, number of individuals, number of species, and α diversity increased with increasing stand age. The same trend was observed in both years and this may be an effect of the planting. Moths were not associated with patchy habitats as were the butterflies. Ordination analysis of the moths indicated that unlike the butterflies, moths were not generally found in association with their foodplants. There was no clear shift in dominant moth species indicated by ordination analysis. Ordination analysis did not reveal any effects of planting on the assemblage of moths.

Measures of β diversity indicated that planted stands and naturally regenerated stands did not significantly differ for the moths. When measured using Sørenson's coefficient, β diversity decreased with increasing stand age in both planted and naturally regenerated stands.

Table of Contents

List of Tables

List of Figures

LIST OF APPENDICES

Introduction

Diversity is an important component of ecology and measures of diversity are often used as indicators of the general health of an ecosystem (Magurran, 1988). Ecological diversity can be usefully defined as a measure that includes both the number of species present and the distribution of individuals within communities (Shafi and Yarranton, 1973). It expresses diversity in term of species, or α diversity, and ecosystem, or β diversity (Magurran, 1988). Species diversity indices make use of the number of species and their relative abundances in a given habitat (Pielou, 1975; Magurran, 1988). Ecosystem diversity indices compare the degree of difference in species assemblages between two or more habitats (Magurran, 1988).

Measurement of diversity may be used to gain insight into the forces responsible for shaping community structure and the effects of changes in the environment on the ecosystem (Kempton and Taylor, 1976). By studying the effects of disturbance on ecological diversity we may gain an understanding of how ecosystems react to different types and levels of disturbance (Frambs, 1990).

Although the effects of modern forestry on faunal diversity are poorly understood (Heliovara and Varsonen, 1984), the effects of anthropogenic disturbances on the forest fauna can be examined by comparing natural forest sites to sites that have been subject to human management (Chandler, 1991). The frequency of anthropogencic disturbance by human means, for example logging, is greater than the rate of disturbance by natural means, such as forest fires (Shafi and Yarranton, 1973). As a result of this increased rate of disturbance, there is the possibility that many of the species associated with a forest climax regime are becoming or are in danger of becoming extinct in areas where forest disturbance is accelerated (Loucks, 1977). Another result of the increased rate of disturbance and subsequent planting of monocultural forest stands is the loss of structural diversity that is extremely important to the diversity of a forest (Orme *et al.*, 1990). As a result of this loss of structural diversity, there may be a concordant loss in arthropod diversity associated with the forest stand (Lawton, 1983).

A group of organisms that is chosen as indicator species is selected on the basis of how their presence or absence and abundance reflects the changes in the environment in which they live (Holloway and Barlow, 1992). The Lepidoptera are useful indicator species of environmental change because they meet several of the criteria identified by Pearson (1995). Many are easy to identify; have well known natural histories; they are readily surveyed by a variety of trapping and collecting methods; higher taxa are broadly distributed geographically; the lower taxa are specialized and sensitive to habitat change; their patterns of biodiversity are reflected in other related and unrelated taxa, their host foodplants, for example; and several species are economically important as defoliators of commercial crops and trees (Gilbert and Singer, 1975; Dempster, 1983; Pearson, 1995). Most Lepidoptera are very closely linked to their foodplants and, in some instances, have coevolved with their larval hosts (Ehrlich and Raven, 1964). Lepidoptera have been used as indicators of biodiversity in Malaysia (Holloway and Barlow, 1992), the United States (Debinski and Brussard, 1994) and Madagascar (Kremen, 1994). These studies indicate that the Lepidoptera are good indicators of the diversity of an ecosystem.

Jack pine, *Pinus banksiana* Lamb, is a coniferous tree that prefers well drained soils and requires fire to cause the serotinous cones to open and release their seeds (Ahlgren, 1959; Smith *et al.*, 1960). Jack pine seedlings are often planted in areas where natural regeneration after harvesting is poor and in the last 40 years, planting has become increasingly important in jack pine regeneration in southeastern Manitoba (Lafrenière, 1994). This study is the second of two to examine the effect of different regeneration techniques on insect ecological diversity. The first examined their influences on carabid beetles (Lafrenière, 1994). This thesis examines patterns of ecological diversity of two groups of Lepidoptera, the butterflies and the moths.

The objectives of this thesis are:

I) To determine whether the α diversity of Lepidoptera differs between planted and naturally regenerated jack pine stands of similar age and composition.

ii) To determine whether differences in the α diversity of Lepidoptera associated with the type of regeneration increases or decreases with stand maturity.

iii) To examine whether the β diversity of Lepidoptera assemblages in planted and naturally regenerated stands differ.

iv) To investigate the relationship between Lepidoptera assemblage composition and the environmental characteristics of sites, to gain insight into the differences between lepidopteran assemblages in planted and naturally regenerated sites at different levels of maturity.

v) To determine whether abiotic or biotic factors play a stronger role in determining the species assemblage of Lepidoptera in planted and naturally regenerated sites at different levels of maturity.

REVIEW OF LITERATURE

Successional processes and disturbance

The structure and composition of an ecosystem changes as one type of community replaces another in what has been termed succession. Succession represents the development towards an equilibrium between organisms and the environment (Clements, 1916). Succession may follow a relatively predictable seral sequence that begins with a pioneer stage, and proceeds through consolidation and subclimax stages, to a final climax stage (Dansereau, 1957).

Disturbances within a forest ecosystem lead to secondary succession (Rowe, 1983). Secondary succession is also caused by natural disturbances (wildfire, windstorms, insects, pathogens) or by anthropogenic disturbances (mechanical clearing, set fires, tree harvesting) (Harper, 1977; McLeod, 1980). Disturbance by man (eg. fire, agriculture) has long been important in determining forest composition in tropical forest ecosystems (McLeod, 1980).

The frequency of disturbance also plays a role in successional processes. A community, if not disturbed, may be reduced to a low diversity equilibrium through processes of competitive exclusion (Connell, 1978). A highly diverse community can be maintained if disturbance is on a moderate scale (McLeod, 1980). The more frequently a disturbance occurs, the less likely succession will reach the stage of a climax community (Petraitis *et al.*, 1989). Diversity often is low at either extreme of the time scale, peaking at moderate disturbance frequencies (McLeod, 1980). Similarly, diversity is expected to be maximal for intermediate time since disturbance and intensity or amount of disturbance (McLeod, 1980). Colonizing organisms are associated with early stages in the succession and are species that are adapted to that type of habitat (Powers and Van Cleve, 1991). The pioneer communities are lower in diversity than later successional stages (McLeod, 1980). At maturity, diversity is declining and therefore diversity is highest in intermediate stages in the succession (Connell, 1978; McLeod, 1980; Petraitis *et al*, 1989). As the structure of the habitat changes so do the assemblages of organisms associated with that habitat. Habitat changes occur most rapidly early in the successional series and as the community matures, change occurs more slowly.

Diversity

Diversity may be thought of as a property of communities that includes both the number of species present, or species richness, and the distribution of individuals between them, or evenness Pielou, 1969). Species richness in its simplest form is simply the number of species in a given sample (Pielou, 1969). Evenness is the equitability of the species present in the communities (Pielou, 1969).

Components of Diversity

The diversity of a given ecosystem may serve as an indication of the ecological well being of that ecosystem (Magurran, 1988). Ecological diversity is composed of species diversity, or α diversity and ecosystem, or β diversity (Pielou, 1975; Wilson and Shmida, 1984; Magurran, 1988). When considered together, α and β diversity measure the overall diversity of a given ecosystem (Wilson and Shmida, 1984).

The simplest way of expressing diversity is in terms of the number of species in a given area or species richness (Pianka, 1966; Pielou, 1975; Magurran, 1988). The number of species is affected by sample size, and this effect may mask differences or shifts in dominance or evenness. Therefore it is desirable to express diversity in terms of the number of species present and their relative abundances (Magurran, 1988). From this, species diversity is the number and relative abundance of species in a given habitat and is used to indicate the well being of that habitat (Pielou, 1975; Whittaker, 1972). It has been suggested that the two components of diversity, species richness and evenness, be treated separately (Pielou, 1969; Hurlbert; 1971).

Ecosystem diversity is a measure of the difference in species assemblages between two habitats (Pielou, 1975; Magurran, 1988). It is a measure of the change, or difference between different habitats (Southwood, 1979).

Effects of Disturbances on Ecological Diversity

Diversity is the result of a balance between the frequency of disturbances that provide opportunities for species to recolonize, and the rate of extinction due to competitive exclusion and other causes (Petraitis *et al.*, 1989). The measurement of biological variables gives a strong indication of the effects of a disturbance (Holloway and Stork, 1991). Disturbances affect the distribution and abundance of species that were present in an ecosystem prior to the disturbance (Frambs, 1990) and may also result in species that were not previously present becoming established (Kempton and Taylor, 1976). As a result, change in abundance may serve as an indication of the disturbance (Kempton and Taylor, 1974; Taylor *et al.*, 1978; Kempton, 1979).

Boreal forest characteristics

The boreal zone is the largest ecological zone in Canada, occupying 2.6 x 10^6 km^2 (Danks and Foottit, 1989). It is characterized by closed coniferous forests, with jack pine being prevalent in the central sections and in drier habitats (Danks and Footit, 1989). In terms of habitat on the scale of invertebrates, the boreal forest is considerably diverse (Danks and Footit, 1989).

Successional processes in the boreal forest

The boreal forest ecosystem is one in which the ecological processes are strongly controlled by disturbances, primarily fire (Rowe, 1961). Habitat heterogeneity of the boreal forest is maintained by recurring fires or other associated disturbances (eg. insect infestation) (Clark, 1990; Loope, 1991). Rowe (1956) stated that in the boreal forest, forest fires limit the age of stands of jack pine to less than 100 years. Fire has been a dominant influence in the history of forests both in recent times and in terms of geological time (Heinselman, 1973). Fires in jack pine forests are usually high-intensity crown fires which initiate secondary succession (Heinselman, 1981; Rowe, 1983). It is likely that all parts of the boreal forest have been burned within the last 140 years (Maclean and Bedell, 1955). In Manitoba, the period between fires in jack pine stands is frequently much shorter and these forests are considered to be successionally young compared to many other areas within the boreal forest (Zoladeski *et al.*, 1995).

Forest disturbances may occur at different spatial scales (van der Maarel, 1993). They may be categorized as either patch size or community size (van der Maarel, 1993). Community size disturbances are large scale disturbances, exemplified by forest fires, and will destroy an entire community which then regenerates as a whole (van der Maarel, 1993). Patch size disturbances occur on a much smaller scale and create gaps within a community, such as the death of a few trees within a forest (van der Maarel, 1993).

Forests develop slowly and alternative research strategies such as chronosequence and retrospective studies may be utilized to produce rapid results, but are limited by uncertainty about the history of a site under investigation (Powers and Van Cleve, 1991). Chronosequence studies substitute space for time by selecting particular stages of development which are selected along a time sequence beginning with initial disturbance and extending to an advanced stage of maturity (Powers and Van Cleve, 1991).

Diversity patterns in the boreal forest

Forest ecosystems are distinguished by their complexity and diversity (Powers and Van Cleve, 1991). The highest level of arthropod diversity in a boreal forest succession occurs just prior to canopy closure. At this time both open habitat and shade tolerant species are able to occupy suitable niche habitats, which were not present earlier in the case of shade tolerant species, and will not be present later for the open habitat species (Loucks, 1977; Petraitis *et al.*, 1989).

A general association between plant and animal diversity is accepted (Southwood, 1979). The general successional patterns that are observed for plants also hold for some arthropods (Murdoch *et al.*, 1972). Invasion of vegetation pioneer species and re-establishment of species present prior to disturbance occurs before canopy closure in forests (De Grandpré *et al.*, 1993). Following canopy closure within the forest, there is no major change in vegetation species in the understorey, as the shade intolerant species disappear prior to canopy closure (Shafi and Yarranton, 1973). A high frequency of forest disturbance may favour tree species intermediate in tolerance of shade, since they can establish during one episode of canopy opening and persist in the understorey through one or more periods of canopy closure (Runkle and Yetter, 1987).

Biology of Lepidoptera

Comparative biology of butterflies and moths

Plant feeding insects that are host specific are thought to provide a precise profile of diversity (Holloway and Barlow, 1992). Many species of Lepidoptera are associated with forest ecosystems and these species are often very localized in distribution (Holloway and Stork, 1991). The Lepidoptera have characteristics that make them useful as indicator species. These characteristics include their relative ease of identification to the species level, the existence of standardized collection techniques, and a high level of association with larval host plants (Southwood, 1979; Dempster, 1983).

The Macrolepidoptera are divided into the Rhopalocera, the butterflies and skippers, and the Heterocera, the moths (Borror *et al.*, 1989) based on differences in antennal structure. This division is somewhat arbitrary but the two groups differ in one principal behavioural way. The majority of butterflies are diurnal, flying only during the day time, while the majority of the moths are nocturnal (Holland, 1903).

The butterflies are well accepted as indicators of the well being of ecosystems (Gilbert, 1974; Sutton and Collins, 1991). Butterfly species are generally confined to taxonomically and chemically related larval host plants and sometimes to a single species (Gilbert and Singer, 1975). Larvae generally have a greater range of host acceptance than oviposition preference indicates (Gilbert and Singer, 1975). The dependence of the larval stages of most species on a relatively narrow range of hosts combined with the actions of the adults as pollinators links them to the health of their habitat (Ehrlich and Raven, 1965; Ehrlich, 1984). The majority of butterfly species are much more restricted geographically in their distributions than are their potential host plants (Heslop, 1964; Svent-Ivany, 1971).

Several factors other than their dependence on food source influence the distribution of butterflies. These include light intensity, relative humidity and changes in temperature, all of which are affected by habitat disturbance (Ehrlich *et al.*, 1972; Whittaker, 1972; Murphy *et al.*, 1990; Sparrow *et al.*, 1994). Adult butterflies are heliotherms and are able to fly only within a certain range of temperatures (Shapiro, 1970). Climactic factors may influence butterfly populations through effects on host quality (Gilbert and Singer, 1975). Cold weather slows development of insects and it has been observed to reduce butterfly fecundity (Gilbert and Singer, 1975). Similarly, Takata (1961) found that fecundity may be depressed by hot weather. Butterflies have different preferences for shade and sunlight (Peterson, 1954; Shapiro and Cardè, 1970). Many prefer sunny habitats, although some have a preference for shaded habitats (Peterson, 1954; Warren, 1985).

Like the butterflies, the moths are phytophagous as larvae and are linked strongly to their habitat. Most moth species are nocturnal as adults and therefore are not strongly influenced by light intensity levels, but like the butterflies, they are sensitive to changes in temperature and relative humidity (Muirhead-Thomson, 1991). Moths as a group are less specific to host taxonomy than butterflies, and have partitioned the parts of plants much more finely (Gilbert and Singer, 1975).

Sampling methods for Lepidoptera

Traps for sampling insect populations play an important role in ecological studies (Vail *et al.*, 1968; Muirhead-Thomson, 1991). Light traps used in the collection of night flying Lepidoptera have proven consistently successful in capturing large numbers of individuals of a large variety of species (Muirhead-Thomson, 1991). Different insects will react in different ways to different light sources (Muirhead-Thomson, 1991). Light traps yield biased samples; the number of any species caught depends not only on abundance but also on the degree of attraction to light (Kempton and Taylor, 1974). Moths do not fly directly to the light trap and are not necessarily collected on their first pass by the trap (Harstack *et al.*, 1968). It has been observed that a large proportion of insects attracted to light traps appear to circle traps and frequently settle on surrounding vegetation (Muirhead-Thomson, 1991). The effective radius of a light trap is the maximum distance at which an insect responds to the light trap, and this is a physiological response which varies between species and individuals (Bowden, 1982). The effective radius is also affected by the degree of vegetative cover which may obstruct the insects view of the light trap (Muirhead-Thomson, 1991). The most important factor in determining the range of insects a light will attract is the source of the light (Vaishampayan, 1985). Estimates of the relative efficiency of capture vary from as little as 8% to as high as 50 % of moths captured, depending on species (Harstack *et al.*, 1968). Several factors affect the efficiency of light traps and these may include the period of illumination, temperature, wind velocity and wind direction (McGeachie, 1988, 1989). Seasonal distribution of catches of moths has been observed to vary between sites and years (Gregg *et al.*, 1993).

With few exceptions, light trap catches are at their lowest around the period of the full moon (Williams, 1936; Nemec, 1971; Muirhead-Thomson, 1991). Hardwick (1972) observed that noctuid moths are less active on cool nights than on warm nights and that compared to this, the lunar cycle has no effect on light trap catches. The changes that are observed in light trap catches associated with differences in lunar illumination may be caused by changes in insect activity, changes in population, or by changes in the range of effectiveness of the light trap (Bowden and Church, 1973). Most light trap investigations indicate that trap catches are at their lowest around the period of the full moon and at their highest at periods of no moon (Williams, 1936; Muirhead-Thomson, 1991). Sheltered sites reduce the impact of winds which results in a decrease in the number of long range dispersing moths reaching the trap and an increase in the number of poor flying species that are able to reach the trap (Muirhead-Thomson, 1991). Light traps in wooded areas tend to catch only local fauna (Muirhead-Thomson, 1991). Height of the trap influences the species composition of the trap catch (Taylor and French, 1974). Members of the Geometridae and Pyralidae are smaller bodied and have slow flapping flight and a greater proportion of the population flies closer to the ground than the heavier bodied Noctuidae and Sphingidae (Greenwalt, 1962; Taylor and Brown, 1972; Taylor *et al.*, 1979). In general, the larger the species, the higher it flies, independent of family and morphological type (Taylor *et al.*, 1979).

Bait traps have been used for the collection of different groups of insects including Diptera and Lepidoptera (Vogt, 1968; Owen, 1975). The general principles of attraction to bait traps and the factors affecting their efficiency may be similar for all insect groups. Baited traps are affected by environmental factors. An increase in wind speed results in a decrease in the efficiency of bait traps (Muirhead-Thomson, 1991). Similarly temperature affects trap efficiency. Above or below their optimal temperature range, insects will not fly to a trap and trap efficiency is consequently decreased (Vogt, 1986). Baits usually become more attractive with increasing time of exposure and it has been suggested that baits should be discarded regularly in case the increase in attraction could be wrongly interpreted as an increase in the population of the organism under study (Vogt *et al.*, 1983). Height of trap may play a role in the efficiency of the trap (Vogt, 1986). Depending upon the insect group to be collected, an optimal height that is related to the characteristic flight height of the organism under study should be determined (Vogt, 1986). Trap siting also plays a role as traps placed in open sunlight may differ in efficiency from those placed in shaded sites (Welch, 1988).

Different species may be differentially attracted by bait or variably likely to escape from the trap (Kremen, 1994). In general, only butterflies in the family Nymphalidae are attracted to fruit based baits (Kremen, 1994). However, Owen (1975) previously observed that members of the Satyridae are attracted to these baits in temperate regions. Butterfly species which feed on baits, dung, rotting fruit and sap, tend to be cryptic (Gilbert and Singer, 1975) and so are not conveniently recorded in visual samples (Kremen, 1994). Trapping complements hand netting and a sampling program involving both netting and trapping will provide a more complete representation of a butterfly assemblage than will either method by itself (Kremen, 1994).

Methods of community analysis

Diversity Measures

Diversity measures have two components: species richness and evenness (Magurran, 1988). Species diversity measures are usually divided into three categories: species richness indices, species abundance models and indices based on the proportional abundances of species (Magurran, 1988). These indices are affected by a variety of factors including sample size, commonness versus rarity of species, presence and absence of species, and relative abundance of species (Southwood, 1979; Magurran, 1988). An ideal measure of species diversity should have good discriminant ability, low sensitivity to sample size and should be easy to calculate (Magurran, 1988).

A problem in ecological studies is obtaining equal sample sizes for all locations (Magurran, 1988). A technique termed rarefaction was developed by Sanders (1968) for calculating the number of species expected in each sample if all samples were of a standard size. The technique was modified by Hurlbert (1971) to produce an unbiased estimate. A problem with rarefaction is the loss of information because the number of species and their relative abundances, known before rarefaction, are lost and all that remains is the expected number of species per sample (Williamson, 1973). Further problems include the assumptions that the assemblages are random and that their is no interspecific interactions and that evenness is the same in the communities being compared, which is often not the case (May, 1975).

The frequency distribution of species abundances is often a more sensitive measure of environmental disturbance than species richness alone (Kempton, 1979). Fisher *et al.* (1943) noted that a characteristic pattern of species abundance occurs in which a few species are very abundant, some are of medium abundance, and most are represented by only a few individuals (Williams, 1964; Pielou, 1974; Southwood, 1978). Species abundance distributions utilize both the number of species and their relative abundance in a community and provides the most complete mathematical description of the data (Magurran, 1988). Diversity is usually examined in relation to four main models of the underlying species abundance distribution (Southwood, 1979): the log normal distribution (Preston, 1948), the geometric series (May, 1975), the logarithmic series (Fisher *et al.*, 1943) and the broken stick model (MacArthur, 1957). Rank-abundance plots are one method of presenting species abundance data and can be used to determine the appropriate underlying distribution (May, 1975). Within each distribution, there is a progression ranging from the geometric series where a few species are dominant and the remainder fairly uncommon, through the log series and log normal distributions where species of intermediate abundance are relatively more common and on to the broken stick model in which species are uniformly distributed with respect to resource apportioning (Pielou, 1975).

Indices based on the proportional abundances of species have been termed heterogeneity indices (Peet, 1974) because they take both evenness and species richness into account. May (1975) has referred to them as non-parametric indices because no assumptions are made about the shape of the underlying species abundance distributions. Magurran (1988) has divided these indices into two categories: information statistic indices that are derived from information theory including the Shannon-Weaver index (May, 1975) and dominance indices, including the Berger-Parker index *d* (Berger and Parker, 1970) and Simpson's index (Simpson, 1949). Information statistic indices are based on the rationale that the diversity in a natural system can be measured in a similar way to the information contained in a code. The Shannon index assumes that individuals are randomly sampled from an effectively infinite population and that the index also assumes that all species are represented in the sample (Pielou, 1975). Dominance measures are weighted towards the abundances of the commonest species rather than providing a measure of species richness (Southwood, 1979). The Berger-Parker index *d* is simple to calculate and expresses the proportion of the total catch that is due to the most dominant species (Southwood, 1979). It is independent of number of species but is influenced by sample size (Magurran, 1988).

It is desirable that diversity indices be able to discriminate between sites with only subtle differences (Magurran, 1988). They should also be independent of sample size and sampling intensity (Magurran, 1988). Kempton and Taylor (1974) found the log series index α was relatively unaffected by either rare species or common ones.

Measurement of species diversity

Alpha Diversity Indices. Several indices of diversity have been developed to characterize habitats based on species diversity (Pielou, 1975; Southwood, 1978). Of these indices, a number of authors have singled out the log series α (Fisher *et al.*, 1943) as the superior measure of species diversity (Kempton and Taylor, 1974; Taylor *et al.*, 1976; Magurran, 1988; Thomas and Thomas, 1994). This index is considered superior because of its good discriminant ability, low sensitivity to sample size and ease of calculation (Magurran, 1988). The log series α is based on the number of species relative to the number of individuals present in a sample. The log series α is most influenced by the frequencies of the moderately abundant species rather than the extremely abundant or extremely rare species (Murdoch *et al.*, 1972; Kempton and Taylor, 1974; Magurran, 1988).

Beta Diversity Indices. A number of indices have been developed to measure ecosystem, or β, diversity (Huhta, 1979; Wilson and Shmida, 1984; Magurran, 1988). Most of these measures are based on presence-absence data and do not consider relative abundance. The original Sørenson index is one of the more widely used indices based on presence absence data (Bray and Curtis, 1957; Southwood, 1979; Magurran, 1988). Pairs of communities which share all their species will have a Sørenson index of 1, while communities which have no species in common will have an index of 0 (Magurran, 1988). In a review of the discriminant ability of sixteen measures of similarity, Huhta (1979) found that Kendall's τ, a quantitative pairwise measure (Kendall, 1962), and the modified form of the Sørenson coefficient (Bray and Curtis, 1957) were the most consistent performers when comparing two stable communities.

Ordination Analysis

Ordination analysis is a multivariate technique developed to aid in the analysis of multidimensional data sets (Bray and Curtis, 1957; Gauch, 1982; ter Braak, 1985). Ordination describes the pattern of relationships among a group of objects in a reduced number of dimensions that represent most of the variation in the original data set (Gauch, 1982; Pielou, 1984; Digby and Kempton, 1987; Jones and McCulloch, 1990). The objects are then displayed graphically in an ordination diagram in which the axes represent gradients of combinations of the attributes of the original data set (Jones and McCulloch, 1990). The data are plotted such that the distance between points indicates the degree of similarity between data points (Greenacre, 1984). The axes in an ordination diagram are arranged orthogonal to each other and each accounts for the maximum possible amount of variance remaining in the data, after the variation attributable to the previous axes has been removed. In most ordination procedures, the eigenvalue of each axis describes the relative importance of an axis (ter Braak, 1987-1992). In an ordination diagram, axis 1 has the largest eigenvalue and is associated with the largest proportion of the variance; axis 2 has the next largest eigenvalue and is associated with the next largest proportion of variance (Green and Carroll, 1976). The positive and negative ends of each axis are arbitrarily assigned (ter Braak, 1986). The ordination axes may be considered as hypothetical environmental variables and are then interpreted on the basis of what is known about the species and the environment (ter Braak, 1987-1992). Species near the centre of the diagram may be ubiquitous and unrelated to the ordination axes (ter Braak and Prentice, 1988).

Principal components analysis (PCA) is a type of ordination analysis which is most appropriate for data that are continuous, such as percent cover (Greenacre, 1984). This technique can be applied to abundance data but cannot be applied to presence-absence data (ter Braak, 1985). PCA is a linear ordination technique that provides the least-squares estimates of the sites and the species scores (ter Braak and Prentice, 1988). This method differs from correspondence analysis (CA) by being a linear method (ter Braak and Prentice, 1988).

Weighted averages of species scores have been shown to give estimates of the species' optima and environmental values when the species' response curves are Gaussian (ter Braak and Prentice, 1988). Weighted averaging works well with presence-absence data, and if abundances are available, they provide the weights (ter Braak and Prentice, 1988). It has been suggested that linear combinations of site scores are the most appropriate scores to use in ordination diagrams (Palmer, 1993), however, weighted averaging methods may be applied over wide ranges of environments where species' abundances may not vary monotonically with variation in the environment (ter Braak and Prentice, 1988).

Correspondence analysis (CA) is a type of ordination analysis which is most appropriate for data consisting of counts and may be used for both abundance data and presence-absence data (ter Braak, 1985; Jones and McCulloch, 1990). CA is a non-linear method of ordination (ter Braak and Prentice, 1988). This type of ordination analysis expresses the associations between two sets of quantitative variables, for example species and sites (Greenacre, 1984). The ordination results in a diagram which is a biplot of species and sites (Benzécri, 1992). Generally, sites are placed close to the species that are most prominent in those sites (Greenacre, 1984).

Canonical correspondence analysis (CCA), differs from correspondence analysis. Both methods produce species and site scores, but in CCA the site scores are constrained by the environmental variables which are included (ter Braak, 1986). The ordination diagram which is produced is very similar to that produced in CA, the only difference being the presence of the environmental variables, which are represented by vectors whose direction and length indicate their amount of influence and importance (ter Braak, 1986).

MATERIALS AND METHODS

General study area description

This study was conducted in the Sandilands Provincial Forest, which is located in southeastern Manitoba. The Sandilands Provincial Forest is located in the southern portion of the Boreal Forest in Manitoba (Zoladeski *et al.*, 1995). The precise location of the sites is presented in Table 1. All sites were located in the Bedford Hills-Whitemouth Lake Plateau physiographic area of the Sandilands Provincial Forest (Smith *et al.*, 1964). Fig. 1 shows the location of the sites in the Sandilands Provincial Forest.

The soils in the study sites have a high sand content and belong to the Sandilands series or the Woodridge series, or they are a mixture of both (Table 1). Jack pine, *Pinus banksiana* Lamb is the dominant tree species in the upland areas of the Sandilands Provincial Forest, while black spruce, *Picea mariana* [Mill.] B.S.P., is the dominant species in the wet lowland regions (Mueller-Dombois, 1964). All sites selected were in the upland areas.

Experimental Design

Two types of site were used, natural and planted stands of jack pine (Table 1). Natural stands were the result of regeneration following fire. Planted stands were not differentiated according to disturbance type (i.e. fire or harvest). Four age classes were selected: 5, 15, 25, and 40 years of age. For each site type, there were two replicates within each age class, with the exception of the 15 year old natural site. No suitable second replicate for this age class/regeneration type was available within the study area.

The dominant tree ages in the five year age class were four to seven years old; the 15 year age class included trees 12 to 17 years old; the 25 year age class included trees 22 to 32 years old; and the 40 year age class included trees 42 to 52 years old. Tree ages were estimated in 1991 by the use of core samples. Estimates of tree age have been adjusted to reflect tree age in 1996.

Site description

Site selection was accomplished in 1991 by Mr. Rhéal Lafrenière with the aid of fire maps and plantation records supplied by Manitoba Department of Natural Resources. Each site measured 100 m by 100 m, was within a stand of at least 2 ha, and was located at least 20 m from any discontinuity such as a roadway. The dominant tree species within each site was jack pine and tree composition within each site was greater than 75% jack pine.

All sites were given code names which indicate the regeneration type and age class of the site (Table 1). For example, the code name B5A indicates that this is the first replicate of a natural (Burned) site burned approximately five years ago. Similarly, P5B indicates the second replicate of a site Planted five years ago.

The five year old sites were open areas with no trees higher than 2 m. Planted and natural sites differed in two principal ways. First, a large proportion of the fallen dead trees, or slash, had been removed from the planted sites but remained in the natural sites. Second, the tree distribution in the natural sites was aggregated, while in the planted sites trees were regularly spaced. Between aggregations of trees there were patches of open areas that were either bare or had some degree of herbaceous ground cover, predominantly grasses.

The 15 year old sites were generally open sites. The distance between branches of individual trees had decreased when compared to the five year old sites. The major difference between the planted and natural sites was the pattern of tree distribution, which was aggregated in the natural site and more uniform in the planted sites. Between aggregations of trees there were patches of open areas covered with various types of ground vegetation.

The 25 year old sites were composed of intermediate sized trees with a greater degree of canopy closure than was observed in the 15 year old sites. Natural sites had more glades than did the planted sites. Further, the natural sites exhibited a greater degree of canopy closure in tree aggregations than did the planted sites. Overall, canopy closure was more complete in the planted sites. The planted stands were partially replanted after the initial planting. The first replicate of the natural stands in this age class, B25A, was mechanically thinned at some time prior to the date of this study.

The 40 year old sites were nearing maturity and were characterized by almost complete canopy closure and were much darker than stands in the other age classes. Sites of each regeneration type were very similar in part due to the natural thinning (Ahlgren, 1974) of aggregated areas in relatively mature jack pine forests.

Vegetation Sampling

In both 1993 and 1994, ground vegetation was sampled. Within each site, 25 1 m by 1 m quadrat samples were selected in a stratified random fashion. Each site was stratified into five 20 m by 100 m blocks and five quadrat samples were taken per block. The ground vegetation was identified and the percent cover of each species was estimated in the field. Ground vegetation was defined as herbaceous plants and woody plants < 30 cm tall. Sampling was conducted twice per year; late May - early June, representing early summer, and late July - early August, representing late summer. Tree sampling to determine tree age, dominant tree species and tree density were carried out in 1992, as was sampling of shrubs (Lafrenière, 1994).

Environmental measurement

Weather

Air temperature was recorded in 1995 using Hobo XT Temperature Loggers (Onset Instruments Corp.®). Temperature loggers were operated from 25 April to 24 July. The temperature probe of each was taped 1 m above the ground on the north side of a tree located at the centre of each site. The probe was placed on the north side of the tree to reduce heating from direct sunlight. Temperature readings were logged once every 1.2 hours and subsequently down loaded to a computer. Monthly and daily mean temperatures for 1993 and 1994 were obtained from Environment Canada sampling records for Winnipeg International Airport. Winnipeg International Airport was the location closest to the Sandilands Provincial Forest (distance from sites to airport = 90 km) with complete meteorological records. Monthly and daily mean hours of bright sunshine and precipitation were also obtained from Environment Canada records for

Winnipeg International Airport.

Light Intensity

In 1994, under clear skies, light intensity measured in µEinsteins $m^{-2}s^{-1}$ was recorded. Prior to taking readings in each site, a measurement was taken in the unshaded roadway to obtain a maximum light intensity value, to allow for standardization of readings from all sites. Light intensity readings from all sites were standardized to the maximum light intensity value obtained during sampling at all sites. Within each site, 25 readings were taken in a grid fashion (Fig. 2). Readings were taken at 2 m above the ground to avoid the influence of ground vegetation and were made using a Li-Cor 185 Quantum/Photometer with a photometer probe.

Sampling of Lepidoptera

Three methods of sampling for Lepidoptera were carried out. Transect sampling and bait trapping for butterflies, and light trapping of moths were carried out from 04 May to 21 September, 1993 and from 25 April to 19 September, 1994.

Butterflies

Transect sampling. Transect sampling of adult butterflies was done in each site every week during the sampling period unless conditions were unsuitable because of rain. A prescribed path of transects was walked through each site and the path ensured that each area of the site was inspected twice. Each transect was 100 m in length and a total of 10 transects were completed during each sampling period. Butterflies seen were captured with an insect net and placed in a cyanide jar, for later identification. Duration of sampling was 30 minutes per site.

Bait Traps. One funnel type bait trap (Martin, 1978) for the collection of adult butterflies was placed on a wooden stand, 1 m in height, located at the centre of each site. Each trap was constructed of either aluminum or fibreglass window screen with a wooden frame. Traps were 60 cm tall and 45 cm in diameter with a 9 cm by 9 cm screened lid on top. The internal cone was 30 cm tall with an opening of 4 cm diameter at the apex. The gap between the stand and the lower rim of the trap was 2.5 cm.

Each trap was baited with 100 ml of a mixture consisting of bananas, beer, brown sugar, fruit juice and molasses. A larger quantity of the mixture was prepared each week and was apportioned out for each trap. The mixture consisted of one bottle of beer (341 ml), one banana (large), 100 grams of brown sugar, 50 ml of molasses and 500 ml of fruit juice (McCain's® fruit punch). This mixture was selected based on the literature (Holland, 1951; Owen, 1975) and the suggestions of local collectors. The mixture was placed in a plastic dish located on the centre of the stand under the bait trap. The dish was 9.5 cm in diameter and 1.5 cm deep. Bait traps were emptied and the bait replenished once per week.

Moths

Light traps. Adult moths were collected using one Luminoc® battery powered light trap at the centre of each site. Traps were placed at a height of 2 m. In the five year old sites, the trap was suspended from a tripod of aluminum poles. In the three other age classes, the traps were suspended from a tree branch. Each trap operated for 4 h per night beginning at dusk when the light was turned on by a photocell (Figure 3). The light source was an ultraviolet light tube operated in the normal intensity position, with an output of approximately 2.86 $\mu W/cm^2$ (Biocom, 1992). Traps were powered by a 6 V Alkaline Duracell® MN 6080 battery. Each trap was supplied with a trichlorvos impregnated resin strip (Vapona®) as a killing agent. From 04 May to 21 September, 1993 and from 25 April to 19 September, 1994, the traps were emptied on a weekly basis and specimens were brought to the laboratory for identification.

Data Analysis

The number of individuals collected and the number of species were used as general indicators of species occurrence and species richness, for both butterflies and moths.

The log series alpha of the equation:

$$S=\alpha \ln(1+N/\alpha) \tag{1}$$

was obtained for each site by a two step process. Firstly the logarithmic series parameter, x was estimated using least squares minimization in the NONLIN module of SYSTAT, (Wilkinson, 1988), for the equation:

$$S/N=[(1-x)/x]\,[-\ln(1-x)] \tag{2}$$

Where N is the total number of individuals and S is the number of species. The value of x is usually between 0.9 and 1.0 (Williams, 1964).

The log series α was derived from N and the estimate of x using :

$$\alpha=N(1-x)/x \tag{3}$$

Sørenson's coefficient, C_s and Kendall's τ rank correlation coefficient were used to measure moth and butterfly β diversity between site replicates. Sørenson's index was obtained from the equation:

$$C_s=2j/a+b \tag{4}$$

Where j is the number of species collected in both sites A and B, and a is the number of species present only in site A, and b is the number of species present only in site B (Southwood, 1978).

The Kendall's τ rank correlation coefficient (Kendall, 1962) index of ecosystem diversity was calculated using the CORR module of SYSTAT (Wilkinson, 1988). Species abundance data for the pair of replicates of each treatment-age combination were used in the rank correlation. Only species present in both replicates were used in the calculation.

Principal Components Analysis, Correspondence Analysis and Canonical Correspondence Analysis ordinations were carried out using the default settings of the CANOCO software (ter Braak, 1987-1992), with the exception of the following:

(1) To reduce the domination of abundant species, a square root transformation was applied to the vegetation data and a logarithmic transformation was used for the butterfly and moth data. Where the

ordinations were performed on combined vegetation and Lepidoptera data, a square root transformation was used for both types of data.

(2) The sample scores used in the canonical correspondence analysis ordination diagram were those determined by weighted averaging (ter Braak, 1987-1992).

The unrestricted Monte Carlo permutation test was used to assess the significance of the relationship between the environmental variables and the butterfly and moth assemblages (ter Braak, 1986). For each test performed, 99 environmental sample numbers were generated randomly and their trace eigenvalues were calculated and compared to the observed environmental trace eigenvalues. If these observed values were higher than 95 % of the randomly generated values, the species abundance was considered to be significantly related to the environmental variables (ter Braak, 1987).

RESULTS

Environmental and vegetational factors

Temperature

Seasonal patterns of mean monthly precipitation, hours of bright sunshine and temperature are shown in Figures 4, 5 and 6. In 1994 there were more hours of bright sunshine than in the same period in 1993. The amount of precipitation was higher in July and August of 1993 when compared to 1994.

Mean daytime and night time temperatures for each site type/age class replicate were obtained in 1995 using Hobo® data loggers (Table 3). Mean daytime temperature is defined as the mean temperature from 06:00 h to 18:00 h. Mean night time temperature is defined as the mean temperature from 18:00 h to 06:00 h. A repeated measures analysis of variance indicated that both daytime ($F_{3,36} = 88.38$) and night time ($F_{3,36} = 35.96$) temperatures among the age classes in natural stands were significantly different (Figure 7, 8). Daytime temperature decreased with increasing stand age and night time temperatures increased with increasing stand age in the natural stands. Among the planted stands, analysis of variance indicated that both daytime ($F_{3,36} = 34.38$) and night time ($F_{3,36} = 29.03$) temperatures differed significantly among the four age classes (Figure 7, 8). Both daytime and night time temperatures increased with increasing stand age. Paired t-tests indicated that in the five year old stands, the planted site was significantly warmer during the daytime ($t=3.01$; d.f. = 12 ; $P < 0.05$), but the natural stand was warmer over a 24 h period ($t=50.89$; d.f. = 12; $P < 0.05$) than was the planted site (Figure 9, 10). In the 15 year old sites, the planted stand was significantly warmer during the daytime than the natural stand ($t = -10.86$; d.f. = 12; $P < 0.05$) and over the 24 h period ($t = -4.90$; d.f. = 12; $p = 0.26$) (Figure 9, 10). The 25 year old planted stand was significantly warmer than the natural stand both during the daytime ($t = -3.65$; d.f. = 12; $P < 0.05$) and over the 24 h period ($t = -7.96$; d.f. = 12; $P < 0.05$) (Figure 9, 10). In the 40 year old stands, the natural stand was significantly warmer during both the daytime ($t = 8.16$; d.f. = 10; $P < 0.05$) and the nighttime ($t = 2.61$; d.f. = 10; $P < 0.05$) (Figure 9, 10).

Light Intensity

All light intensity measurements were standardized to allow for comparison of measurements between the sites. Light intensity readings were taken in the rodway adjacent to each site to obtain a maximum light intensity value. All readings from all sites were then standardized to the maximum reading obtained for all sites. Mean light intensity was much higher in the five year old stands than in any other age class, and in general mean light intensity decreased with an increase in stand age (table 2; Figure 11). An analysis of variance indicated that only stand age ($F_{3,7} = 16.67$; $P < 0.001$) had a significant effect on mean light intensity. The coefficient of variation of light intensity was calculated in an attempt to quantify the patchiness of the sites. The coefficient of variation of light intensity within sites was very low in the five year old stands and peaked in the 25 year old stands for both treatment types. Neither the type of regeneration ($F_{1,7} = 2.417$), stand age ($F_{3,7} = 4.066$) nor the interaction of treatment type with stand age ($F_{3,7} = 0.442$) had a significant effect on the coefficient of variation of light intensity (Table 2; Figure 12). Levene's test was used for the comparison of coefficient of variation values (Milliken and

Johnson, 1984).

Vegetation

Results of the vegetation sampling for both 1993 and 1994 are contained in Appendix I. The common ground vegetation types have been summarized in Table 1.

In natural stands, the trees are distributed irregularly and may be in clumps. In the planted stands the trees are regularly spaced. The mean tree density was higher in the younger sites than in the older sites and the difference may be attributed to tree mortality as the trees in a stand age. Mean tree density per site and the coefficient of variation of tree density have been summarized in Table 2. Tree density was generally higher in the natural stands, notably in the five and fifteen year old sites (Figure 13). An analysis of variance of mean tree density indicated that all of regeneration type ($F_{1,7} = 18.873$; $P < 0.05$), stand age ($F_{3,7} = 6.095$; $P < 0.05$) and the interaction of regeneration type and stand age ($F_{3,7} = 9.002$; $P < 0.01$) were significant. Tree distribution was more patchy in the five and the 25 year old natural stands, but was quite similar in the 40 year old planted and natural stands (Figure 14). Although the coefficient of variation of tree density was not significantly affected by treatment, age or their interaction, there was a tendency for the trees to be more clumped in the naturally regenerated stands than in the planted stands.

An analysis of variance of the number of ground vegetation species indicated that in 1993 neither regeneration type ($F_{1,7} = 0.234$), stand age ($F_{3,7} = 1.593$) nor the interaction of the two ($F_{3,7} = 3.35$) were significant. In 1994, all of regeneration type ($F_{1,7} = 11.065$; $P < 0.05$), stand age ($F_{3,7} = 7.021$; $P < 0.05$) and the interaction term ($F_{3,7} =$

4.653; $P < 0.05$) were significant. The data show a similar trend and the lack of significance in 1993 may be attributed to higher intersite variation. The number of species recorded was higher in 1993 (Fig. 15) than in 1994 (Fig. 16). The number of ground vegetation species recorded did not differ between planted and naturally regenerated stands in both 1993 and 1994. In three of the 40 year old sites, the number of species was less than that observed in the three younger age classes. In 1994, the trend was similar to that observed in 1993. In general, the species sampled within each site remained constant from year to year.

In the five year old sites the dominant ground vegetation was Graminaceae such as *Andropogon gerardi* Vitman and *Koeleria gracilis* Pers. These stands resembled an open grassland more than a forest habitat. The 15 year old stands differed from the younger stands. The ground vegetation retained a high percentage of grasses, but species typical of open forest areas such as *Cladina* spp. and *Vaccinium angustifolium* Ait. were becoming dominant. The 25 year old stands retained some of the grass species but were dominated more by vegetation adapted to moister conditions such as the moss *Pleurozium schreberi* (Brid.) Spreng. Other species which prefer moist, cooler conditions were abundant, including *Anemone nemorosa* L. and *Arctostaphylos uva-ursi* (L.) Spreng. These sites also retained some of the species that prefer open drier habitat such as *Andropogon gerardi*. *P. schreberi* was the dominant species in three of the four 40 year old sites. These sites were dominated to an even greater extent than the 25 year old sites by vegetation species which prefer moister cooler conditions. These species include *Maianthemum canadense* Desf. and *Oryzopsis asperifolia* Michx.

Principal Components Analysis of vegetation species

Principal Components Analysis (PCA) of the most common vegetation species (percentage of each species sampled > 1% of the total ground cover sampled within the site). In the sites produced an ordination diagram in which the combined eigenvalue of the first two axes explained 50.2 % of the total variation (Fig. 17). The first axis separated the sites mainly on the basis of age. Axis 2 appears to separate sites of intermediate age. The five year old sites were separated from the remainder of the age classes and were placed at the positive end of axis 1. Moving toward the negative end of axis 1 the sites were then placed in order of increasing age from the 15 year old sites through the 40 year old sites. The eigenvector elements of some vegetation species which are characteristic of open dry habitats such as *Poa compressa* L., *Carex rossii* Boott and *K. gracilis*, have a strong positive correlation to axis 1 and were responsible for dictating the distribution of the five year old sites at the positive end of axis 1. The eigenvectors of dark, cool adapted vegetation species such as *P schreberi*, *Dicranum polysetum* Sw. and *M. canadense* were strongly negatively correlated with axis 1 and were responsible for placing the 40 year old sites at the negative end of axis 1. The second axis seemed to separate the sites on the basis of degree of openness of the sites. *Amorpha canescens* Pursh, *Symporicarpos alba* (L.) Blake and *Monarda fistulosa* L. played a strong role in placing the more closed sites at the positive end of axis 2, while *Arctostaphylos uva-ursi* (L.) Spreng. was instrumental in placing the more open sites at the negative end of axis 2.

In 1994, the ordination diagram was similar to that of the previous year. The first two axes explained 51.1 % of the total variation of the axes (Figure 18). As with 1993, the separation along axis 1 was on the basis of stand age with the five year old sites strongly associated with the positive end of axis 1.

Canonical Correspondence Analysis - Vegetation species and environmental variables. Canonical Correspondence Analysis (CCA) of vegetation species with environmental variables produced an ordination with a high degree of covariability among the environmental variables. Forward selection was used to determine which of the environmental variables was most important in explaining the trends in the vegetation data. Monte Carlo testing of the environmental variables determined that only mean light intensity was significant. The use of only one environmental variable results in an ordination diagram in which all sites are aligned along axis 1. To increase the dimensionality, the second most important environmental variable as determined by forward selection, coefficient of variation of light intensity, was added.

In the CCA diagram of 1993 vegetation species and the two environmental variables, mean light intensity and coefficient of variation of light intensity, the first two axes accounted for 23.6% of the variation in the species data (Figure 19). In 1994, the first two axes accounted for 21.7% of the variance (Figure 20). The arrangement of the sites and vegetation species was very similar to the PCA ordination diagrams. The trend was for the young, open sites to be strongly correlated with the positive end of axis 1, while the more closed, older forest sites were placed at the negative end of axis 1. One exception was the placement of the site B25A, which was very strongly correlated with axis 2. The placement of this site may be attributed to the very high degree of variability in light intensity within the site (Table 2).

Butterflies

Number of butterfly species and individuals collected

A total of 58 species were collected during the course of the study; 48 species were collected in 1993 and 55 species were collected in 1994 (Appendix II, III). Of the total numbers collected, the numbers collected in bait traps were: 321 individuals representing 15 species in 1993 and 660 individuals representing 17 species in 1994 (Appendix III). The numbers of individuals of each species and the date of collection has been recorded (Appendix IV).

The single dominant butterfly species for each flight period is given and the three dominant species of the entire collection period are given for each site for 1993 (Table 4) and 1994 (Table 5). The five year old sites were dominated by species such as *Boloria bellona* (Fabricius), *Speyeria aphrodite* (Fabricius) and *Cercyonis pegala* (Fabricius). The dominant species found in the 15 year old sites included species such as *C. pegala, S. aphrodite, Limenitis arthemis* (Drury) and *Colias interior* Scudder. In the 25 year old stands, species which prefer forested habitat such as *Enodia anthedon* (A. H. Clark) and *Nymphalis antiopa* (Linnaeus) were the most abundant species collected. The 40 year old stands are characterized by a decrease in the numbers of open habitat species and are dominated by forest inhabiting species such as *Enodia anthedon, Polygonia faunus* (W. H. Edwards) and *Celastrina argiolus* (Linnaeus). In 1994, *Oeneis macounii* (W. H. Edwards) was abundant in the three older age classes.

In 1993, type of regeneration ($F_{1,7} = 0.968$), stand age ($F_{3,7} = 4.244$) and the interaction of the two ($F_{3,7} = 0.437$) had no significant effect on the mean number of butterflies per site. The number of butterflies collected peaked in the 25 year old sites for both planted and natural stands (Figure 21). Similarly, in 1994 none of type of regeneration ($F_{1,7} = 0.078$), stand age ($F_{3,7} = 3.188$) and the interaction of the two ($F_{3,7} = 0.308$) were found to be significant when tested by analysis of variance. As in 1993, the number of butterflies collected in 1994 peaked in the 25 year old age class (Figure 22).

Stand age ($F_{3,7} = 5.152$; $P < 0.05$) was found to have a significant effect on the mean number of species per site in 1993. The number of species collected in 1993 peaked in the 15 year old sites for the planted stands and in the 25 year old stands for the natural sites but neither type of regeneration ($F_{1,7} = 0.222$) nor its interaction with stand age ($F_{3,7} = 1.525$) was significant (Figure 23). In 1994, neither the type of regeneration ($F_{1,7} = 0.840$), stand age ($F_{3,7} = 3.706$) nor the interaction of the two ($F_{3,7} = 0.855$) had a significant effect on the mean number of species per site. The same trend was observed in 1994, with number of species peaking in the 15 year old stands for the planted sites, and later in the 25 year old stands for the natural sites (Figure 24).

Butterfly α diversity

Alpha diversity, as indicated by the log series alpha, peaked in the 15 year age class for the planted stands and peaked in the 25 year age class for the natural sites (Figure 27). The natural stands in the five year old age class had much higher values for the log series α

than did the planted stands. The 40 year old sites were quite similar in their values. An analysis of variance of the log series α index for butterflies in 1993 indicated that type of regeneration ($F_{1,7} = 6.533$; $P < 0.05$) and the interaction of treatment type and stand age ($F_{3,7} = 8.548$; $P < 0.01$) were statistically significant, but stand age ($F_{3,7} = 2.205$) was not. In 1994, none of type of regeneration ($F_{1,7} = 0.575$), stand age ($F_{3,7} = 1.691$) nor the interaction of the two ($F_{3,7} = 1.143$) were significant. As with 1993, the log series α index for butterflies collected in 1994 peaked in the 15 year age class for the planted sites and in the 25 year age class for the natural sites (Figure 28). Both the five year old sites and the 40 year old sites had quite similar values of α diversity. In both years the 15 and 25 year old replicates within each treatment type were quite variable.

In 1993, type of regeneration had a significant effect on the Berger Parker index of dominance in both the first ($F_{1,7} = 7.115$; $P < 0.05$) and second ($F_{1,7} = 5.824$; $P < 0.05$) flight periods. The degree of dominance peaked in the 15 year old natural stands and in the 25 year old planted stands. Planted stands exhibited a greater degree of variability between replicates. Butterflies from the second flight period exhibited a greater degree of dominance than did the butterflies from the first flight period (Figure 25). In 1994, none of treatment type ($F_{1,7} = 0.512$), stand age ($F_{3,7} = 0.492$) nor the interaction of treatment type and stand age ($F_{3,7} = 0.823$) were statistically significant. Similar to 1993, the butterflies from the second flight period exhibited a greater degree of dominance. The planted stands were more variable than the natural stands between replicates (Fig. 26).

Butterfly β diversity

In 1993, a paired t-test of Kendall's τ showed that planted stands and natural stands did not significantly differ ($t = 1.363$; d.f. = 2) in degree of similarity between replicates (Fig. 29). In 1994, planted stands had a greater degree of similarity between replicates ($t = -5.057$; d.f. = 2; $P < 0.05$) than did natural stands, and thus plantations were significantly lower in beta diversity than naturally regenerated stands (Fig. 30).

When natural and planted stand replicates were compared using Sørenson's coefficient of similarity, planted and natural stands did not significantly differ in either 1993 ($t=1.362$; d.f. = 2) (Fig. 31) or in 1994 ($t=1.605$; d.f. = 2) (Fig. 32).

Ordination analysis of butterfly species

Correspondence Analysis. In 1993, the Correspondence Analysis of the most common butterfly species in the sites produced an ordination diagram in which the combined eigenvalue of the first two axes was 0.404, which explained 36.0 % of the variation in the data set (Fig. 33). The five year old sites are separated from the remainder of the sites, and are strongly correlated with the positive end of axis 1. The eigenvector elements of open habitat butterfly species such as *Euchloe ausonides* (Lucas) and *C. pegala* have a strong positive correlation with axis 1 and were the main butterfly species responsible for dictating the distribution of the five year old sites at the positive end of the first axis. The 15 year old sites were separated from the remainder of the older sites, however the 25 and 40 year old sites were largely clustered together.

As a result of the clustering, the five year old sites were discarded and an ordination was performed on the remaining age classes. Species used in this ordination were the more abundant species collected (number of each species collected > 1% of the total number of butterflies collected). The resulting ordination diagram was produced in which the combined eigenvalue of the first two axes was 0.258, which explained 51.4% of the total variation around the axes (Figure 34). Axis 1 separated the sites on the basis of stand age with the younger sites located on the positive end of axis 1 and the older sites associated with the negative end of axis 1. Axis 2 separated the sites also on the basis of stand age with the older sites at the negative end of axis 2 and the younger sites associated with the positive end. One exception is the placement of B15A, which is closely positioned to the 40 year old sites. This may be due to the high density of trees in the site, giving a stronger degree of canopy closure than the other 15 year old sites.

In 1994, an ordination diagram was produced in which the combined eigenvalue of the first two axes was 0.406, which explained 41.9 % of the total variation around the axes (Fig. 35). As with 1993, the five year old sites were again separated off from the rest of the age groups. The eigenvectors of some the butterfly species characteristic of open habitats such as *Nymphalis milberti* (Godart), *Erynnis icelus* (Scudder & Burgess) and *C. pegala* are associated strongly with the negative end of axis 1 and were the main butterfly species responsible for dictating the distribution of the 5 year old sites at the negative end of the first axis.

The five year old sites were discarded from the 1994 data set and an ordination was performed on the remaining age classes. In the resulting ordination diagram, the combined eigenvalue of the first two axes was 0.302, which explained 62.2% of the total variation around the axes (Figure 36). Axis 1 separated the sites on the degree of light intensity. Strongly associated with the positive end of axis 1 were the darkest sites, P25A and B40A. These sites were associated with butterfly species which prefer darker habitats such as *C. argiolus* and *E. anthedon*. The younger, open sites were associated with the negative end of axis 1. Their placement at this end of the axis was dictated by butterfly species associated with more open habitats, such as *C. pegala* and *C. interior*.

Canonical Correspondence Analysis - Butterflies with their foodplants. Canonical correspondence analysis (CCA) was performed on a number of butterfly species and several vegetation species. The vegetation species were selected in a two step process. The first step involved using the forward selection procedure in CANOCO. The second process involved the production of several ordination diagrams of butterfly species with their respective food plants. From these processes, vegetation species were selected to produce a CCA diagram. Only the three older age classes were used. An ordination diagram was produced in which the combined eigenvalue of the first two ordination axes was 0.272 which explained 51.2% of the variance around the axes (Figure 37). Both butterfly species and vegetation species were responsible for site placement. At the positive end of axis 1 were the 15 year old sites. Species in CA ordinations that were associated with younger sites are again responsible for the placement of the younger sites. These species include *C. interior*, *C. pegala* and *P. batesii*. Similarly, the grass *O. pungens* is associated with the younger sites. At the negative end of axis 1 are the two 25 year old planted sites. The very high degree of dominance of a single species, *E.*

anthedon, is responsible for their location in the ordination diagram. The 40 year old sites and the 25 year old natural stands are intermediate along axis 1 as they were not strongly dominated by any of the species more common in the younger sites. In all the ordinations performed, certain butterfly species were associated with their food plants. For example, *C. interior* is associated with its foodplant, *V. angustifolium*. Other species, such as *E. martialis* was not usually strongly associated with its host plant, *C. ovatus*.

The data from 1994 produced an ordination diagram in which the combined eigenvalue of the first two ordination axes was 0.354 which explained 59.2% of the variance around the axes (Figure 38). The distribution of sites and species was similar to that observed in 1993 with the sites being separated on the basis of degree of openness. The species distribution pattern was much the same as that observed in 1993.

Canonical Correspondence Analysis - Butterflies and environmental variables. Canonical Correspondence Analysis of butterfly species with environmental variables produced an ordination with a high degree of covariability among the environmental variables. Forward selection was used to determine which of the environmental variables were most important in explaining the trends in the vegetation data. Monte Carlo testing of the environmental variables determined that only mean light intensity was significant. The use of only one environmental variable results in an ordination diagram in which all sites are aligned along axis 1. To increase the dimensionality, a second environmental variable, mean tree density (100 m^2), was added.

In the CCA diagram of 1993 butterfly species and the two environmental variables, mean light intensity and coefficient of variation of light intensity, the first two axes accounted for 30.0% of the variation in the species data (Figure 39). In 1994, the first two axes accounted for 30.7% of the variance (Figure 40). The arrangement of the sites and butterfly species was very similar to the CA ordination diagrams. The trend was for the young, open sites to be strongly associated with higher values of mean light intensity, while the more closed, older forest sites were associated with the opposite end of the axis. One exception was the placement of the site B15A, which was very strongly associated with mean tree density. The placement of this site may be attributed to the very high tree density within the site (Table 2).

Moths

Number of moth species and number of individuals collected

A total 233 species were collected during the course of the study;193 species were collected in 1993 and 206 species were collected in 1994 (Appendix V). All individuals collected were collected from the light traps. The numbers of individuals of each species and the date of collection has been recorded (Appendix VI).

The three dominant moth species of the entire collection period are given for each site for 1993 and 1994 (Table 8). The five year old sites were dominated by species such as *Enargia decolor* (Walker) and species in the genus *Abagrotis*. The dominant species in the 15 year old sites included *Eulithis explanata* (Walker), *Itame occiduaria* (Packard) and *Nycteola frigidana* (Walker). In the 25 year old sites the dominant species included those found in the 15 year old sites and *Caripeta angustiorata* Walker. In the 40 year old age class, the most abundant species included those found in the 25 year age class, although *N. frigidana* was less prevalent. Species such as *N. frigidana* and members of the genus *Itame* are common to all age classes (Table 8).

In 1993, neither type of regeneration ($F_{1,7} = 0.282$) nor the interaction of regeneration type with stand age ($F_{3,7} = 0.722$) were significant, but stand age ($F_{3,7} = 7.521$; $P < 0.05$) had a significant effect on the mean number of moths collected per site. In general, the mean number of moths increased with an increase in stand age, peaking in the 40 year age class (Fig. 41). The same general trend was observed in 1994, except that the number of moths peaked in the 25 year old sites in the natural stands rather than the 40 year old sites as was the case in 1993. The number of moths collected in the planted stands peaked in the 40 year age class in 1994 as it did in 1993 (Fig. 42). All of regeneration type ($F_{1,7} = 8.756$; $P < 0.05$), stand age ($F_{3,7} = 19.544$; $P < 0.001$) and the interaction term ($F_{3,7} = 6.096$; $P < 0.05$) were significant for the mean number of moths collected in 1994.

The mean number of species of moths collected in 1993 and 1994 showed the same trends as were observed for the mean number of moth individuals. Planted stands peaked in the 40 year age class in both years, the natural stands peaked in the 40 year age class in 1993 and in the 25 year age class in 1994 (Figs. 43, 44). In 1993, only stand age ($F_{3,7} = 11.322$; $P < 0.01$) had a significant effect on mean number of moth species, and type of regeneration ($F_{1,7} = 0.040$) and the interaction term ($F_{3,7} = 0.215$) were not significant. In 1994, all of type of regeneration($F_{1,7} = 18.361$; $P < 0.01$), stand age ($F_{3,7} = 72.178$; $P < 0.001$) and the interaction term ($F_{3,7} = 10.948$; $P < 0.01$) had a significant effect on the mean number of moth species.

Moth α diversity

An analysis of variance of the log series α for moths in 1993 indicated that stand age ($F_{3,7} = 4.736$; $p < 0.05$) was statistically significant, but neither regeneration type ($F_{1,7} = 0.243$) nor the interaction term ($F_{3,7} = 0.407$) were. Log series α values for natural stands peaked in the 25 year age class, while in the planted stands, log series α values peaked in the 40 year age class (Fig. 46). In general, there was an increase in α diversity with an increase in age in 1993. The replicates within each treatment type / age class were quite variable. In 1994, all of regeneration type ($F_{1,7} = 7.817$; $P < 0.05$), stand age ($F_{3,7} = 27.395$; $P < 0.001$) and the interaction term ($F_{3,7} = 6.367$; $P < 0.05$) were significant. Alpha diversity values for natural stands increased with increasing age (Fig. 47). The values for the natural stands were quite variable in the 25 year age class but were stable in the other age classes. The planted stands showed the same general trend, but the α values dropped in the 25 year age class before peaking in the 40 year age class. The planted stands were more variable than the natural stands in all but the 25 year age class.

In 1993, none of type of regeneration ($F_{1,7} = 5.047$), stand age ($F_{3,7} = 1.781$) nor the interaction of the two ($F_{3,7} = 2.711$) had a significant effect on the Berger Parker index of dominance. The planted stands exhibited a higher degree of dominance than was observed in the natural stands in all but the youngest age class. The degree of dominance was fairly uniform across all age classes (Figure 45). In 1994, only stand age ($F_{3,7} = 17.890$; $P < 0.001$) was statistically significant. Neither type of regeneration ($F_{1,7} = 0.968$)

nor the interaction of the two ($F_{3,7} = 1.035$) was significant. Both planted and naturally regenerated stands exhibited a similar degree of dominance. The level of dominance peaked in the five year old stands and decreased with increasing stand age (Figure 45).

Moth β diversity

In 1993, a paired t-test of Kendall's τ showed that there was no significant difference between planted and natural stands ($t = 0.422$; d.f. = 2) (Fig. 48). Planted and natural stands did not differ significantly in 1994 ($t = -1.183$; d.f. = 2), however, the 25 and 40 year old planted stands were much more similar than were the natural stands (Fig. 49).

When Sørenson's coefficient was used to determine the degree of similarity between replicates, no significant difference ($t = 0.688$; d.f. = 2) was observed between planted and natural stands in 1993 and the amount of difference between planted and natural stands was less than that observed when Kendall's τ was used (Fig. 50). In 1994, again there was no significant difference between planted and natural stands ($t = -0.375$; d.f. = 2). As with 1993, the planted and natural stands differed less in degree of similarity than when calculated with Kendall's τ (Fig. 51).

Ordination analysis of moth species

Correspondence analysis. In 1993, the Correspondence Analysis of the most common moth species in the sites produced an ordination diagram in which the combined eigenvalue of the first two axes was 0.54 and thus explained 27.2 % of the variation around the axes (Fig. 52). As with the ordination diagrams of the vegetation species and the butterflies, the five year old sites are separated from the rest of the age classes. The eigenvector elements of some of the moth species which prefer open habitats such as *Leucania commoides*, *Apamaea commoda* (Walker) and *Rhyncagrotis anchocelioides* (Guenée) have a strong positive correlation to axis 1 and were responsible for dictating the distribution of the 5 year old sites at the positive end of the first axis.

The five year old sites were removed and an ordination was performed on the most abundant moth species of the remaining age classes (number of each species collected > 1% of the total number of moths collected). An ordination diagram was produced in which the combined eigenvalues of the first two axes was 0.225 which explained 60.6% of the ordinates' variance around the axes (Figure 53). Axis 1 separated the sites on the basis of age. The younger sites are correlated with the positive end of axis 1 and the older sites are correlated with the negative end.

In 1994, the ordination diagram was similar to that of the previous year. The first two axes had a combined eigenvalue of 0.441 which explained 26.9 % of the ordinates' variation around the axes (Fig. 54). The five year old sites were again separated from the remaining age classes and the positive end of axis 1. The eigenvectors of open habitat moth species such as *Xylomyges dolosa* Grote, *Sicya macularia* (Harris), *Caenurgina crassiuscula* (Haworth), and *Amathes collaris* (Grote & Robinson) have a strong positive correlation to axis 1 and were the main moth species responsible for dictating the distribution of the 5 year old sites at the positive end of the first axis.

Again, the five year old sites were removed and an ordination was performed on the remaining age classes. An ordination diagram was produced in which the combined eigenvalue of the first two axes was 0.164 which explained 54.6% of the ordinates' variance around the axes (Figure 55). Axis 1 separated the sites on the basis of age. The younger sites are correlated with the positive end of axis 1 and the older sites are correlated with the negative end.

Canonical Correspondence Analysis - Moths with their foodplants

An ordination was performed on a number of monophagous and polyphagous moth species and their respective foodplants. Only the three older age classes were used. An ordination diagram was produced in which the combined eigenvalue of the first two ordination axes was 0.226 which explained 56.0% of the ordinates' variance around the axes (Figure 56). Both moth species and vegetation species were responsible for site placement. Axis 1 separated the sites primarily on the basis of age, with the younger sites correlated with the positive end of the axis. Axis 2 separated the sites on the basis of degree of openness, the darker sites most strongly correlated with the positive end of the axis. As was the case with the butterflies, moth species tend to be placed in the same region as their foodplants in the ordination diagram. For example *Clemensia albata* Packard, which is more commonly found in forest sites of intermediate to older ages, is strongly associated with its foodplants, the lichens in the genus *Cladina*. From other ordinations, it was observed that this was not always the case for all moth species, as is exemplified by *Euchlaena obtusaria* (Hübner) which was not strongly associated with its food plant, *Rosa acicularis* Lindl..

An ordination diagram of the 1994 data, in which the combined eigenvalue of the first two axes was 0.125, which explained 43.6% of the variance around the axes (Figure 57). The distribution of sites and species was similar to that observed in 1993 with the sites being separated on the basis of degree of openness. The species distribution pattern was much the same as that observed in 1993.

Canonical Correspondence Analysis - Moths and environmental variables.

Canonical Correspondence Analysis (CCA) of moth species with environmental variables produced an ordination with a high degree of covariability among the environmental variables. Forward selection was used to determine which of the environmental variables was mot important in explaining the trends in the vegetation data. Monte Carlo testing of the environmental variables determined that only mean light intensity was significant. The use of only one environmental variable results in an ordination diagram in which all sites are aligned along axis 1. To increase the dimensionality, a second environmental variable, mean tree density, was added.

In the CCA diagram of 1993 moth species and the two environmental variables, mean light intensity and coefficient of variation of light intensity, the first two axes accounted for 21.7% of the variation in the species data (Figure 58). In 1994, the first two axes accounted for 24.8% of the variance (Figure 59). The arrangement of the sites and moth species was very similar to the CA ordination diagrams. The trend was for the more open sites to be strongly correlated with the positive end of axis 1, while the more closed, older forest sites were placed at the negative end of axis 1.

Table 1. Site description, location, plantation size and soil series.

Site	Type of Regeneration	Age Class (Years)	Section Township Range	Year of Fire or	Plantation Size (ha)	Soil Type* (series or complex)
B5A	Natural	5	NW 24-5-10E	1987	N/A	Sandilands-Woodridge
B5B	Natural	5	NW 15-5-10E	1987	N/A	Sandilands
P5A	Planted	5	SW 28-5-10E	1989	4	Sandilands
P5B	Planted	5	SW 16-5-10E	1989	6	Sandilands
B15A	Natural	15	SW 13-4-10E	1974	N/A	Sandilands-Woodridge
P15A	Planted	15	SE 24-6-10E	1978	11	Sandilands and shallow peat
P15B	Planted	15	NE 26-4-9E	1976	8	Sandilands-Woodridge
B25A	Natural	25	NE 23-4-10E	1964	N/A	Sandilands-Woodridge
B25B	Natural	25	SE 23-4-9E	1963	N/A	Woodridge
P25A	Planted	25	NE 3-5-9E	1965†	16	Woodridge
P25B	Planted	25	SW 36-4-9E	1964†	25	Sandilands
B40A	Natural	40	NE 22-3-12E	1946	N/A	Woodridge-Lonesand-Kerry
B40B	Natural	40	NW 13-4-10E	1952	N/A	Woodridge
P40A	Planted	40	SE 16-4-10E	1952	10	Sandilands
P40B	Planted	40	NW 32-4-11E	1952	8	Woodridge

* Soil descritions are from the Manitoba Soil Survey (Smith *et al.*, 1964)

† Indicates sites were partially replanted at a later date.

Table 2. Maximum, minimum, daytime and night time mean temperatures* (°C).

Site	Age Class (Years)	Type of Regeneration	Maximum Temperature	Minimum Temperature	Mean Daytime Temperature†	Mean Nighttime Temperature**
B5B	5	Natural	38.0	-9.7	17.0	11.6
P5B	5	Planted	36.3	-10.2	16.4	10.4
B15A	15	Natural	37.9	-6.8	17.4	11.7
P15B	15	Planted	38.8	-10.2	19.0	11.3
B25A	25	Natural	42.6	-6.8	17.6	11.6
P25B	25	Planted	39.2	-7.8	18.2	12.3
B40B	40	Natural	37.9	-5.9	19.4	12.7
P40A	40	Planted	38.3	-6.9	17.1	11.7

*** Temperatures were recorded from 25 April to 23 July, 1995.**

† Daytime is defined as the period from 06:00 h to 18:00 h.

****Night time is defined as the period from 18:00 h to 06:00 h.**

Table 3. **Light intensity, tree density and dominant ground vegetation within the study sites.**

Site	Mean Light Intensity (Lux)	CV(x) Light Intensity**	Mean Tree Density (/100m^2)	CV(x) Tree Density**	Dominant Ground Vegetation
B5A	106440	0.246	35.4	0.817	*Andropogon gerardi* *Antennaria neodioica* *Koeleria gracilis*
B5B	114000	0.000	32.3	0.709	*Andropogon gerardi* *Vaccinium angustifolium* *Arctostaphylos uva-ursi*
P5A	114000	0.000	12.8	0.463	*Koeleria gracilis* *Andropogon gerardi* *Carex pensylvanica*
P5B	114000	0.000	24.4	0.507	*Oryzopsis pungens* *Calamovilfa longifolia* *Andropogon gerardi*
B15A	45024	0.868	61.9	0.473	*Vaccinium angustifolium* *Cladina* spp. *Oryzopsis pungens*
P15A	63567	0.607	14.2	0.271	*Vaccinium angustifolium* *Cladina* spp. *Oryzopsis pungens*
P15B	86040	0.455	12.0	0.583	*Andropogon gerardi* *Amorpha canescens* *Fragaria virginiana*
B25A	85440	2.547	29.0	0.444	*Cladina* spp. *Vaccinium angustifolium* *Pleurozium schreberi*
B25B	53600	0.771	12.9	0.766	*Arctostaphylos uva-ursi* *Andropogon gerardi* *Pleurozium schreberi*
P25A	20280	0.906	22.8	0.237	*Vaccinium angustifolium* *Andropogon gerardi* *Anemone nemorosa*
P25B	64120	0.674	12.2	0.390	*Symphoricarpos albus* *Andropogon gerardi* *Arctostaphylos uva-ursi*
B40A	31868	1.115	18.6	0.217	*Pleurozium schreberi* *Oryzopsis asperifolia* *Pteridium aquilinum*
B40B	32960	0.972	14.3	0.289	*Pleurozium schreberi* *Maianthemum canadense* *Vaccinium angustifolium*
P40A	42560	0.804	17.0	0.344	*Pleurozium schreberi* *Oryzopsis asperifolia* *Vaccinium angustifolium*
P40B	35606	0.730	11.9	0.420	*Cladina* spp. *Pleurozium schreberi* *Maianthemum canadense*

** CV(x)=SD/Mean

Table 4. **Dominant Butterfly and Skipper Species for 1993.**

Site	Type of Regeneration	Dominant Butterfly Species First Flight Period*	Dominant Butterfly Species Second Flight Period†	Dominant Butterfly Species
B5A	Natural	*Boloria bellona*	*Speyeria aphrodite*	*Boloria bellona* *Speyeria aphrodite* *Cercyonis pegala*
B5B	Natural	*Boloria bellona*	*Speyeria aphrodite*	*Boloria bellona* *Speyeria aphrodite* *Cercyonis pegala*
P5A	Planted	*Euchloe ausonides*	*Cercyonis pegala*	*Cercyonis pegala* *Euchloe ausonides* *Boloria bellona*
P5B	Planted	*Boloria bellona*	*Cercyonis pegala*	*Cercyonis pegala* *Colias interior* *Boloria bellona*
B15A	Natural	*Boloria bellona*	*Colias interior*	*Colias interior* *Phyciodes batesii* *Boloria bellona*
P15A	Planted	*Boloria bellona*	*Colias interior*	*Colias interior* *Speyeria aphrodite* *Cercyonis pegala*
P15B	Planted	*Euchloe ausonides*	*Cercyonis pegala*	*Euchloe ausonides* *Cercyonis pegala* *Speyeria aphrodite*
B25A	Natural	*Callophrys polios*	*Colias interior*	*Colias interior* *Callophrys polios* *Boloria bellona*
B25B	Natural	*Callophrys polios*	*Colias interior*	*Colias interior* *Callophrys polios* *Enodia anthedon*
P25A	Planted	*Celastrina argiolus*	*Enodia anthedon*	*Enodia anthedon* *Celastrina argiolus* *Satyrium liparops*
P25B	Planted	*Poanes hobomok*	*Enodia anthedon*	*Enodia anthedon* *Limenitis arthemis* *Poanes hobomok*
B40A	Natural	*Glaucopsyche lygdamus*	*Enodia anthedon*	*Enodia anthedon* *Limenitis arthemis* *Glaucopsyche lygdamus*
B40B	Natural	*Poanes hobomok*	*Colias interior*	*Colias interior* *Poanes hobomok* *Callophrys polios*
P40A	Planted	*Amblyscirtes vialis*	*Enodia anthedon*	*Enodia anthedon* *Colias interior* *Amblyscirtes vialis*
P40B	Planted	*Glaucopsyche lygdamus*	*Enodia anthedon*	*Enodia anthedon* *Glaucopsyche lygdamus* *Colias interior*

* First flight period is from week one to week eleven as defined in Appendix III.

† Second flight period is from week twelve to week twenty-two as defined in Appendix III.

Table 5. Dominant Butterfly and Skipper Species for 1994.

Site	Type of Regeneration	Dominant Butterfly Species First Flight Period*	Dominant Butterfly Species Second Flight Period†	Dominant Butterfly Species
B5A	Natural	*Boloria bellona*	*Speyeria aphrodite*	*Speyeria aphrodite* *Colias interior* *Nymphalis milberti*
B5B	Natural	*Boloria bellona*	*Speyeria aphrodite*	*Speyeria aphrodite* *Cercyonis pegala* *Colias interior*
P5A	Planted	*Boloria bellona*	*Cercyonis pegala*	*Cercyonis pegala* *Pieris rapae* *Boloria bellona*
P5B	Planted	*Boloria bellona*	*Cercyonis pegala*	*Cercyonis pegala* *Boloria bellona* *Pieris rapae*
B15A	Natural	*Boloria bellona*	*Colias interior*	*Colias interior* *Speyeria aphrodite* *Boloria bellona*
P15A	Planted	*Oeneis macounii*	*Colias interior*	*Colias interior* *Oeneis macounii* *Callophrys polios*
P15B	Planted	*Boloria bellona*	*Limenitis arthemis*	*Limenitis arthemis* *Speyeria aphrodite* *Cercyonis pegala*
B25A	Natural	*Boloria bellona*	*Colias interior*	*Colias interior* *Boloria bellona* *Callophrys polios*
B25B	Natural	*Oeneis macounii*	*Limenitis arthemis*	*Limenitis arthemis* *Enodia anthedon* *Oeneis macounii*
P25A	Planted	*Celastrina argiolus*	*Enodia anthedon*	*Enodia anthedon* *Limenitis arthemis* *Celastrina argiolus*
P25B	Planted	*Boloria bellona*	*Enodia anthedon*	*Enodia anthedon* *Limenitis arthemis* *Speyeria cybele*
B40A	Natural	*Oeneis macounii*	*Enodia anthedon*	*Enodia anthedon* *Limenitis arthemis* *Oeneis macounii*
B40B	Natural	*Oeneis macounii*	*Enodia anthedon*	*Enodia anthedon* *Colias interior* *Oeneis macounii*
P40A	Planted	*Oeneis macounii*	*Enodia anthedon*	*Enodia anthedon* *Oeneis macounii* *Colias interior*
P40B	Planted	*Oeneis macounii*	*Colias interior*	*Oeneis macounii* *Colias interior* *Callophrys interior*

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* First flight period is from week one to week eleven as defined in Appendix III.

† Second flight period is from week twelve to week twenty-two as defined in Appendix III.

Table 6. Butterfly and skipper species distribution by family within all sites (1993 and 1994).

Family	Year	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B
Hesperiidae	1993	10.5	0	0	0	3.1	8.9	3.8	1.8	10.5	1.1	4.3	4.4	17.5	8.9	6.3
	1994	6.6	0	4.4	0	2.6	6.7	0.5	3.5	5.2	1.5	5.7	8.5	2.7	6.4	1.9
Papilionidae	1993	0	0	0	0	1.6	0	1.3	0	0.8	0	0	2.2	2.5	0	6.3
	1994	0	0	0	0	0	0	0	1.8	0.6	0	0	0	0.7	0	0
Pieridae	1993	10.5	14.3	6.3	28.0	45.3	33.3	26.9	31.6	18.1	1.1	3.8	6.7	37.5	8.9	16.7
	1994	29.5	28.6	24.4	27.0	49.7	29.8	4.7	35.9	8.4	0	10.5	8.5	25.3	6.4	18.5
Lycaenidae	1993	10.5	28.6	0	4.0	9.4	15.6	11.5	31.6	22.6	9.8	8.1	20.0	20.0	6.4	33.3
	1994	11.5	0	0	8.1	9.2	16.3	4.2	12.2	9.4	1.5	6.7	5.0	7.8	8.8	14.8
Nymphalidae	1993	57.8	50.0	12.5	24.0	40.6	31.1	30.8	19.3	22.6	8.7	15.4	40.0	32.5	16.7	37.5
	1994	44.3	50.0	20.0	35.0	33.3	26.9	78.8	28.9	51.9	1.8	44.8	14.9	28.0	13.6	18.5
Satyridae	1993	10.5	7.1	81.3	36.0	1.6	11.1	17.9	8.8	10.5	79.3	68.8	22.2	7.5	58.9	18.8
	1994	6.6	21.4	51.1	27.0	3.9	15.4	11.4	18.4	22.4	95.2	31.4	62.4	34.9	64.8	42.6
Danaidae	1993	0	0	0	0	0	0	2.6	0	0	0	0.5	0	0	0	0
	1994	0	0	0	0	0	1.0	0.2	0	1.0	0	1.0	0	0	0	0

Table 7. **Butterfly and skipper species distribution by feeding strategy within all sites (1993 and 1994).**

Feeding Strategy	Year	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B
Generalist*	1993	36.8	21.4	93.8	48.0	18.8	31.1	64.1	35.1	50.4	92.4	85.5	66.7	50.0	76.9	64.5
Specialist†	1993	63.2	78.6	6.2	52.0	81.2	68.9	35.9	64.9	49.6	7.6	14.5	33.3	50.0	23.1	35.5
Generalist*	1994	37.7	46.4	77.8	48.6	17.0	39.4	66.0	39.5	78.2	98.1	57.6	93.6	50.7	84.0	64.8
Specialist†	1994	62.3	53.6	22.2	51.4	83.0	60.6	34.0	60.5	21.8	1.9	42.3	6.4	49.3	16.0	35.2

* Generalist species is one that feeds on a wide variety of host plants

† Specialist species is one that feeds on a limited range of closely related host plants (one or two species of host)

Table 8. Dominant Moth Species for 1993 and 1994.

Site	Type of Regeneration	Age Class (Years)	Dominant Moth Species 1993	Dominant Moth Species 1994
B5A	Natural	5	*Enargia decolor* *Abagrotis placida* *Abagrotis alternata*	*Enargia decolor* *Caenurgina crassiuscula* *Nycteola frigidana*
B5B	Natural	5	*Euxoa mimallonis* *Enargia decolor* *Abagrotis alternata*	*Enargia decolor* *Nycteola frigidana* *Itame occiduaria*
P5A	Planted	5	*Enargia decolor* *Anaplectoides pressus* *Nycteola frigidana*	*Enargia decolor* *Itame occiduaria* *Holomelina ferruginosa*
P5B	Planted	5	*Enargia decolor* *Nycteola frigidana* *Itame occiduaria*	*Itame occiduaria* *Enargia decolor* *Nycteola frigidana*
B15A	Natural	15	*Itame occiduaria* *Eulithis explanata* *Nycteola frigidana*	*Eulithis explanata* *Itame occiduaria* *Itame brunneata*
P15A	Planted	15	*Eulithis explanata* *Itame occiduaria* *Platysenta videns*	*Eulithis explanata* *Itame occiduaria* *Nycteola frigidana*
P15B	Planted	15	*Itame occiduaria* *Itame anataria* *Apodrepanulatrix liberaria*	*Itame occiduaria* *Prochoerodes transversata* *Eulithis explanata*
B25A	Natural	25	*Eulithis explanata* *Nycteola frigidana* *Caripeta angustiorata*	*Itame occiduaria* *Eulithis explanata* *Itame brunneata*
B25B	Natural	25	*Nycteola frigidana* *Itame occiduaria* *Caripeta angustiorata*	*Herculia olinalis* *Caripeta angustiorata* *Itame occiduaria*
P25A	Planted	25	*Caripeta angustiorata* *Eulithis explanata* *Nycteola frigidana*	*Eulithis explanata* *Caripeta angustiorata* *Anaplectoides pressus*
P25B	Planted	25	*Apodrepanulatrix liberaria* *Itame occiduaria* *Itame anataria*	*Itame occiduaria* *Eulithis explanata* *Apodrepanulatrix liberaria*
B40A	Natural	40	*Nycteola frigidana* *Eulithis explanata* *Caripeta angustiorata*	*Eulithis explanata* *Cabera erythemaria* *Itame brunneata*
B40B	Natural	40	*Eulithis explanata* *Caripeta angustiorata* *Nycteola frigidana*	*Eulithis explanata* *Itame brunneata* *Itame occiduaria*
P40A	Planted	40	*Eulithis explanata* *Itame occiduaria* *Caripeta angustiorata*	*Itame brunneata* *Eulithis explanata* *Caripeta angustiorata*
P40B	Planted	40	*Eulithis explanata* *Caripeta angustiorata* *Nycteola frigidana*	*Eulithis explanata* *Itame brunneata* *Enargia decolor*

Table 9. Moth species distribution by family within all sites (1993 and 1994).

Family	Year	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B
Oecophoridae	1993	0	0	0	0	1.7	0	0.6	2.5	1.0	0	1.3	0.3	1.3	0.5	0.8
	1994	0	0	0	0	1.0	0	0.4	1.5	0.7	0	0	0	0.6	0	0.1
Tortricidae	1993	0	0	0	0	0	0	0.6	0	0	0	0.5	0	0	0.1	0
	1994	0	5.2	5.7	1.6	3.0	6.8	1.1	1.9	1.8	0	0	0	2.4	0	1.0
Pyralidae	1993	2.6	0	12.5	17.1	0.9	3.8	8.1	0	0.5	0	0.3	0.3	3.6	0.5	0.3
	1994	0	0	0.4	0	0.4	0.5	0.4	0.4	0.5	0.3	0	0	0.2	0.2	0
Thyatiridae	1993	0	0	0	0	0	0	0	0	0.5	0	0	0.3	0	0	0
	1994	0	0	0	0	0	0	0	0.1	0	0	0	0.4	0	0	0
Drepanidae	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0
	1994	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0
Geometridae	1993	7.7	15.6	2.5	18.3	63.5	52.9	54.4	55.5	49.1	56.6	52.6	52.3	55.9	72.5	62.5
	1994	8.1	6.9	18.4	47.6	70.8	48.9	48.7	67.7	39.6	59.3	76.1	87.0	67.5	64.3	56.7
Sphingidae	1993	2.6	0	1.3	1.2	1.3	1.9	0	6.3	0.5	2.0	0	2.3	0.8	1.4	4.0
	1994	0	0	0	0	0.4	0	0.7	0.8	1.5	0	0.3	0.8	0.5	0.3	1.5
Notodontidae	1993	0	0	1.3	0	0.4	0	0	0.4	0	0	0	0	0	0	0.5
	1994	0	0	0	0	0	0	0.4	0.2	0.8	0	0	0.6	0.2	0	0.5
Arctiidae	1993	0	15.6	0	3.7	8.6	5.8	2.5	5.9	1.9	0	3.3	2.6	6.6	4.2	5.4
	1994	0	6.9	3.9	0.8	1.9	3.1	5.0	5.4	3.0	1.8	7.1	1.9	4.4	4.5	5.9
Lymantriidae	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1994	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0
Noctuidae	1993	87.2	68.8	82.5	59.8	23.9	35.6	33.8	29.4	46.7	41.4	42.1	41.8	31.9	20.6	26.5
	1994	91.9	84.5	71.5	49.6	22.6	40.6	43.4	22.0	51.8	38.6	16.5	9.3	24.3	30.6	34.1

Table 10. Moth species distribution by feeding strategy within all sites (1993 and 1994).

Feeding Strategy	Year	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B
Generalist*	1993	84.6	90.6	67.5	81.7	73.4	63.5	69.4	51.7	74.5	73.7	67.2	70.9	70.9	43.0	55.8
Specialist†	1993	15.4	9.4	32.5	18.3	26.6	36.5	30.6	48.3	25.5	26.3	32.8	29.1	29.1	57.0	44.2
Generalist*	1994	87.1	87.1	91.7	82.3	56.6	68.8	70.6	73.7	63.5	47.8	61.8	70.9	71.2	70.7	60.3
Specialist†	1994	12.9	12.9	8.3	17.7	43.4	31.2	29.4	26.3	36.5	52.2	38.2	29.1	28.8	29.3	39.7

* Generalist species is one that feeds on a wide variety of host plants

† Specialist species is one that feeds on a limited range of closely related host plants (one or two species of host)

Figure 1. Location of study sites in the Sandilands Provincial Forest, located in southeastern Manitoba. Sites are represented by (●). Code description for sites may be found in Table 1. (Map obtained from Surveys and Mapping Branch, Department of Energy, Mines and Resources, Ottawa, Canada).

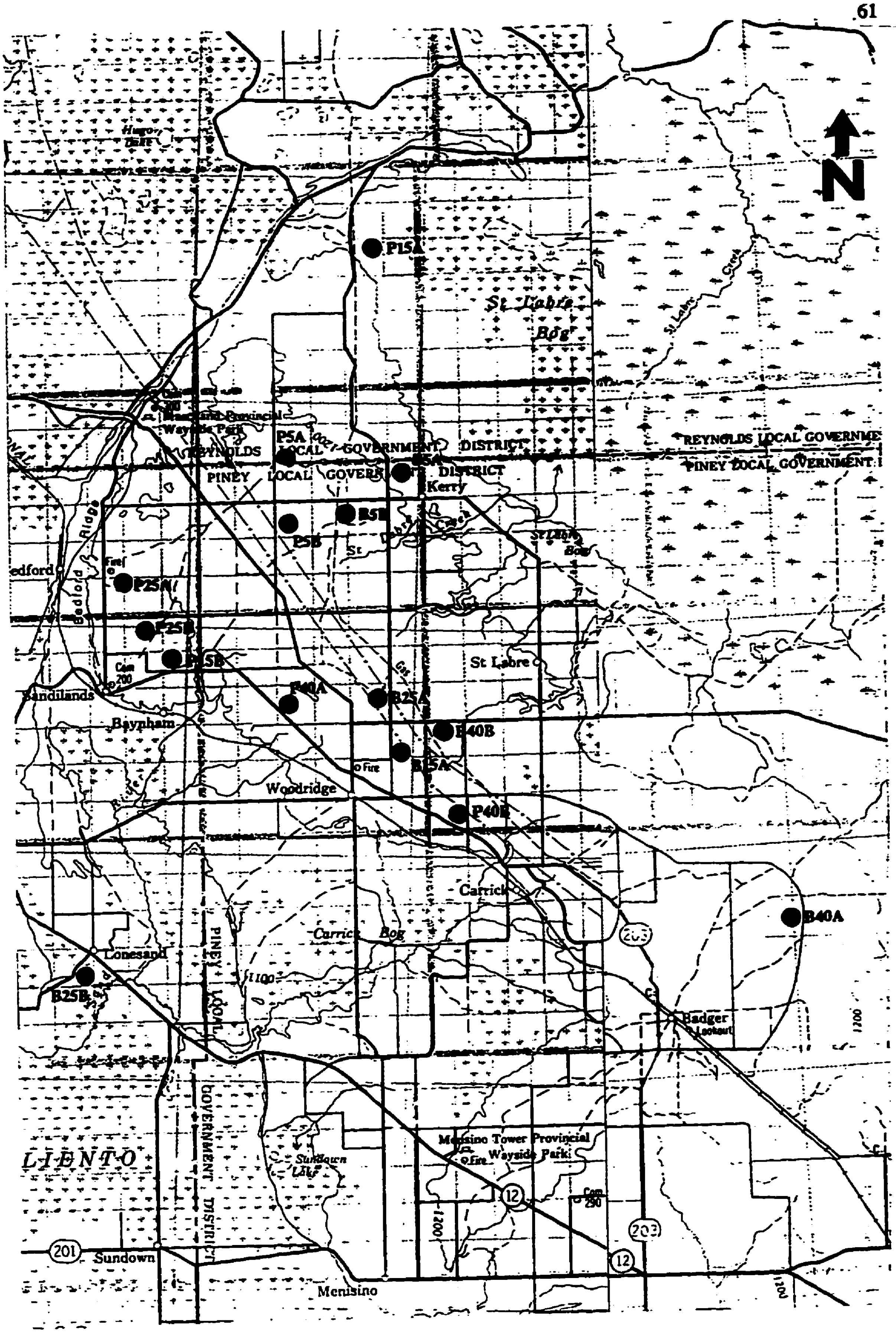

N
Hugo Lake
P15A
St Labre Bog
Sandilands Provincial Wayside Park
P5A
REYNOLDS LOCAL GOVERNMENT DISTRICT
PINEY LOCAL GOVERNMENT DISTRICT
B5A
Kerry
REYNOLDS LOCAL GOVERNME
PINEY LOCAL GOVERNMENT
B5B
P5B
St Labre Bog
Bedford
Ridge
edford
Fire
P25A
P25B
B15B
Com 200
Sandilands
Bayham
St Labre
P40A
B25A
B40B
B15A
Fire
Woodridge
P40B
Carrick
Carrick Bog
205
B40A
Lonesand
B25B
1100
PINEY LOCAL GOVERNMENT DISTRICT
Badger Lookout
1200
LIENTO
Sundown Lake
Menisino Tower Provincial Wayside Park
Fire
12
Com 290
1200
203
201
Sundown
12
Menisino
1200

Figure 2. Schematic representation of light intensity sampling pattern within study plots in the Sandilands Provincial Forest. Each X represents the location within the site where a single measurement of light intensity was taken. The scales represent the dimensions of the one hectare plot and are in ten metre increments. Direction was measured from east to west and north to south.

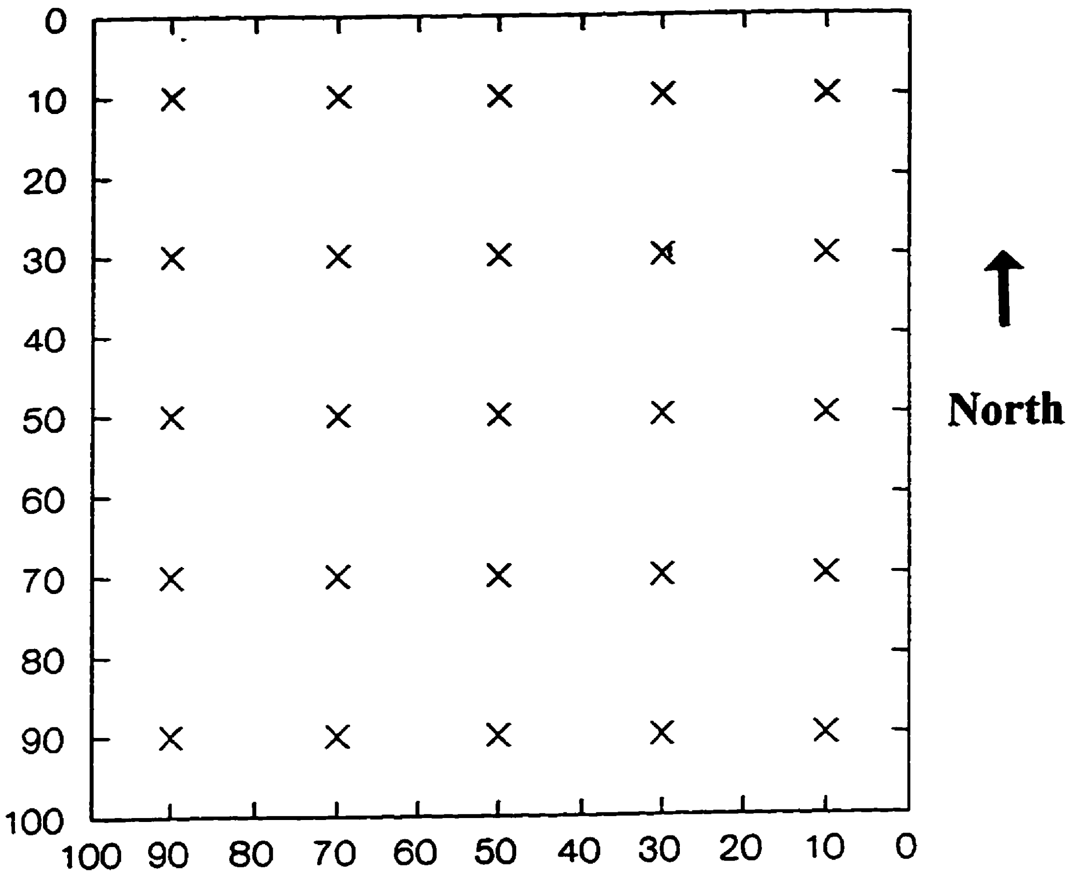

0
10
20
30
40
50
60
70
80
90
100
100
90
80
70
60
50
40
30
20
10
0
North

Figure 3. Schematic diagram of a Luminoc® (Biocom, 1992) light trap used for collection of moths. (Modified from Biocom, 1992)

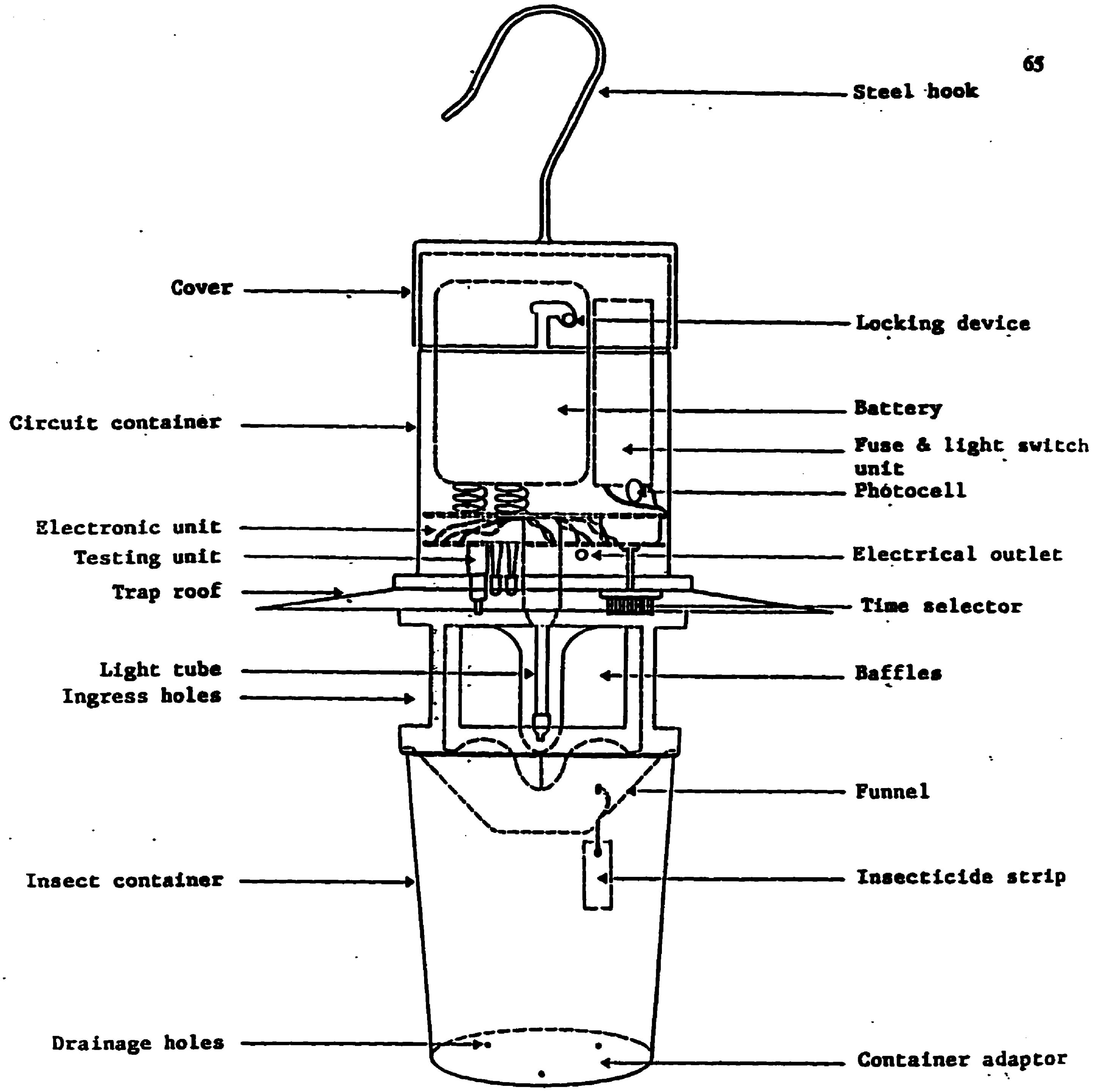

Steel hook
Cover
Locking device
Circuit container
Battery
Fuse & light switch unit
Photocell
Electronic unit
Testing unit
Electrical outlet
Trap roof
Time selector
Light tube
Ingress holes
Baffles
Funnel
Insect container
Insecticide strip
Drainage holes
Container adaptor

Figure 4. Monthly totals of precipitation (mm) in 1993 (▲—) and 1994 (■---) at the Winnipeg International Airport for the months of April through September. Data obtained from Environment Canada monthly summaries.

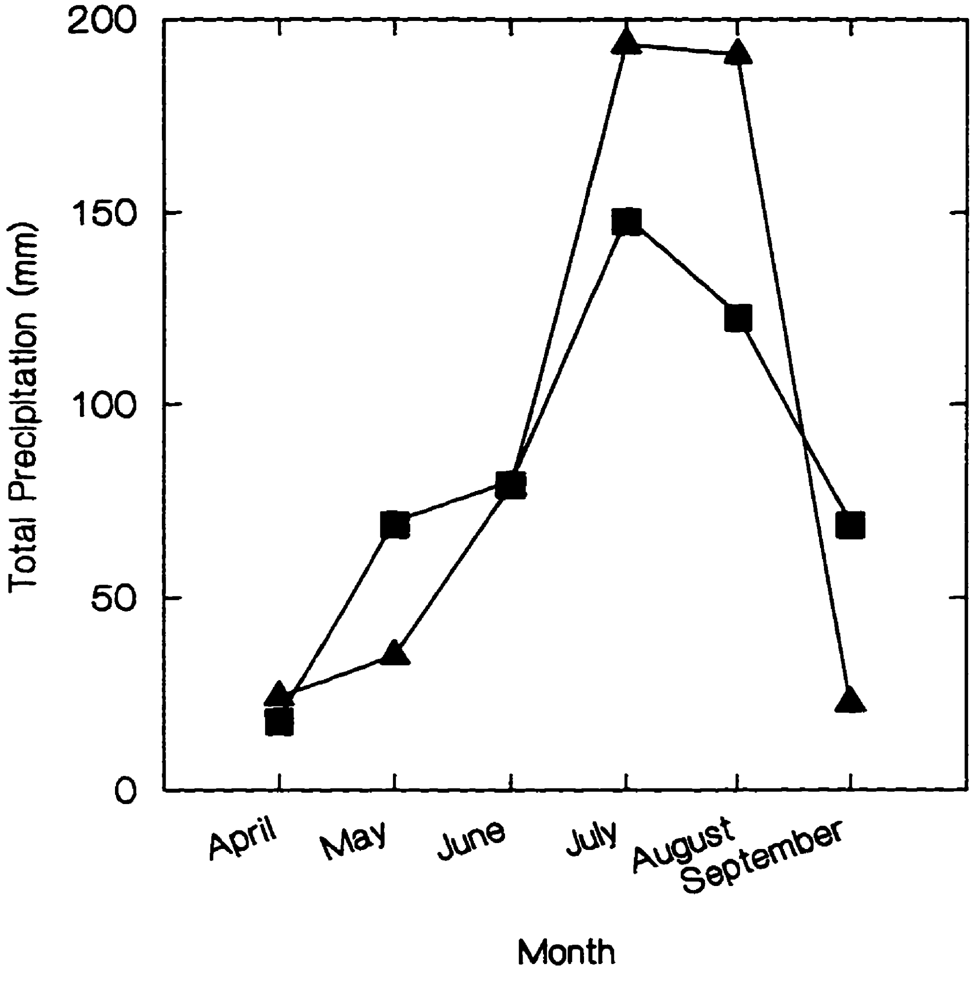

200
150
100
50
0
Total Precipitation (mm)
April
May
June
July
August
September
Month

Figure 5. Monthly totals of bright sunshine (hours) in 1993 (▲—) and 1994 (■---) at the Winnipeg International Airport for the months of April through September.

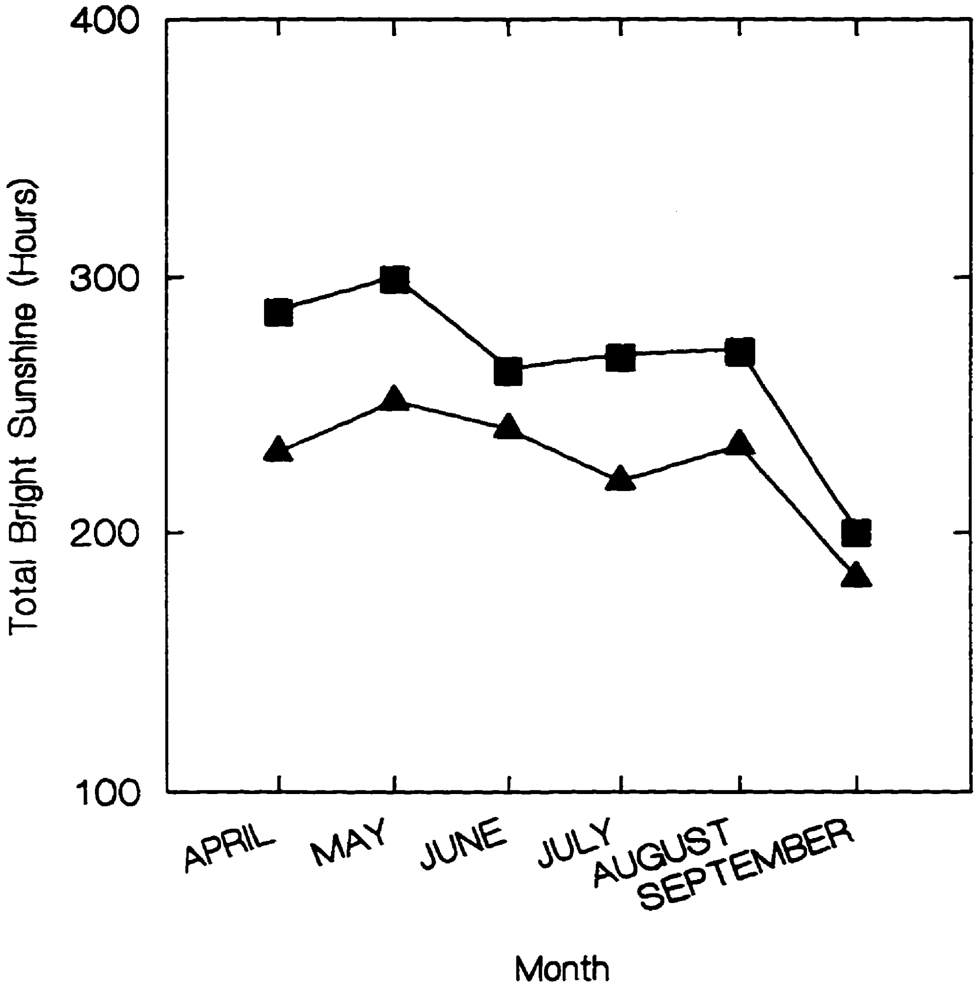

400
300
200
100
Total Bright Sunshine (Hours)
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
Month

Figure 6. Monthly mean temperature (°C) in 1993 (▲—) and 1994 (■---) at the Winnipeg International Airport for the months of April through September.

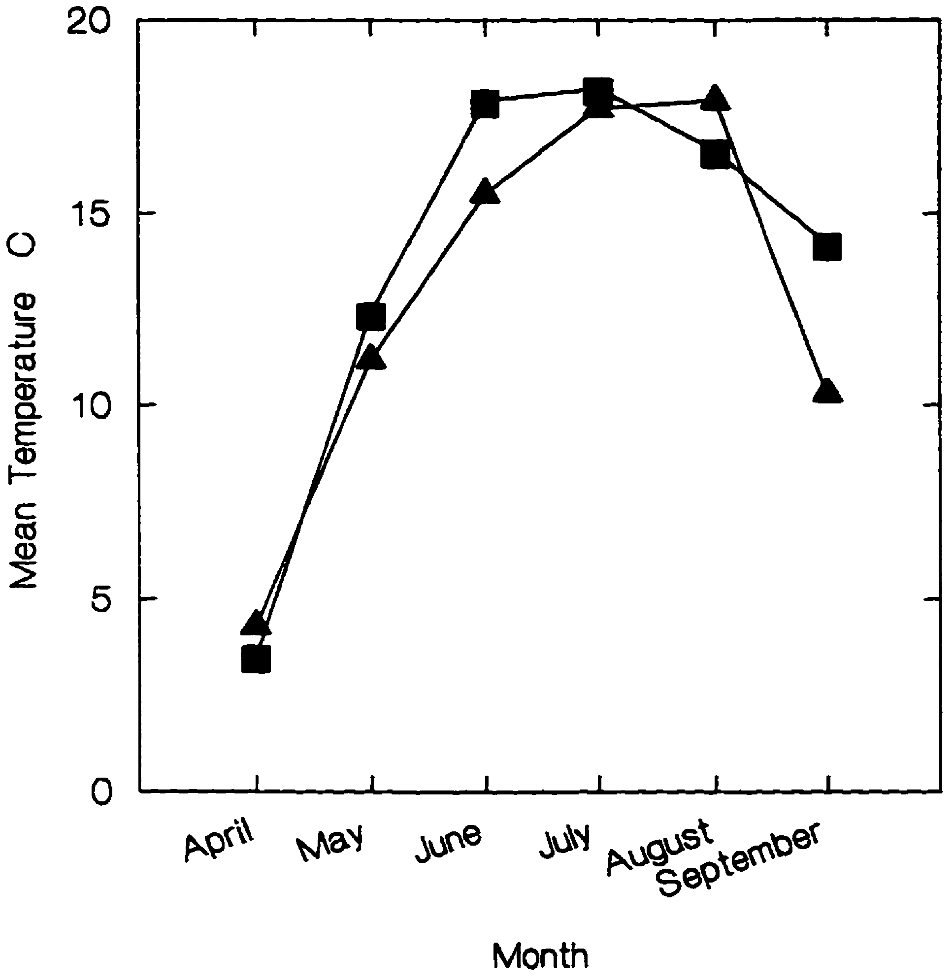

20
15
10
5
0
Mean Temperature C
April
May
June
July
August
September
Month

Figure 7. Mean daytime air temperatures at a height of one metre in 5 year old (●—), 15 year old (▲– –), 25 year old (■---)and 40 year old (✳---) planted and naturally regenerated stands located in the Sandilands Provincial Forest. Time is expressed in weeks starting with "week 1", which corresponds to the week of April 25, 1995.

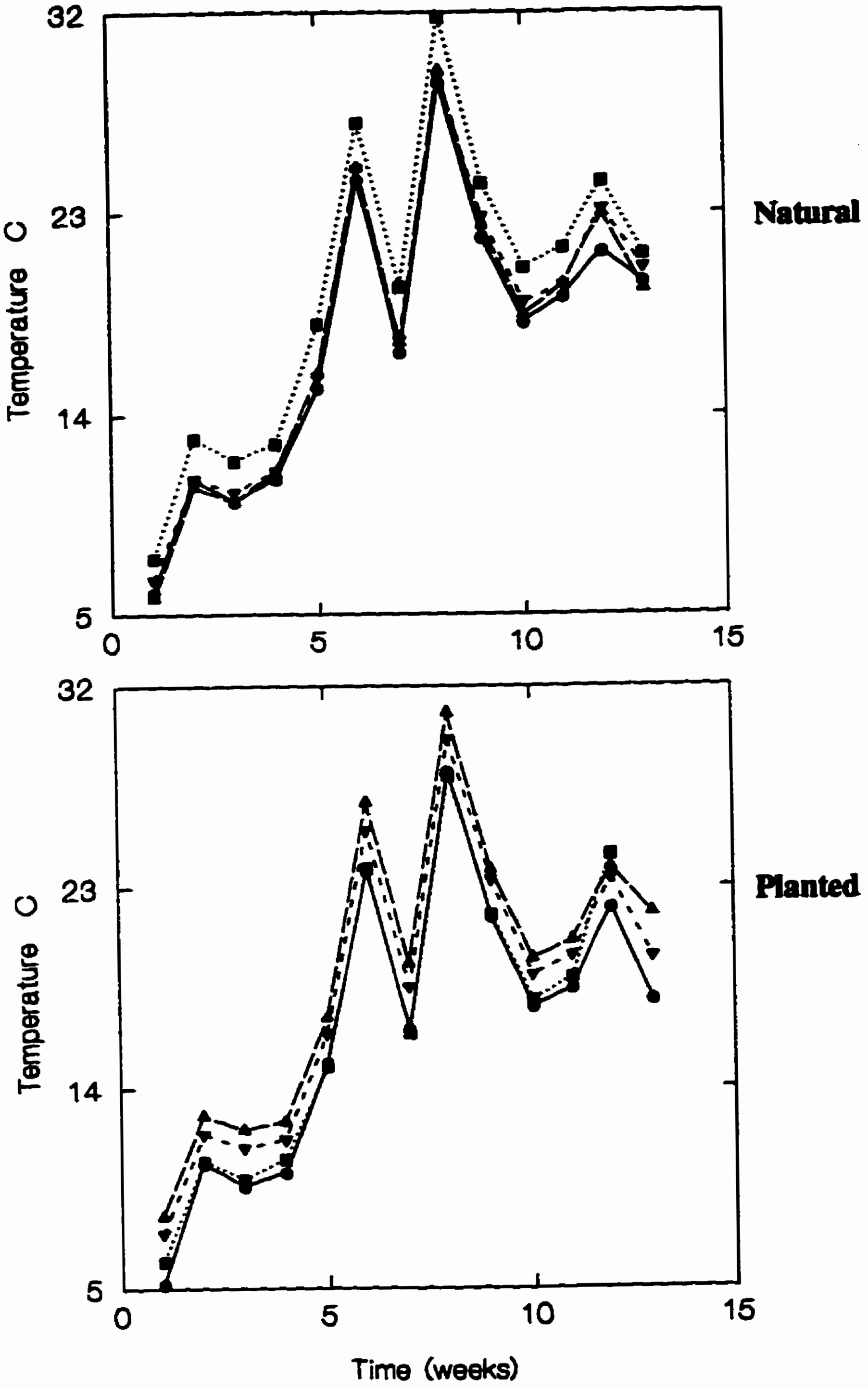

32
23
14
5
Temperature C
0
5
10
15
Natural
32
23
14
5
Temperature C
0
5
10
15
Planted
Time (weeks)

Figure 8. Mean night time air temperature at a height of one metre in 5 year old (●—), 15 year old (▲– –), 25 year old (■—) and 40 year old (✳—) planted and naturally regenerated stands located in the Sandilands Provincial Forest. Time is expressed in weeks starting with "week 1", which corresponds to the week of April 25, 1995.

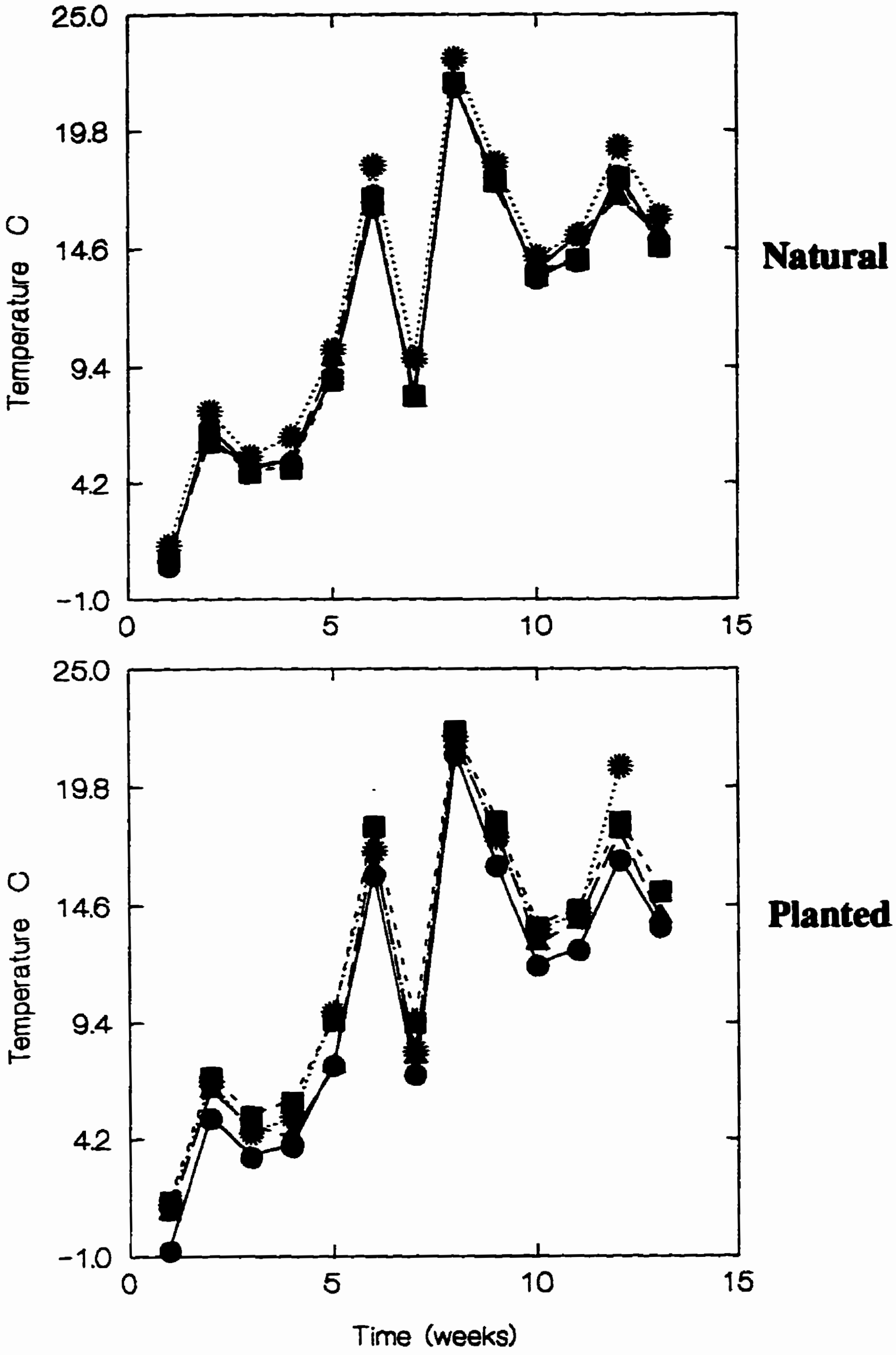

25.0
19.8
14.6
9.4
4.2
-1.0
Temperature C
0
5
10
15
Natural
25.0
19.8
14.6
9.4
4.2
-1.0
Temperature C
0
5
10
15
Time (weeks)
Planted

Figure 9. Mean daytime air temperature at a height of one metre, in planted (■---) and naturally regenerated (▲—) stands of the four age classes for stands located in the Sandilands Provincial Forest. Time is expressed in weeks starting with "week 1", which corresponds to the week of April 25, 1995.

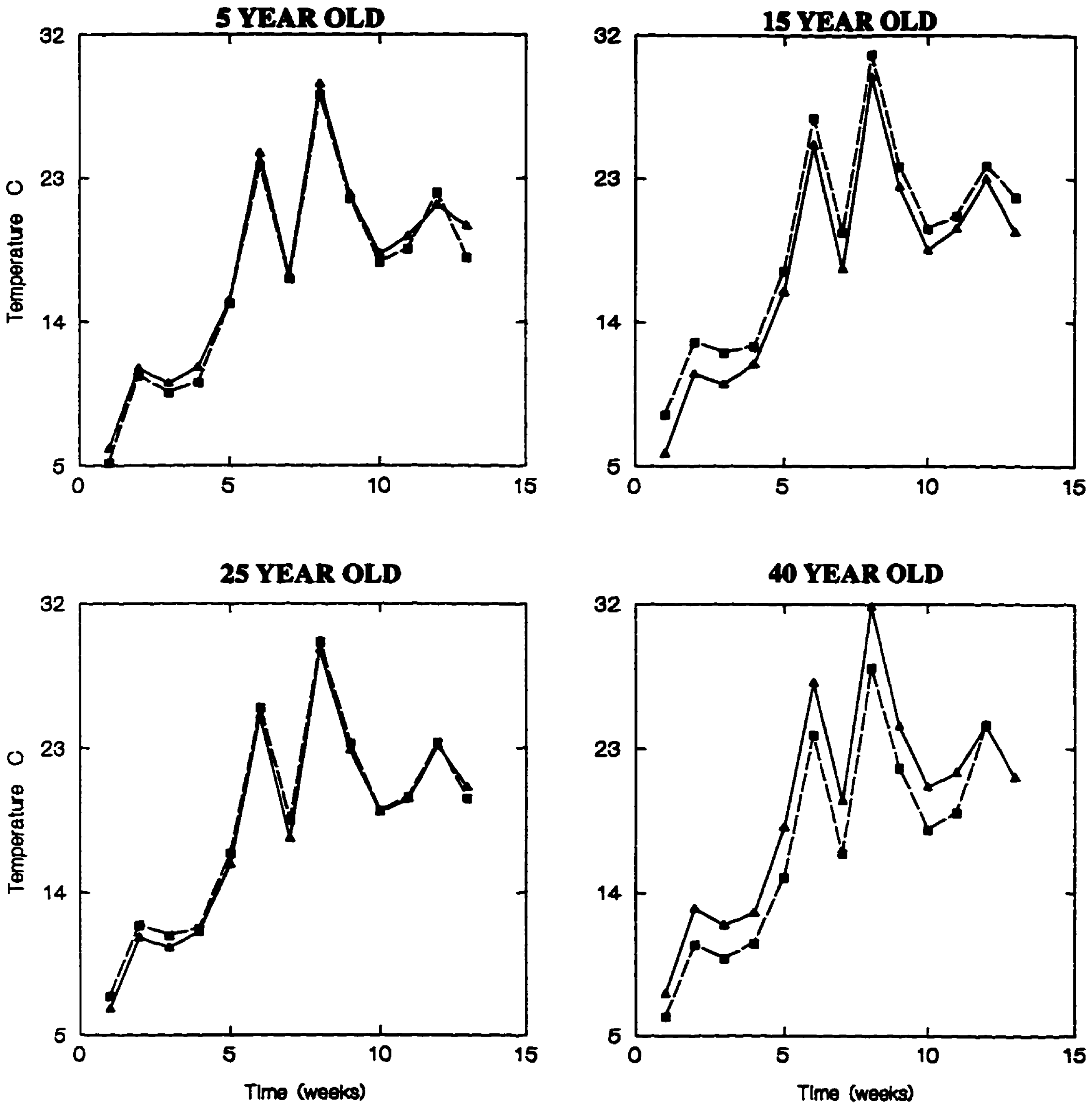
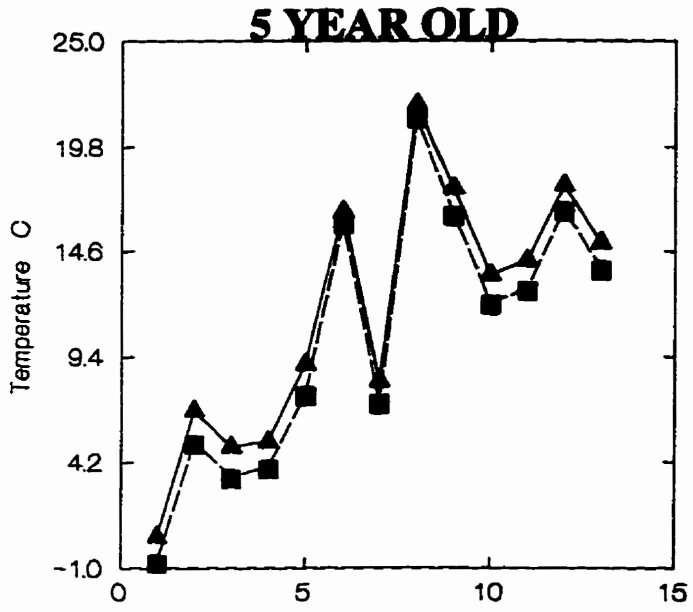
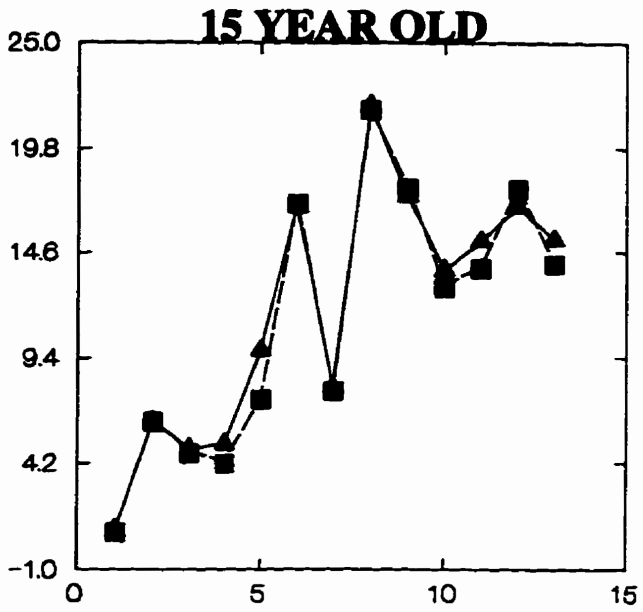
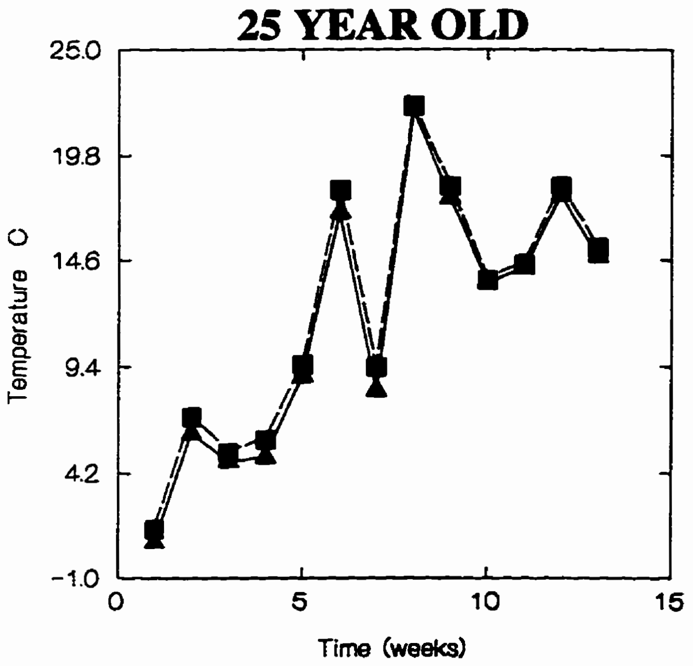

5 YEAR OLD
15 YEAR OLD
25 YEAR OLD
40 YEAR OLD
Temperature C
32
23
14
5
0
5
10
15
Time (weeks)

Figure 10. Mean night time air temperatures at a height of one metre, in planted (■---) and naturally regenerated (▲—) stands of the four age classes located in the Sandilands Provincial Forest. Time is expressed in weeks starting with "week 1", which corresponds to the week of April 25, 1995.


5 YEAR OLD


15 YEAR OLD


25 YEAR OLD

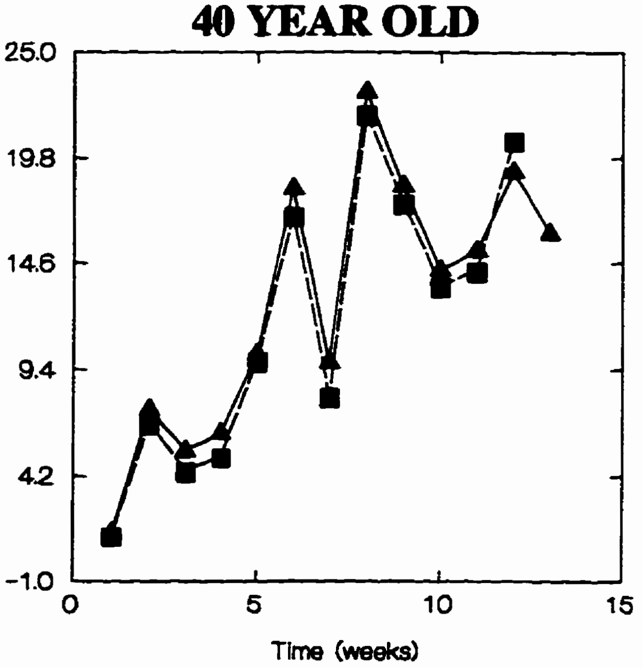

40 YEAR OLD

Figure 11. The effects of stand age on mean light intensity (lux) of each stand at a height of 2 m in planted (■---) and naturally regenerated (▲—) stands in 1994. (Error bars represent standard error; no replication of 15 year old naturally regenerated stand.)

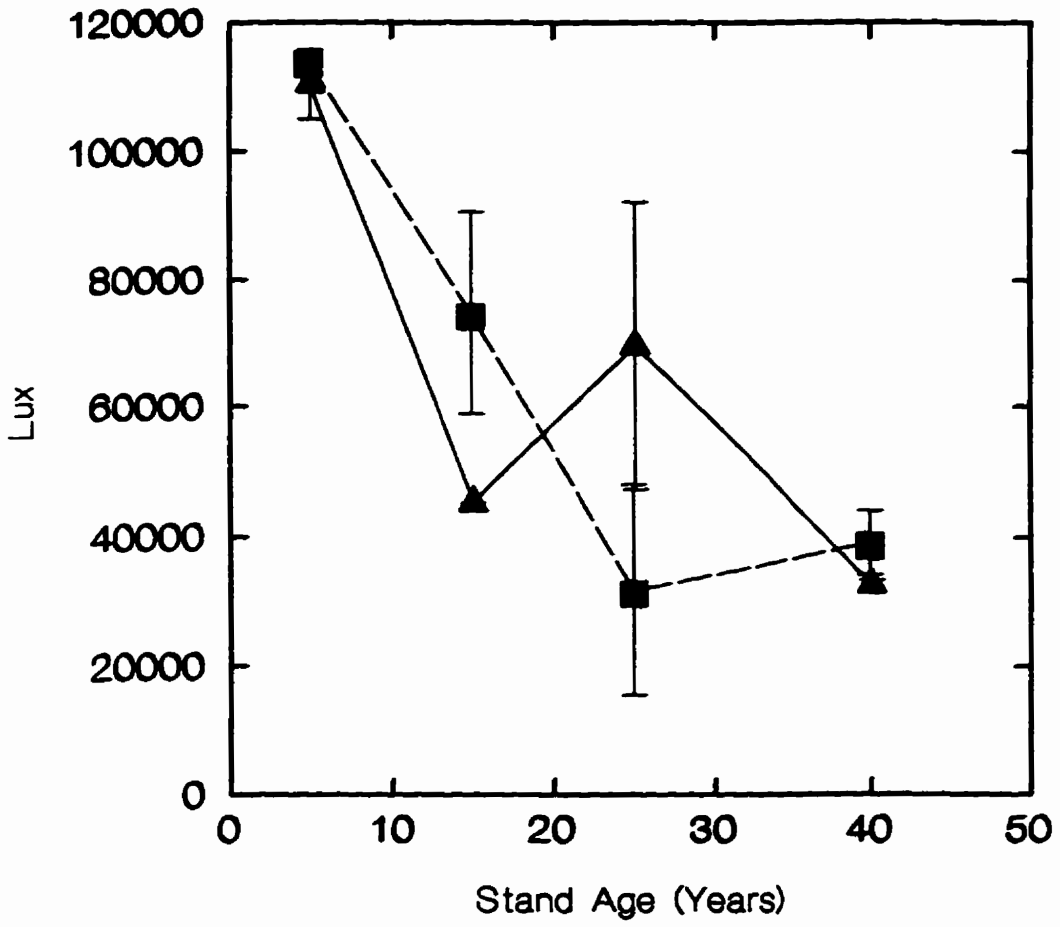

120000
100000
80000
60000
40000
20000
0
Lux
0
10
20
30
40
50
Stand Age (Years)

Figure 12. The effects of stand age on the mean coefficient of variation of light intensity in planted (■—) and naturally regenerated (▲—) stands in 1994.

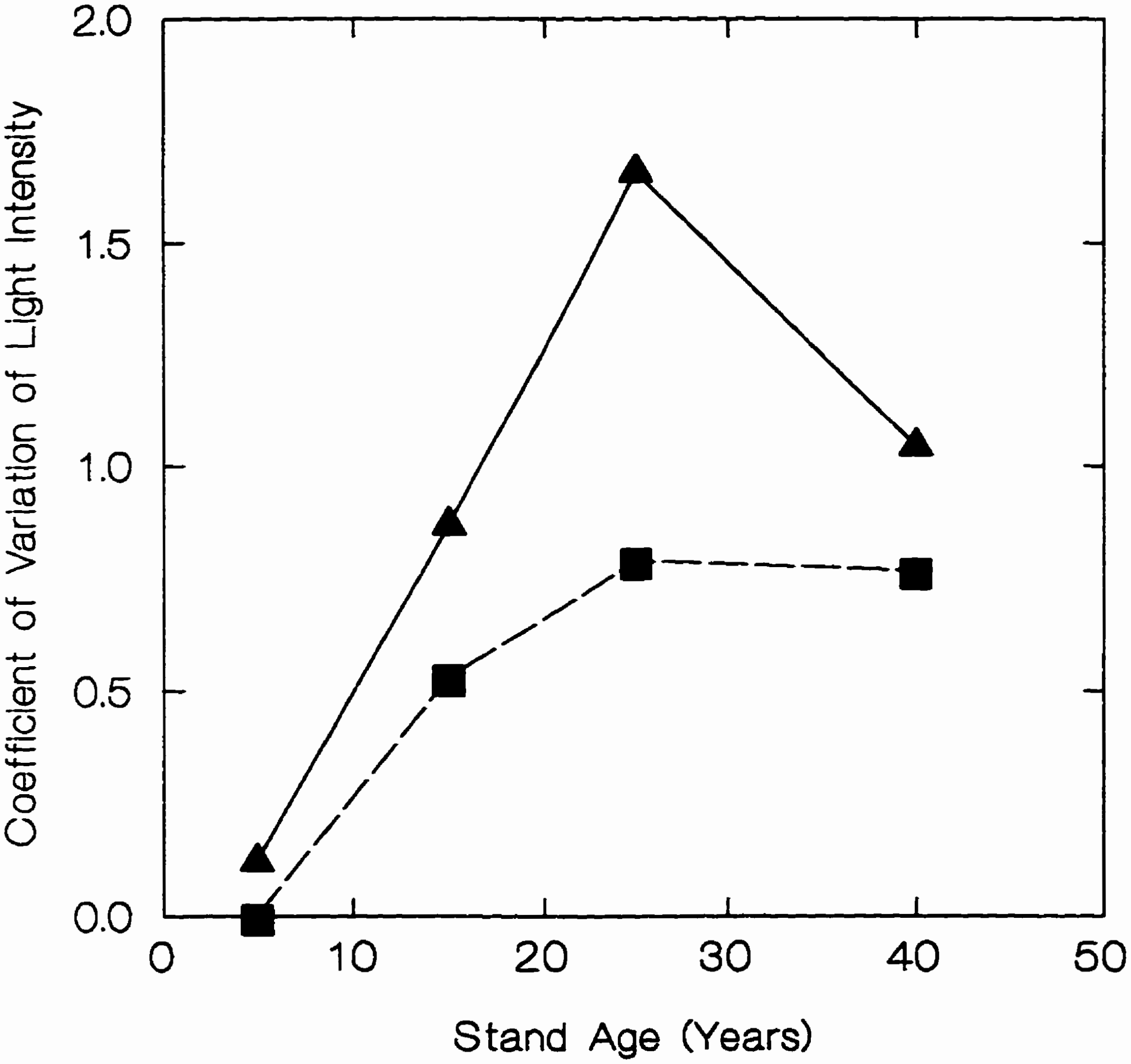

2.0
1.5
1.0
0.5
0.0
0
10
20
30
40
50
Coefficient of Variation of Light Intensity
Stand Age (Years)

Figure 13. The effects of stand age on mean tree density (trees per 100 m^2) in planted (■---) and naturally regenerated (▲—) stands. (Error bars represent standard error; no replication of 15 year old naturally regenerated stand.)

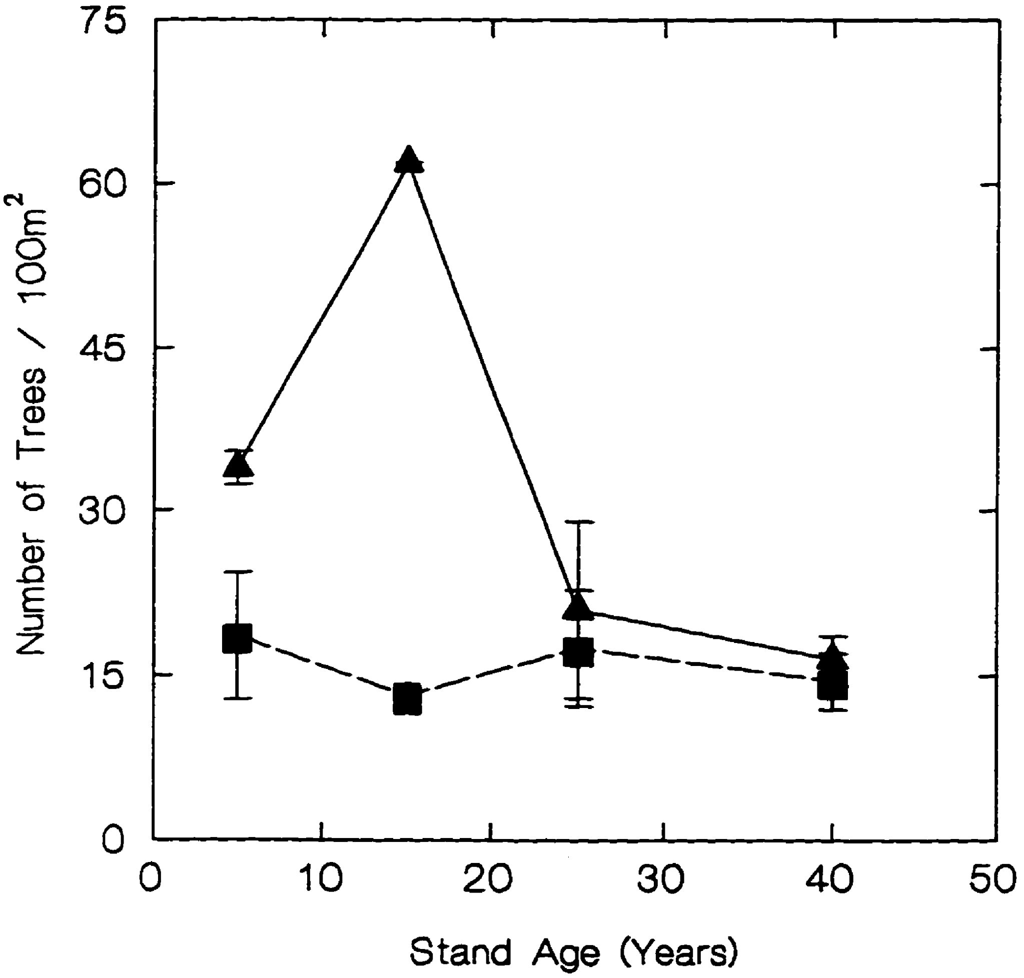

75
60
45
30
15
0
Number of Trees / 100m^2
0
10
20
30
40
50
Stand Age (Years)

Figure 14. The effects of stand age on the coefficient of variation within sites of tree density in planted (■---) and naturally regenerated (▲—) stands.

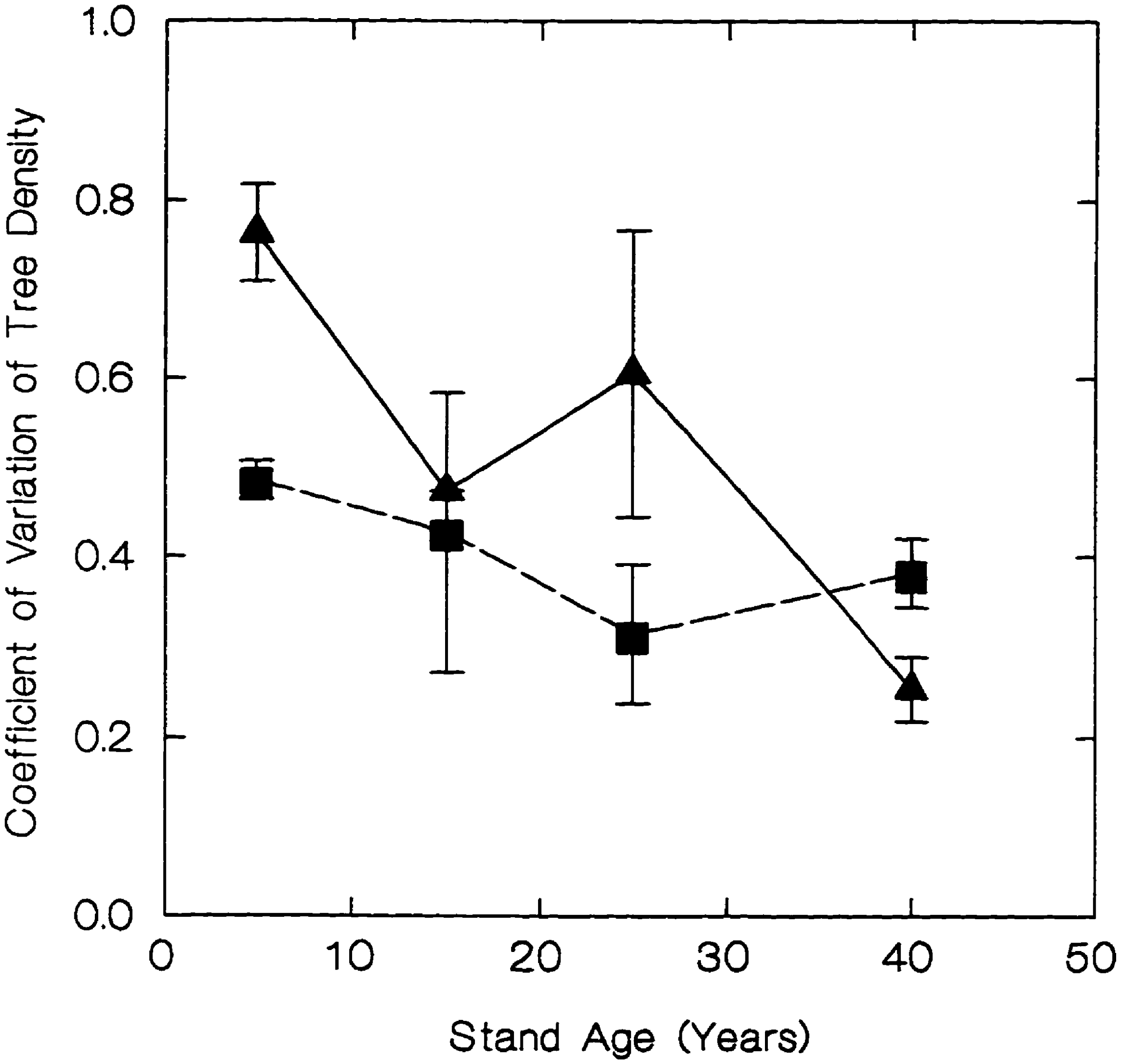

Coefficient of Variation of Tree Density
1.0
0.8
0.6
0.4
0.2
0.0
0
10
20
30
40
50
Stand Age (Years)

Figure 15. **The effects of stand age on the mean number of ground vegetation species sampled in planted (■---) and naturally regenerated (▲—) stands in 1993. (Error bars represent standard error; no replication of 15 year old naturally regenerated stand.)**

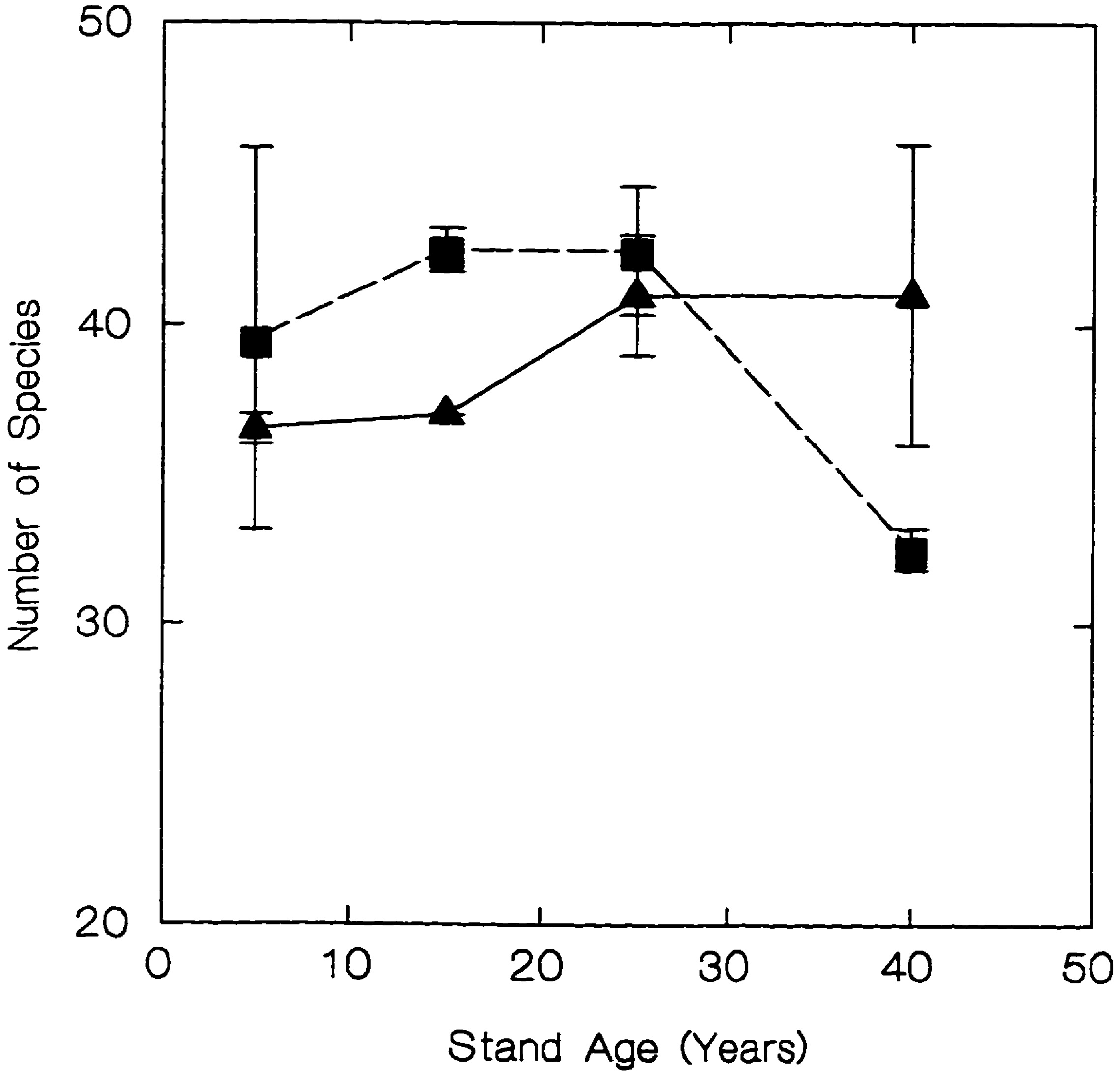

Number of Species
50
40
30
20
0
10
20
30
40
50
Stand Age (Years)

Figure 16. The effects of stand age on the mean number of ground vegetation species sampled in planted (■---) and naturally regenerated (▲—) stands in 1994. (Error bars represent standard error; no replication of 15 year old naturally regenerated stand.)

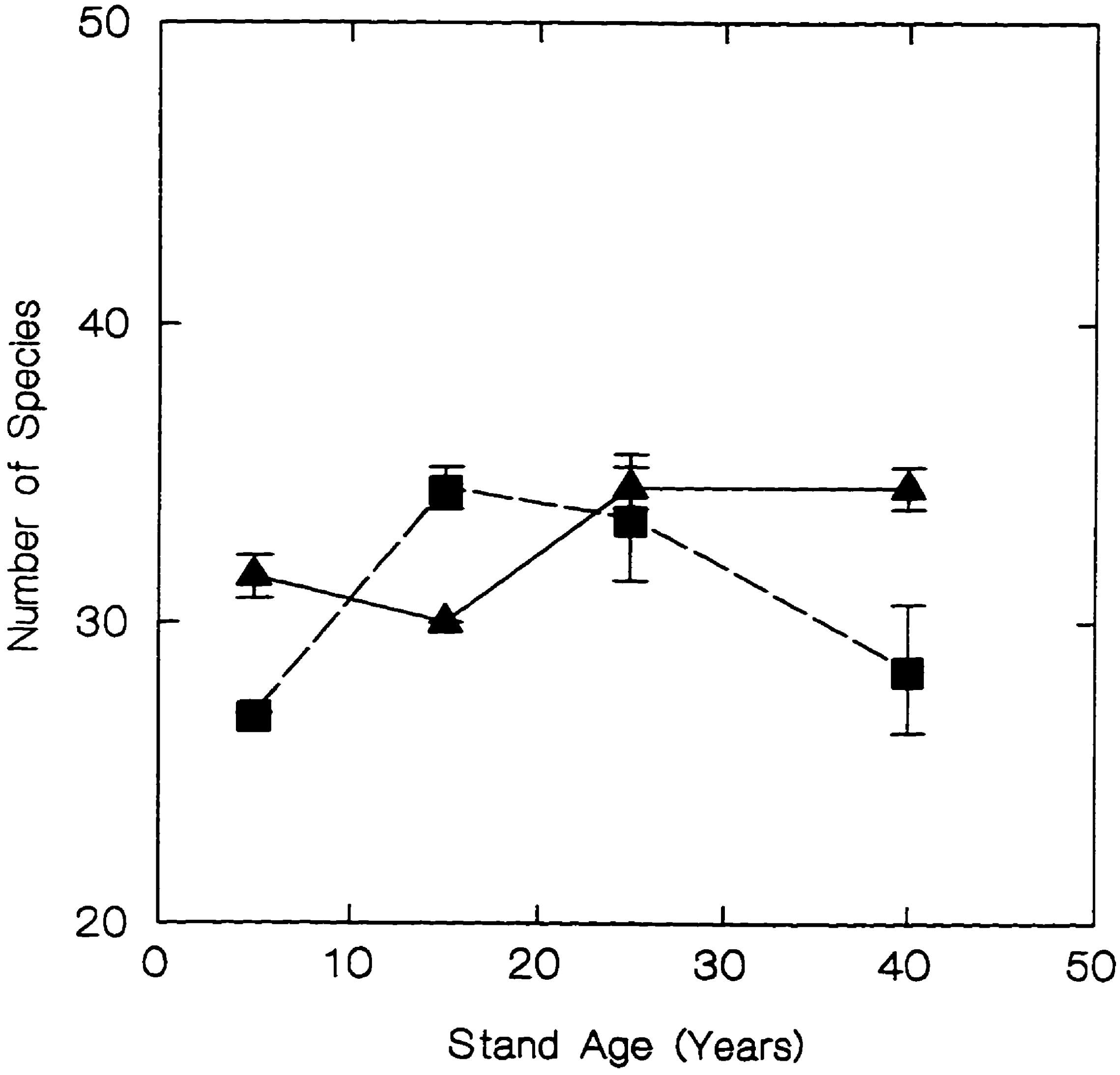

50
40
30
20
0
10
20
30
40
50
Number of Species
Stand Age (Years)

Figure 17. Ground vegetation data (1993). PCA ordination diagram with site scores (◆) and species scores (●); first axis (horizontal) has an eigenvalue of 0.337 = 33.7 % and the second axis, (vertical) has an eigenvalue of 0.165 = 16.5%.

Key to vegetation species: amelanch = *Amelanchier alnifolia*, amorpha = *Amorpha canescens*, andropog = *Andropogon gerardi*, anempat = *Anemone patens*, apocynum = *Apocynum androsaemifolium*, arctost = *Arctostaphylos uva-ursi*, asterl = *Aster laevis*, carexpen = *Carex pensylvanica*, carexric = Carex richardsonii, carexros = *Carex rossii*, c.mitis = *Cladina mitis*, c.rangif = *Cladina rangiferina*, cladonia = *Cladonia* spp., cornus = *Cornus canadensis*, dicranum = *Dicranum polysetum*, epilobiu = *epilobium angustifolium*, equiset = *Equisetum hyemale*, firemoss = *Ceratodon purpureus*, fragaria = *Fragaria virginiana*, gaulther = *Gaultheria procumbens*, koeleria = *Koeleria gracilis*, maianth = *Maianthemum canadense*, monarda = *Monarda fistulosa*, o.asper = *Oryzopsis asperifolia*, o.pung = *Oryzopsis pungens*, pleuroz = *Pleurozium schreberi*, poa = *Poa compressa*, prunvirg = *Prunus virginiana*, pterid = *Pteridium aquilinum*, pyvirens = *Pyrolia virens*, rhus = *Rhus radicans*, symphori = *Syphoricarpos albus*, vaccin = *Vaccinium angustifolium*, viola = *Viola adunca*.

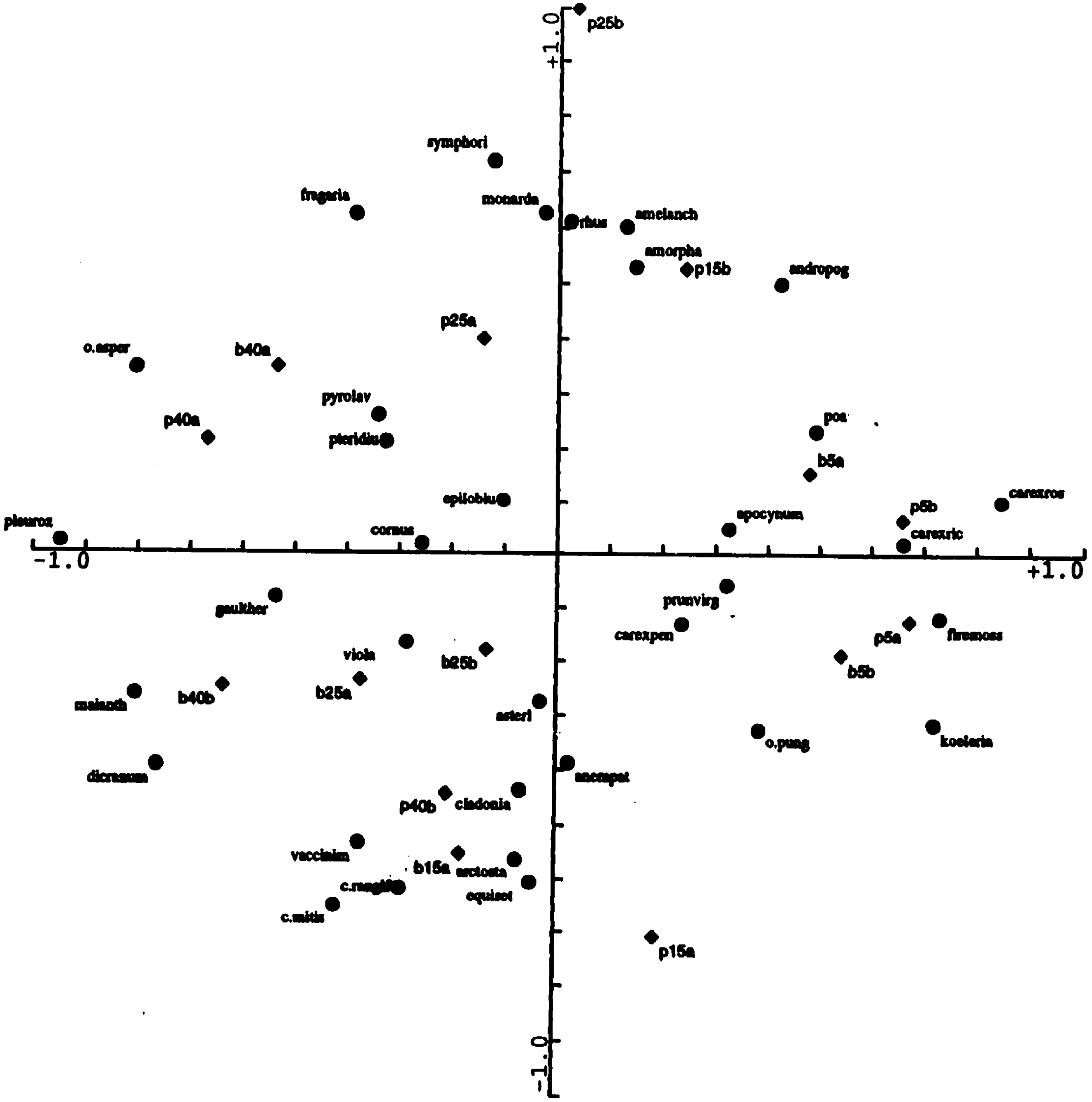

+1.0
-1.0
-1.0
+1.0
p25b
symphori
fragaria
monarda
rhus
amelanch
amorpha
p15b
andropog
p25a
o.asper
b40a
pyrolav
p40a
pteridiu
poa
b5a
epilobiu
carexros
p5b
apocynum
carexric
pleuroz
cornus
prunvirg
gaulther
carexpen
p5a
firemoss
viola
b25b
b5b
maianth
b40b
b25a
asteri
o.pung
koeleria
dicranum
ancaspat
p40b
cladonia
vaccinim
b15a
arctosta
c.magn
equiset
c.mitis
p15a

Figure 18. Ground vegetation data (1994). PCA ordination diagram with site scores (◆) and species scores (●); first axis (horizontal) has an eigenvalue of 0.324 = 32.4% and the second axis, (vertical) has an eigenvalue of 0.187 = 18.7%.

Key to vegetation species: amelanch = *Amelanchier alnifolia*, amorpha = *Amorpha canescens*, andropog = *Andropogon gerardi*, arctost = *Arctostaphylos uva-ursi*, ceanoth = *Ceanothus ovatus*, carexpen = *Carex pensylvanica*, c.mitis = *Cladina mitis*, c.rangif = *Cladina rangiferina*, cornus = *Cornus canadensis*, corylus = *Corylus cornuta*, dicranum = *Dicranum polysetum*, equiset = *Equisetum hyemale*, erigeron = *Erigeron acris*, firemoss = *Ceratodon purpureus*, gaulther = *Gaultheria procumbens*, heuchera = *Heuchera richardsonii*, maianth = *Maianthemum canadense*, monarda = *Monarda fistulosa*, o.asper = *Oryzopsis asperifolia*, o.pung = *Oryzopsis pungens*, pleuroz = *Pleurozium schreberi*, poa = *Poa compressa*, polygona = *Polygonatum canaliculatum*, prunvirg = *Prunus virginiana*, pterid = *Pteridium aquilinum*, pyvirens = *Pyrolia virens*, rhus = *Rhus radicans*, rosa = *Rosa acicularis*, rubus = *Rubus idaeus*, spiraea = *Spiraea alba*, solidago = *Solidago nemoralis*, symphori = *Syphoricarpos albus*, vaccin = *Vaccinium angustifolium*, viola = *Viola adunca*.

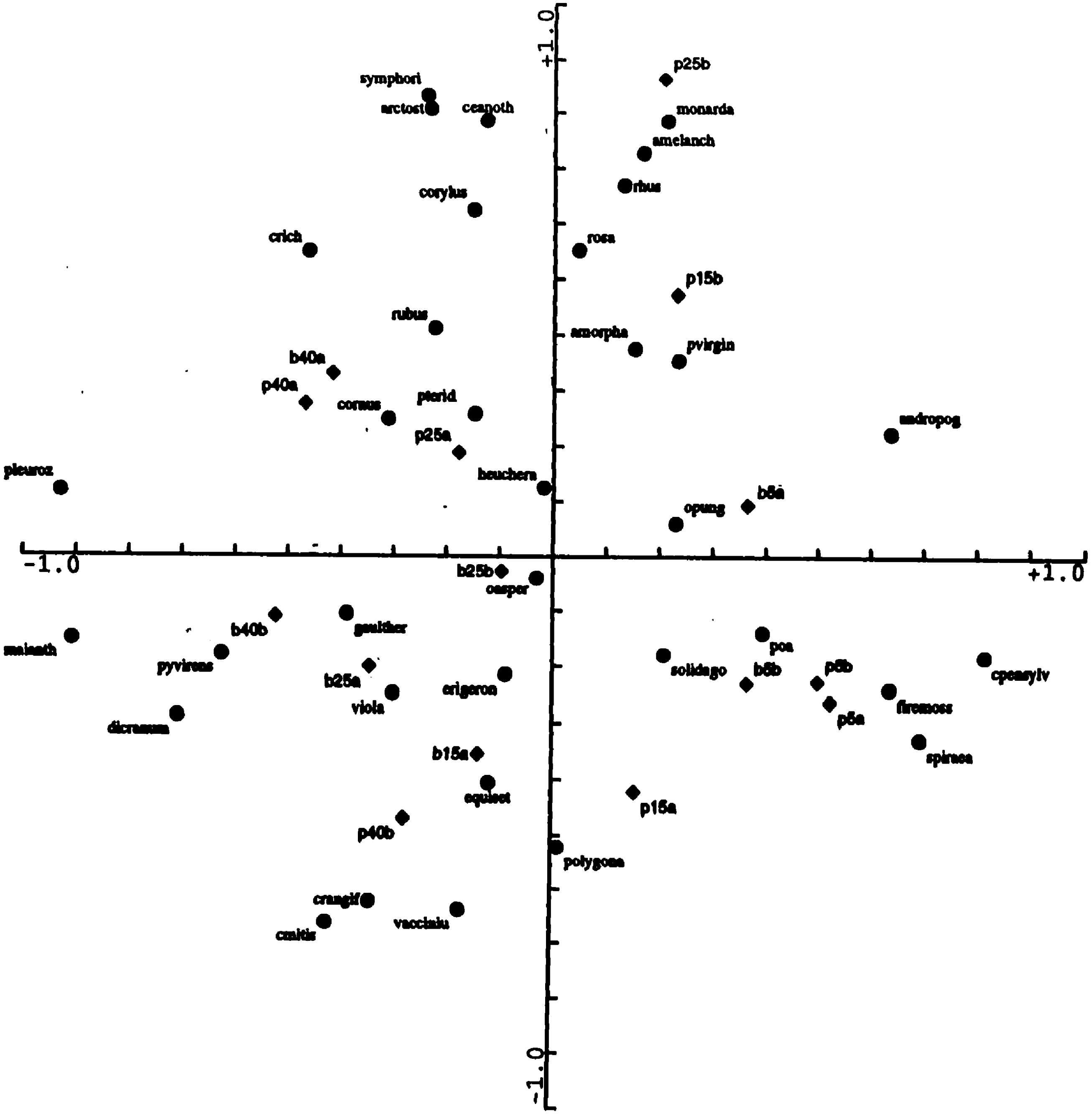

+1.0
-1.0
-1.0
+1.0
symphori
arctost
ceanoth
p25b
monarda
amelanch
rhus
corylus
crich
rosa
p15b
rubus
amorpha
pvirgin
b40a
p40a
cornus
pterid
p25a
andropog
pleuroz
beuchera
b5a
opung
b25b
oasper
b40b
gaulther
maianth
pyvirens
b25a
viola
erigeron
poa
solidago
b5b
p5b
cpensylv
firemoss
p5a
dicranum
spiraea
b15a
equiset
p15a
p40b
polygona
crangif
vaccinium
cmitis

Figure 19. Ground vegetation and environmental data (1993). CCA ordination diagram with site scores (◆), species scores (●) and environmental variables (arrows); first axis (horizontal) has an eigenvalue of 0.212 = 21.5% and the second axis (vertical) has an eigenvalue of 0.021 = 2.1%.

Key to vegetation species: amelanch = *Amelanchier alnifolia*, apocynum = *Apocynum androsaemifolium*, calamovi = *Calamovilfa longifolia*, cladonia = *Cladonia* spp., c.rangif = *Cladina rangiferina*, dicranum = *Dicranum polysetum*, monarda = *Monarda fistulosa*, pleuroz = *Pleurozium schreberi*, prunvirg = *Prunus virginiana*, solidago = *Solidago nemoralis*, thalictr = *Thalictrum dasycarpum*.

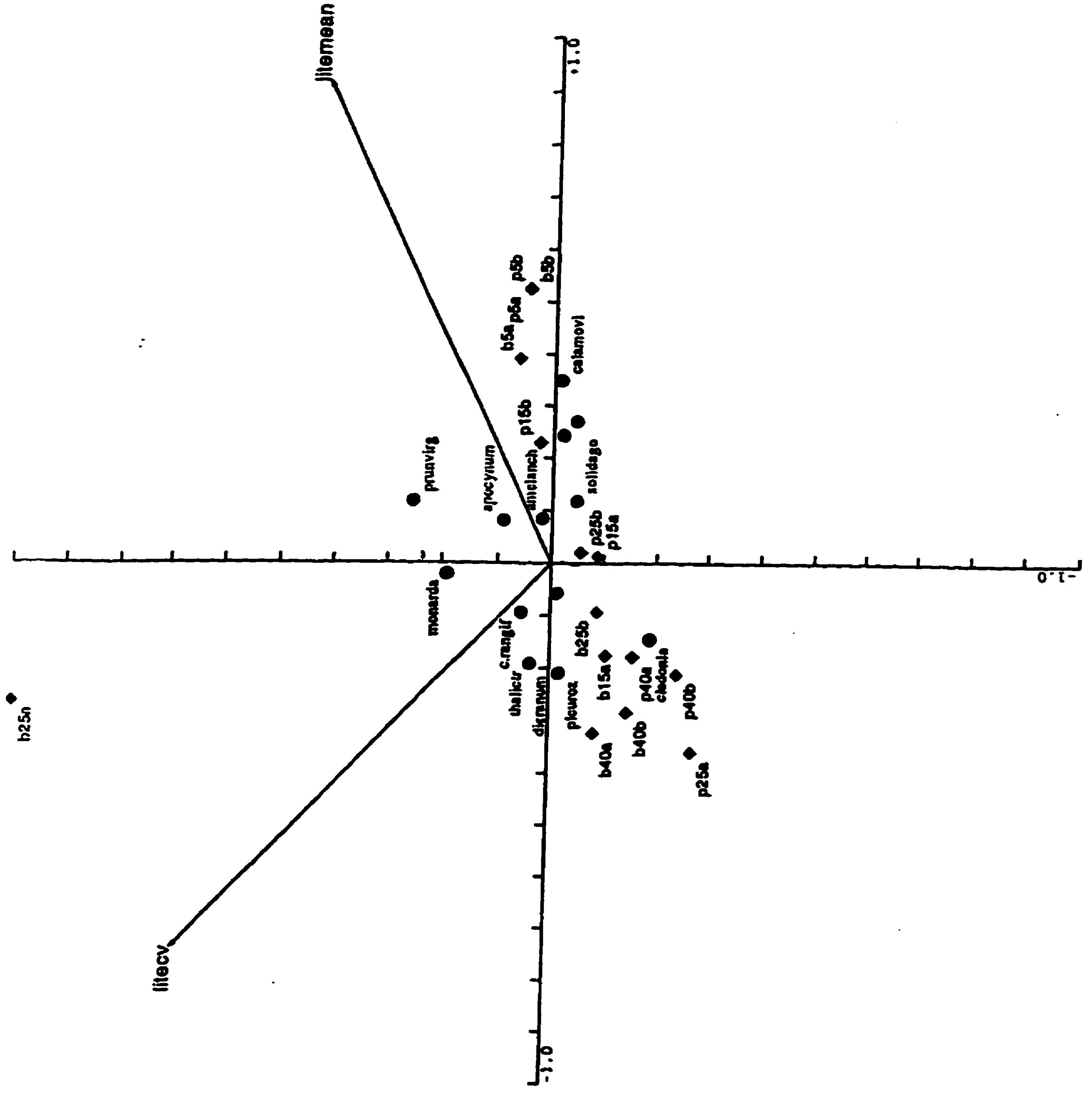

litemean
litecv
+1.0
-1.0
+1.0
-1.0
b25a
prunvirg
apocynum
amelanch
solidago
calamovi
p15b
b5a
p5a
p5b
b5b
p25b
p15a
monarda
c.rugif
thalictr
dicranum
pleuroz
b25b
b15a
p40a
cladonia
p40b
b40b
b40a
p25a

Figure 20. Ground vegetation and environmental data (1994). CCA ordination diagram with site scores (◆), species scores (●) and environmental variables (arrows); first axis (horizontal) has an eigenvalue of 0.238 = 20.2% and the second axis (vertical) has an eigenvalue of 0.018 = 1.5%.

Key to vegetation species: apocynum = *Apocynum androsaemifolium*, campanul = *Campanula rotundifolia*, ceanoth = *Ceanothus ovatus*, c.mitis = *Cladina mitis*, polygona = *Polygonatum canaliculatus*, pleuroz = *Pleurozium schreberi*, selagine = *Selaginella rupestris*, solidago = *Solidago nemoralis*, thalictr = *Thalictrum dasycarpum*, zizia = *Zizia aptera*.

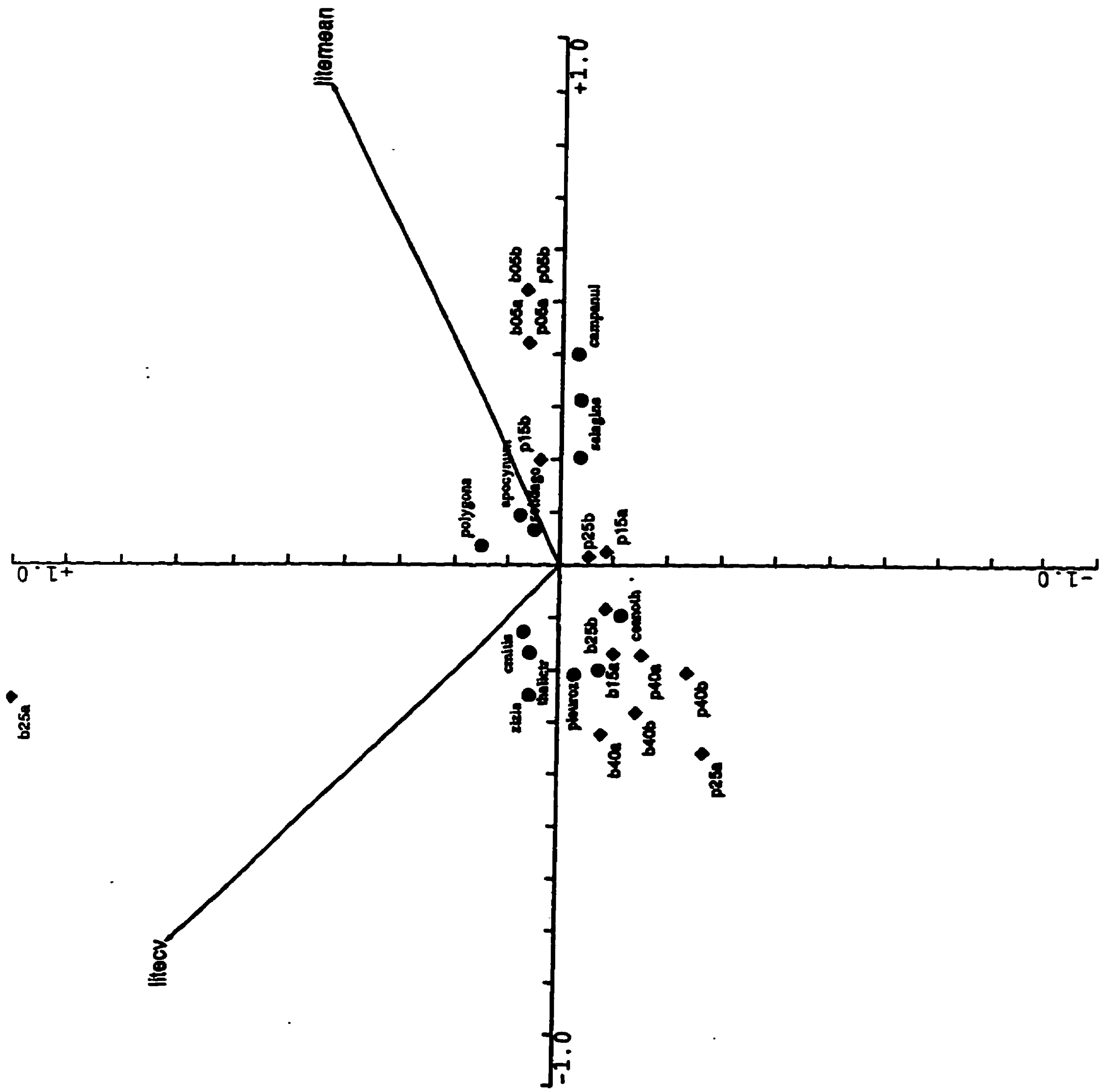

litemean
litecv
+1.0
-1.0
+1.0
-1.0
polygona
apocynum
solidago
p15b
b05a
b05b
p05a
p05b
campanul
selagine
p25b
p15a
b25a
cmitis
thalictr
zizia
pleuroz
b25b
b15a
b40a
b40b
p40a
p40b
p25a
ceanoth

Figure 21. The effects of stand age on the mean number of butterflies collected per site in planted (■---) and naturally regenerated (▲—) stands in 1993. (Error bars represent standard error; no replication of 15 year old naturally regenerated stand.)

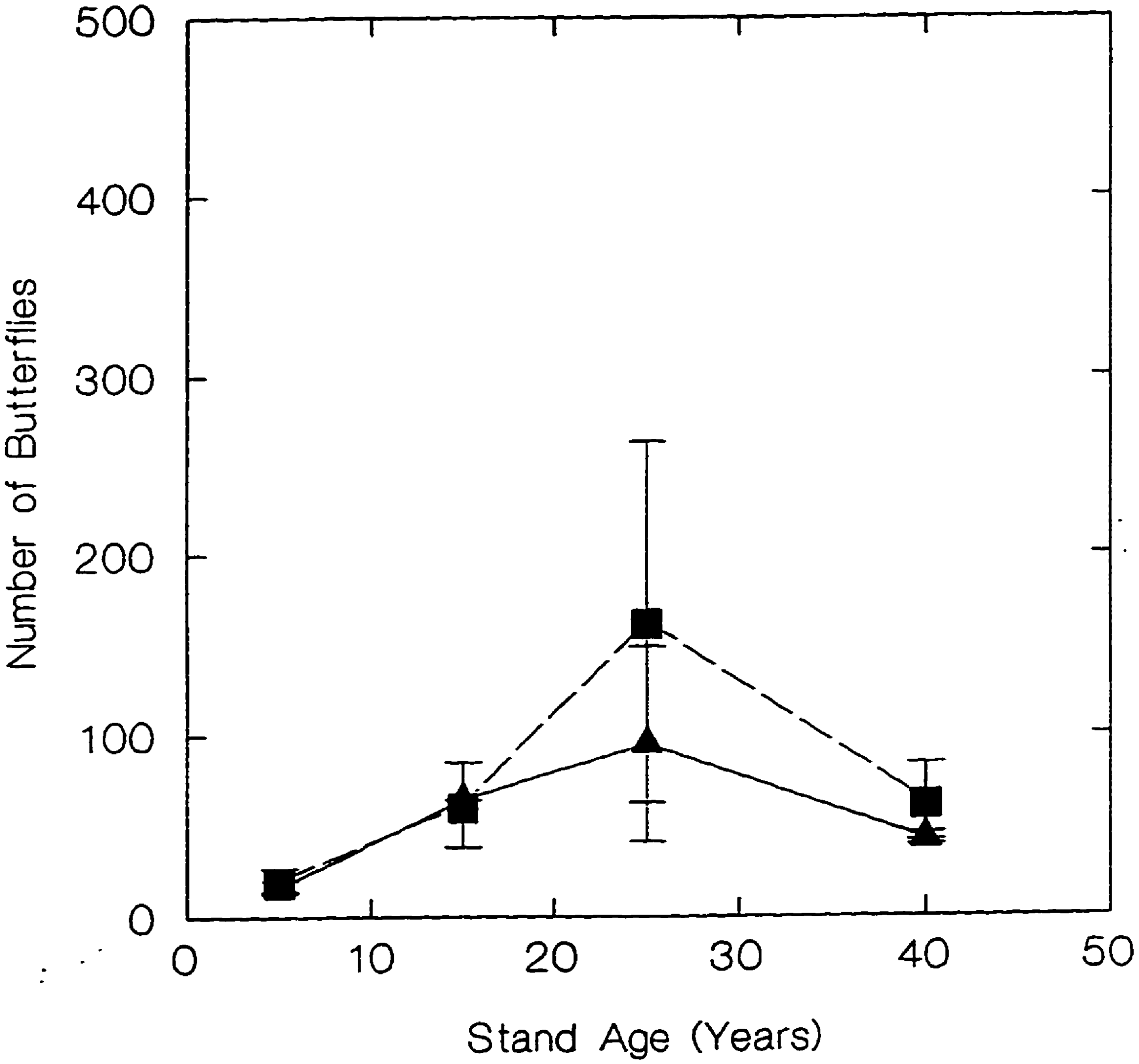

500
400
300
200
100
0
0
10
20
30
40
50
Number of Butterflies
Stand Age (Years)

Figure 22. The effects of stand age on the mean number of butterflies and skippers collected per site in planted (■---) and naturally regenerated (▲—) stands in 1994. (Error bars represent standard error; no replication of 15 year old naturally regenerated stand.)

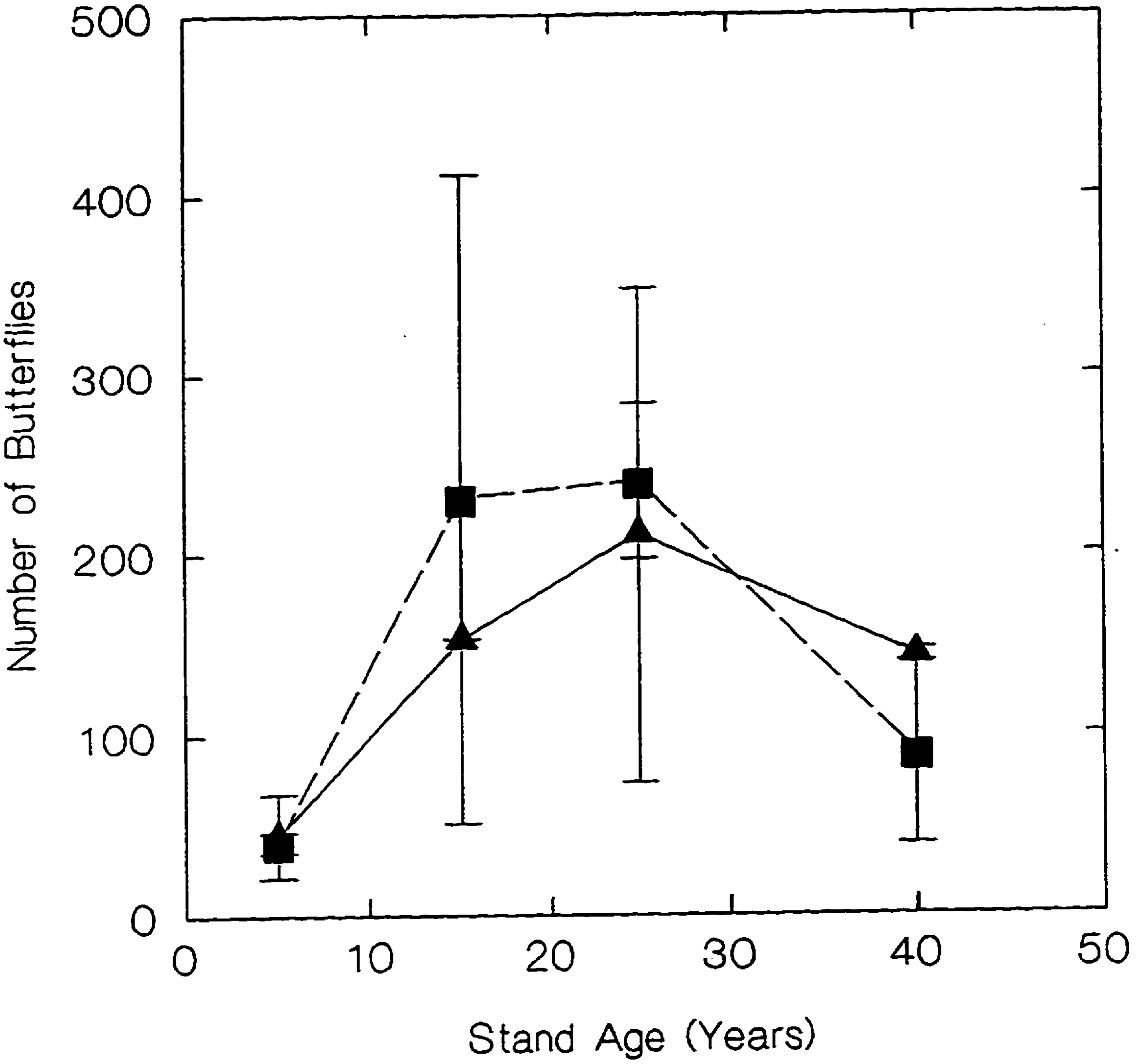

500
400
300
200
100
0
Number of Butterflies
0
10
20
30
40
50
Stand Age (Years)

Figure 23. The effects of stand age on the mean number of butterfly and skippers species collected in planted (■—) and naturally regenerated (▲—) stands in 1993. (Error bars represent standard error; no replication of 15 year old naturally regenerated stand.)

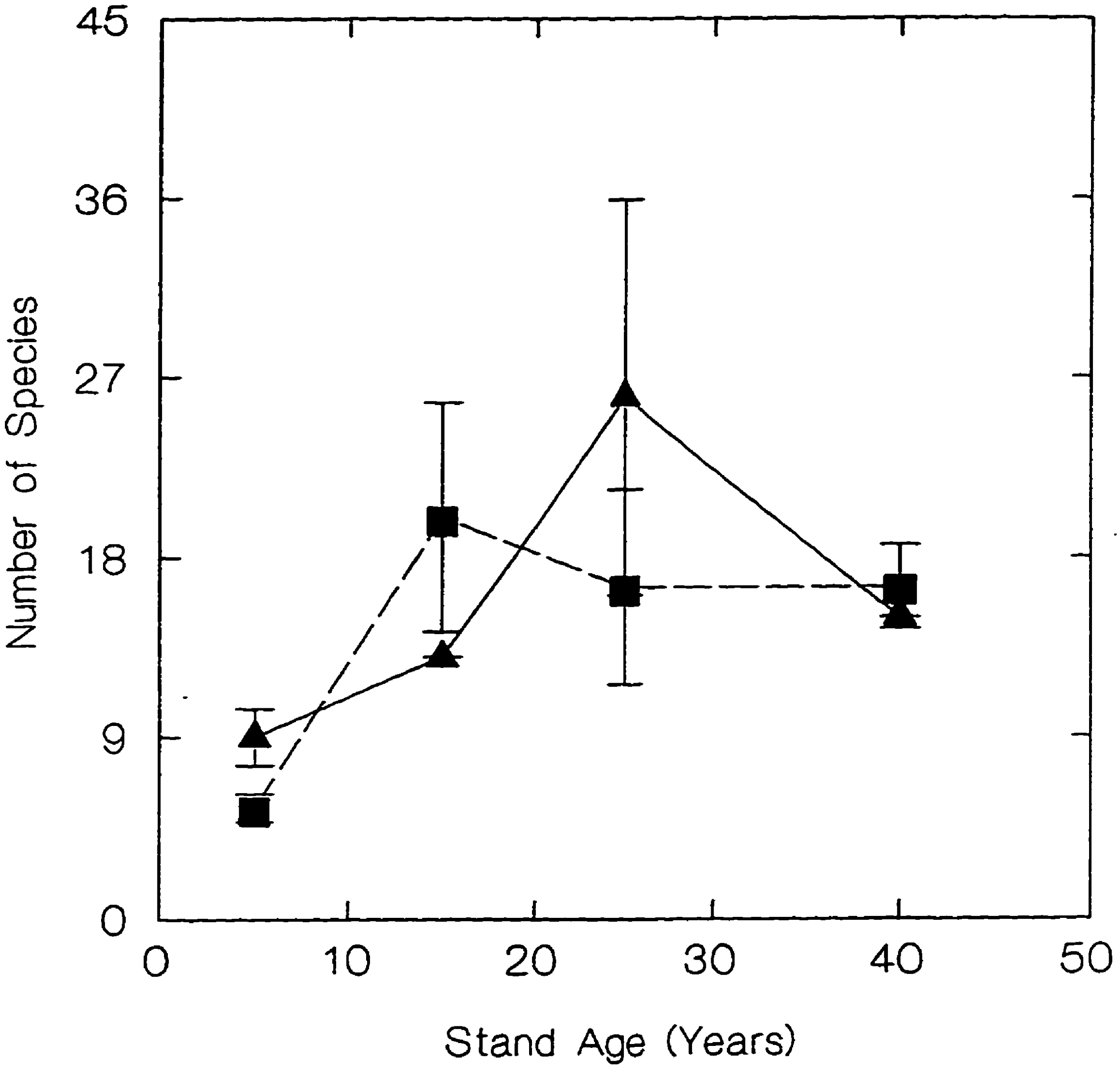

45
36
27
18
9
0
0
10
20
30
40
50
Number of Species
Stand Age (Years)

Figure 24. The effects of stand age on the mean number of butterfly and skippers species collected in planted (■---) and naturally regenerated (▲—) stands in 1994. (Error bars represent standard error; no replication of 15 year old naturally regenerated stand.)

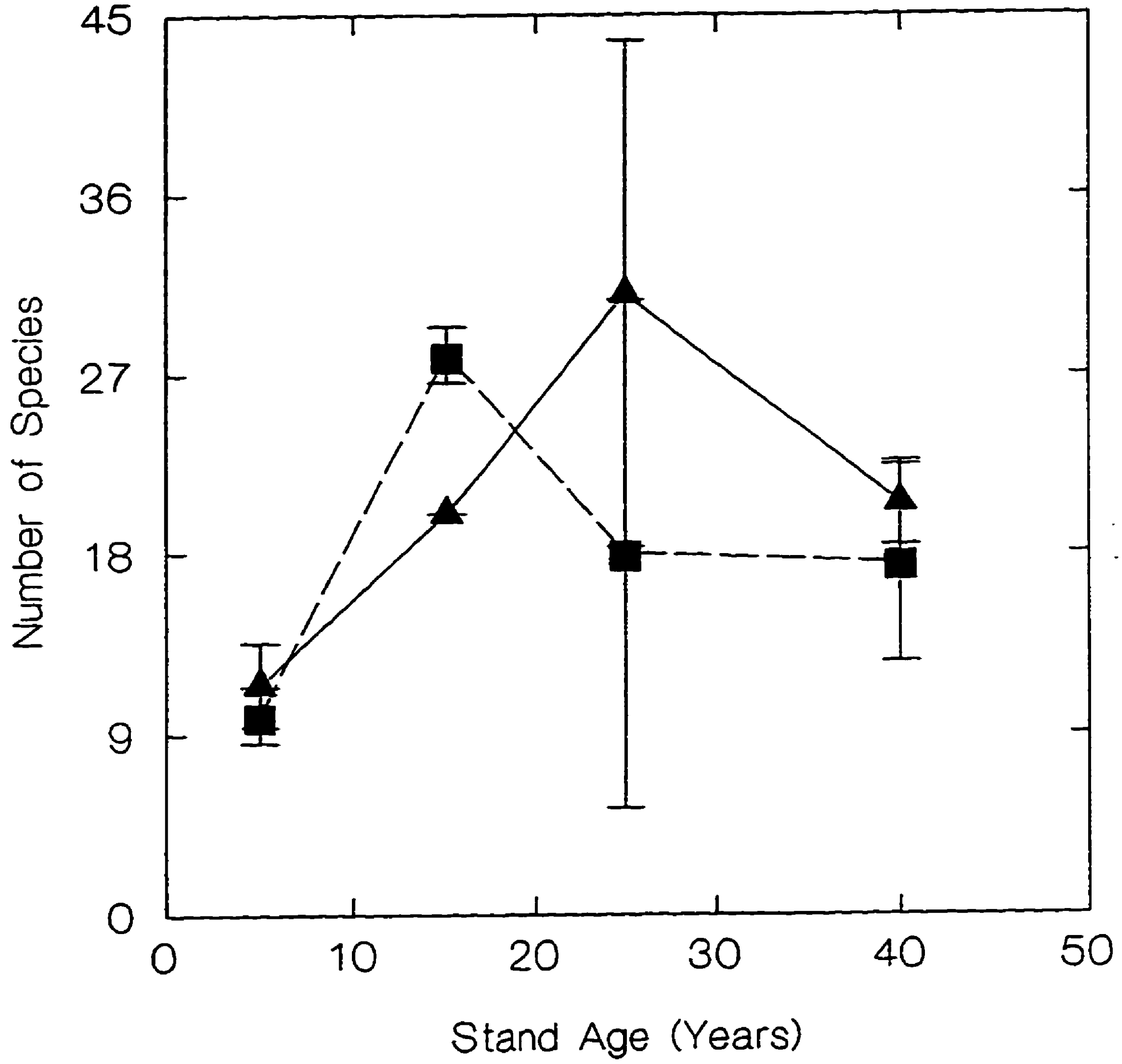
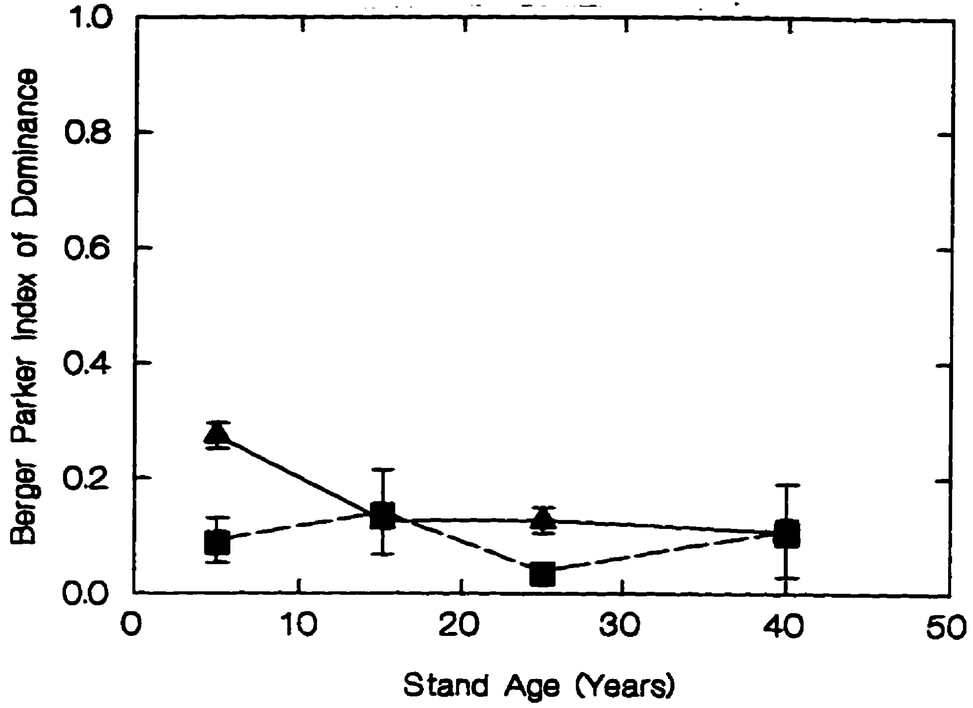
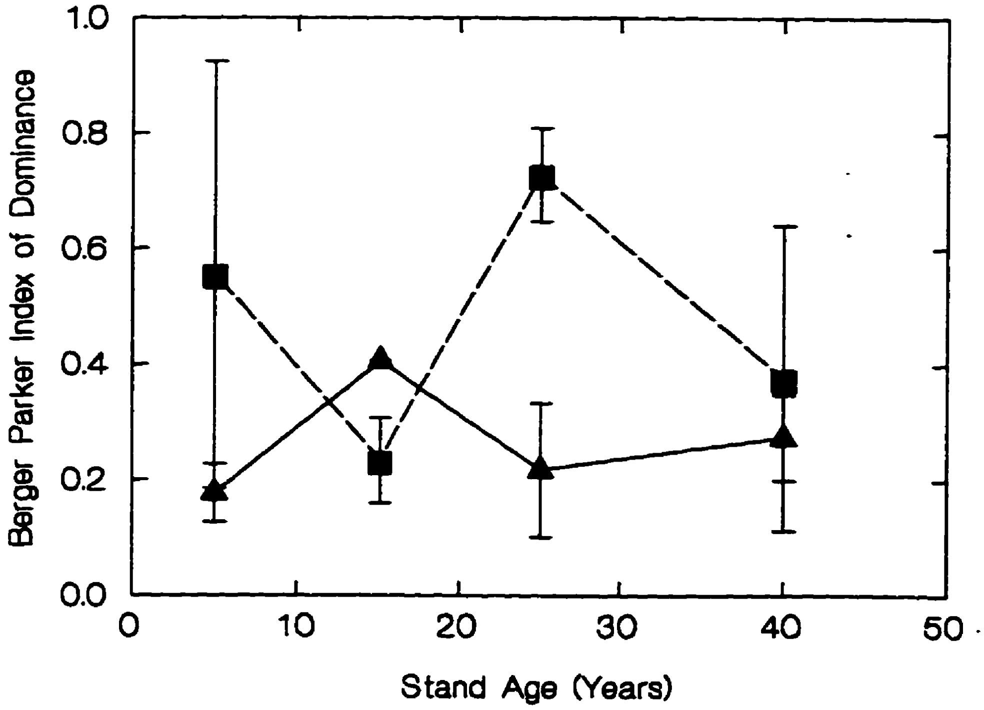

45
36
27
18
9
0
Number of Species
0
10
20
30
40
50
Stand Age (Years)

Figure 25. The effects of stand age on the Berger Parker index of dominance for butterflies and skippers collected in planted (■—) and naturally regenerated (▲—) stands in 1993. (Error bars represent standard error; no replication of 15 year old naturally regenerated stand.)



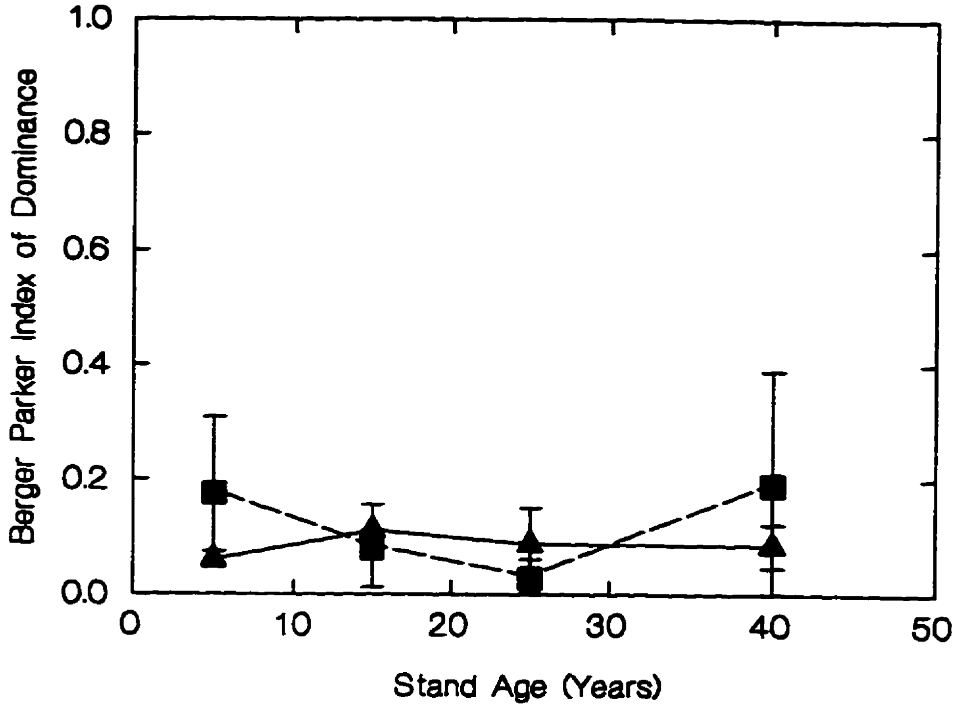
Flight Period 1



Flight Period 2

Figure 26. The effects of stand age on the Berger Parker index of dominance for butterflies and skippers collected in planted (■—) and naturally regenerated (▲—) stands in 1994. (Error bars represent standard error; no replication of 15 year old naturally regenerated stand.)

Flight Period 1



Flight Period 2

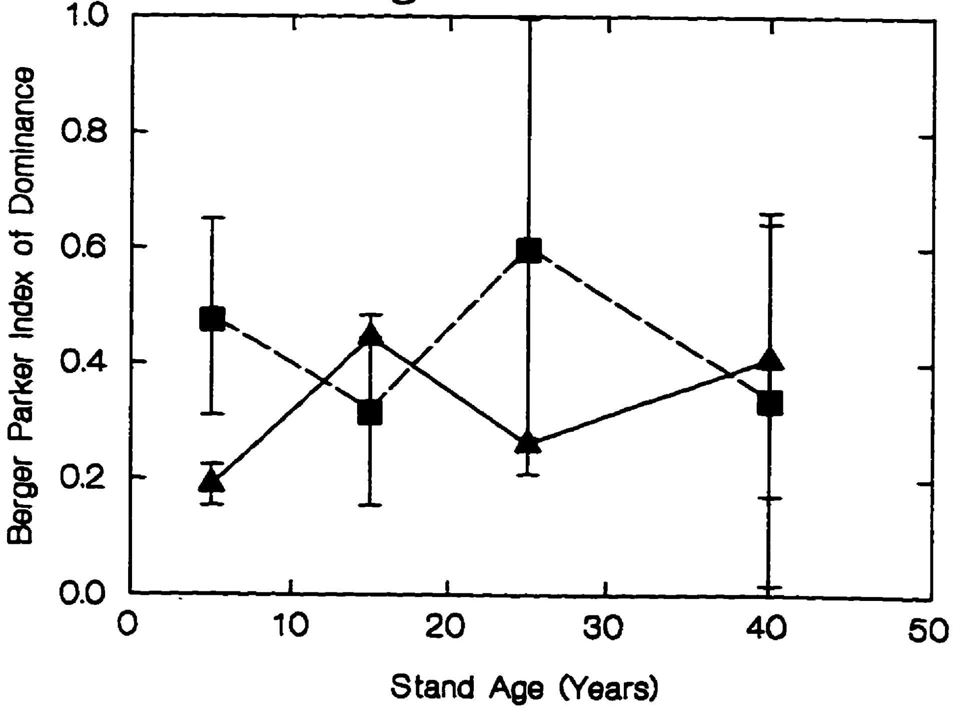


Figure 27. The effects of stand age on the log series α index for butterflies and skippers in planted (■—) and naturally regenerated (▲—) stands in 1993. (Error bars represent standard error; no replication of 15 year old naturally regenerated stand.)

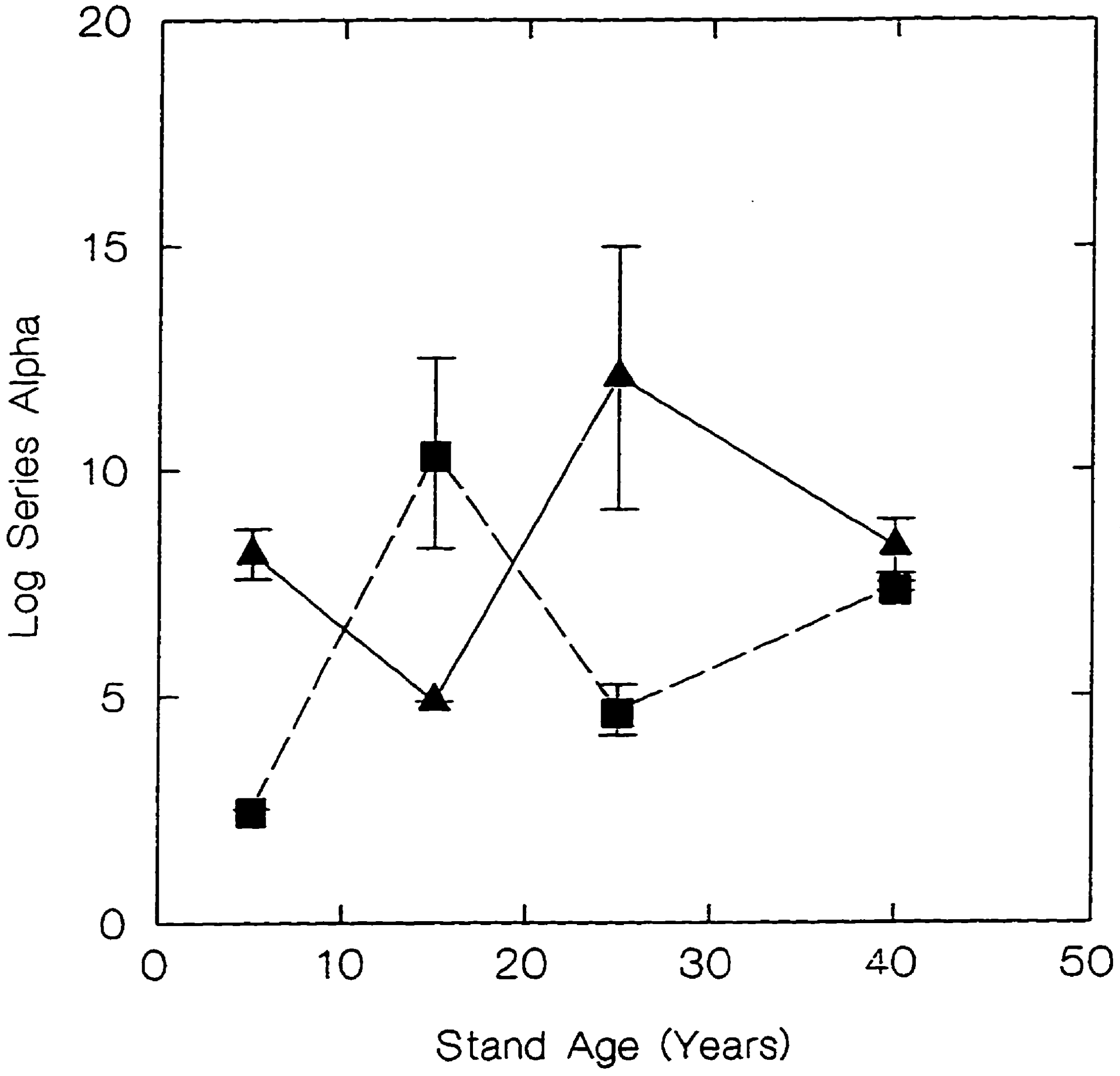

20
15
10
5
0
0
10
20
30
40
50
Log Series Alpha
Stand Age (Years)

Figure 28. The effects of stand age on the log series α index for butterflies and skippers in planted (■---) and naturally regenerated (▲—) stands in 1994.(Error bars represent standard error; no replication of 15 year old naturally regenerated stand.)

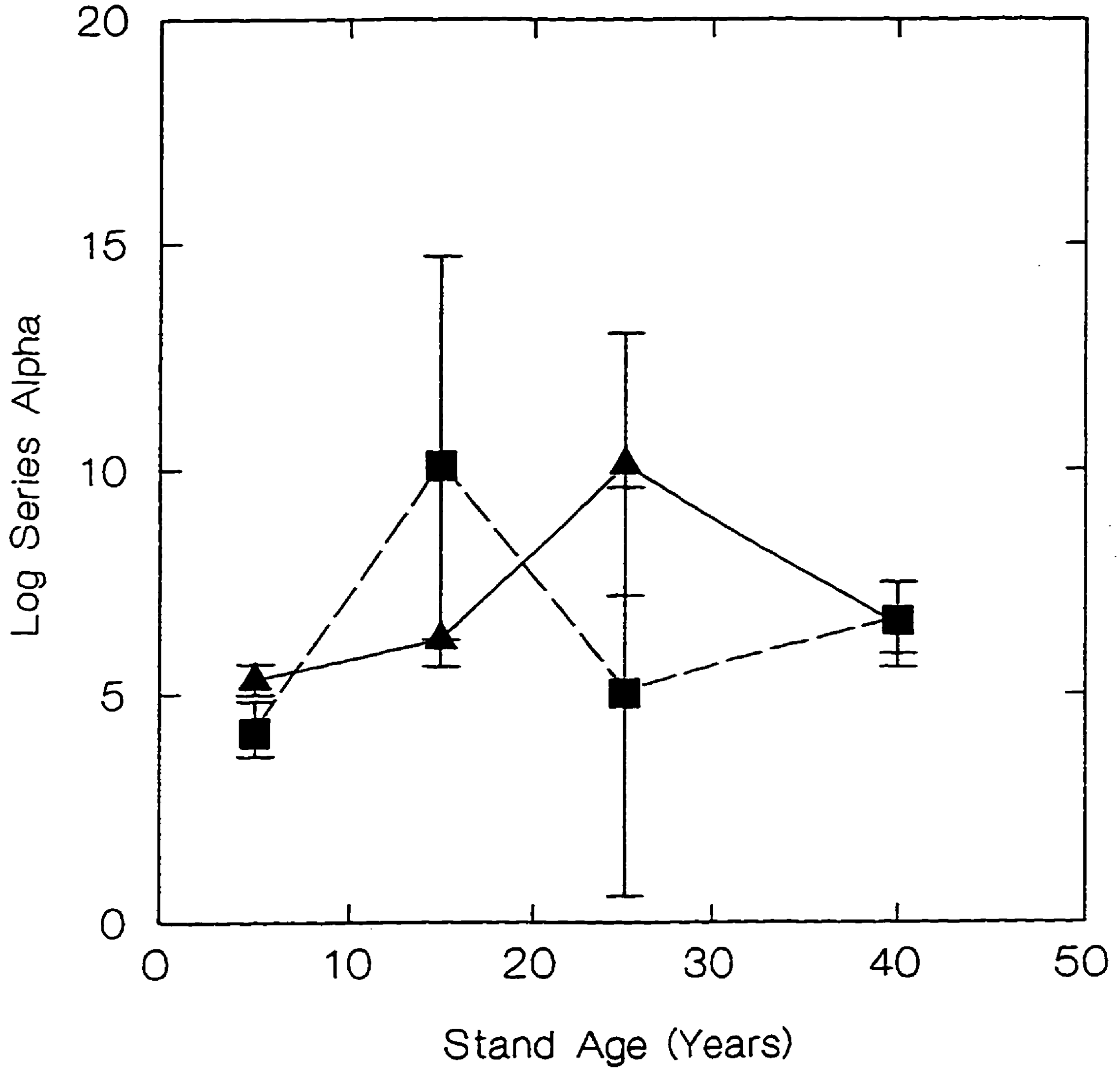

Log Series Alpha
0
5
10
15
20
0
10
20
30
40
50
Stand Age (Years)

Figure 29. The effects of stand age on Kendall's τ index of similarity for butterflies and skippers in planted (■---) and naturally regenerated (▲—) stands in 1993.

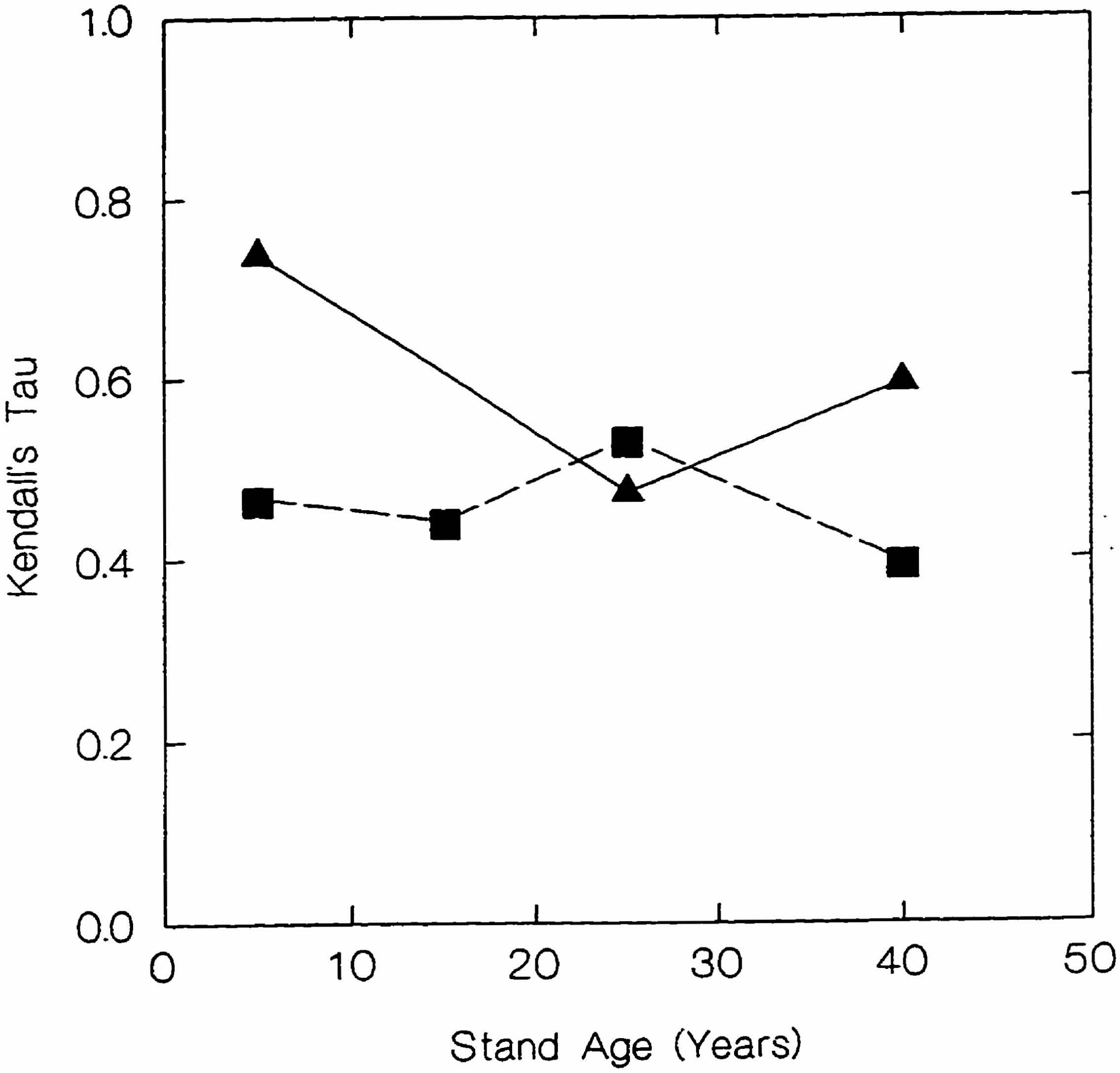
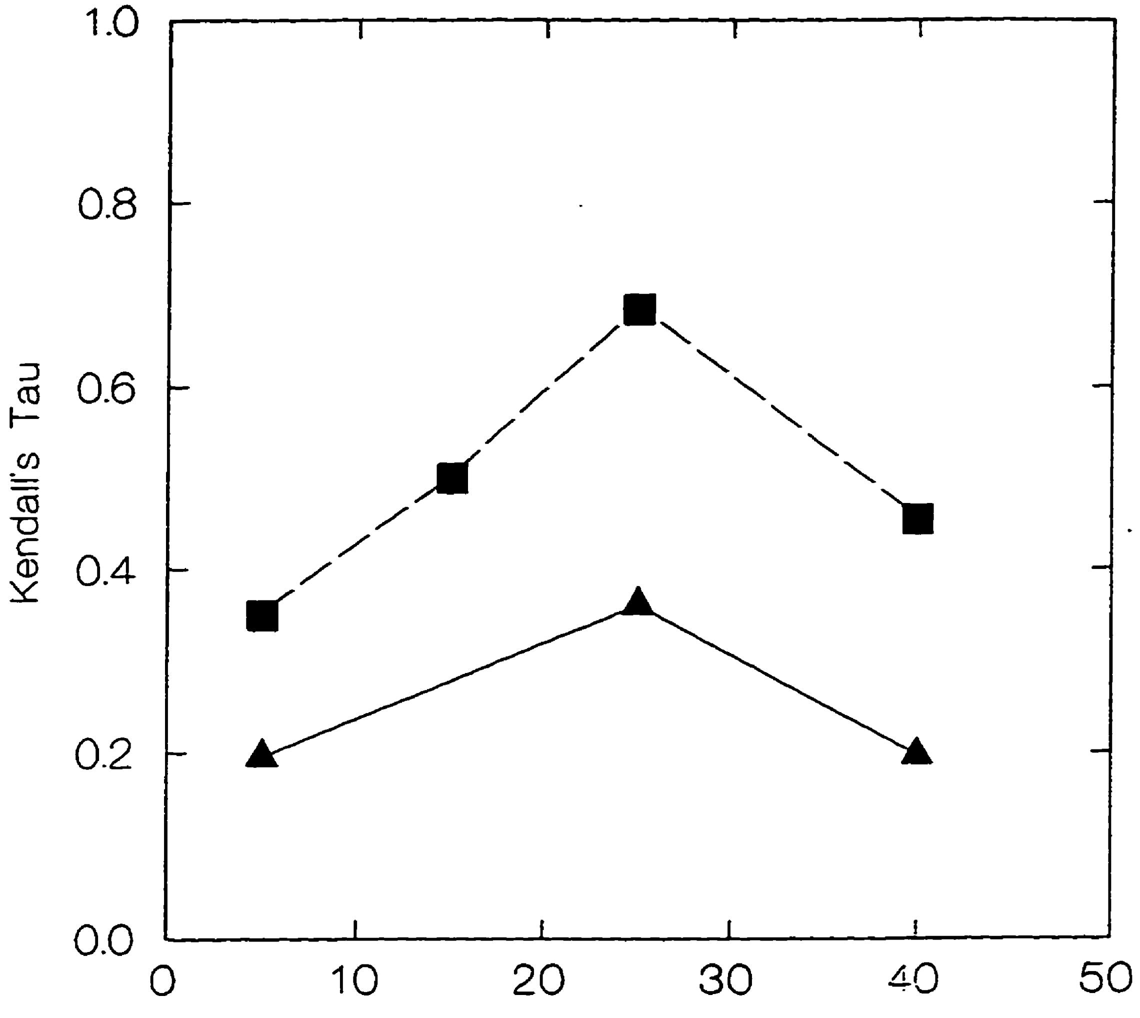

Kendall's Tau
1.0
0.8
0.6
0.4
0.2
0.0
0
10
20
30
40
50
Stand Age (Years)

Figure 30. **The effects of stand age on Kendall's τ index of similarity for butterflies and skippers in planted (■---) and naturally regenerated (▲—) stands in 1994.**



1.0
0.8
0.6
0.4
0.2
0.0
Kendall's Tau
0
10
20
30
40
50
Stand Age (Years)

Figure 31. The effects of stand age on Sørenson's coefficient of similarity for butterflies and skippers in planted (■---) and naturally regenerated (▲—) stands in 1993.

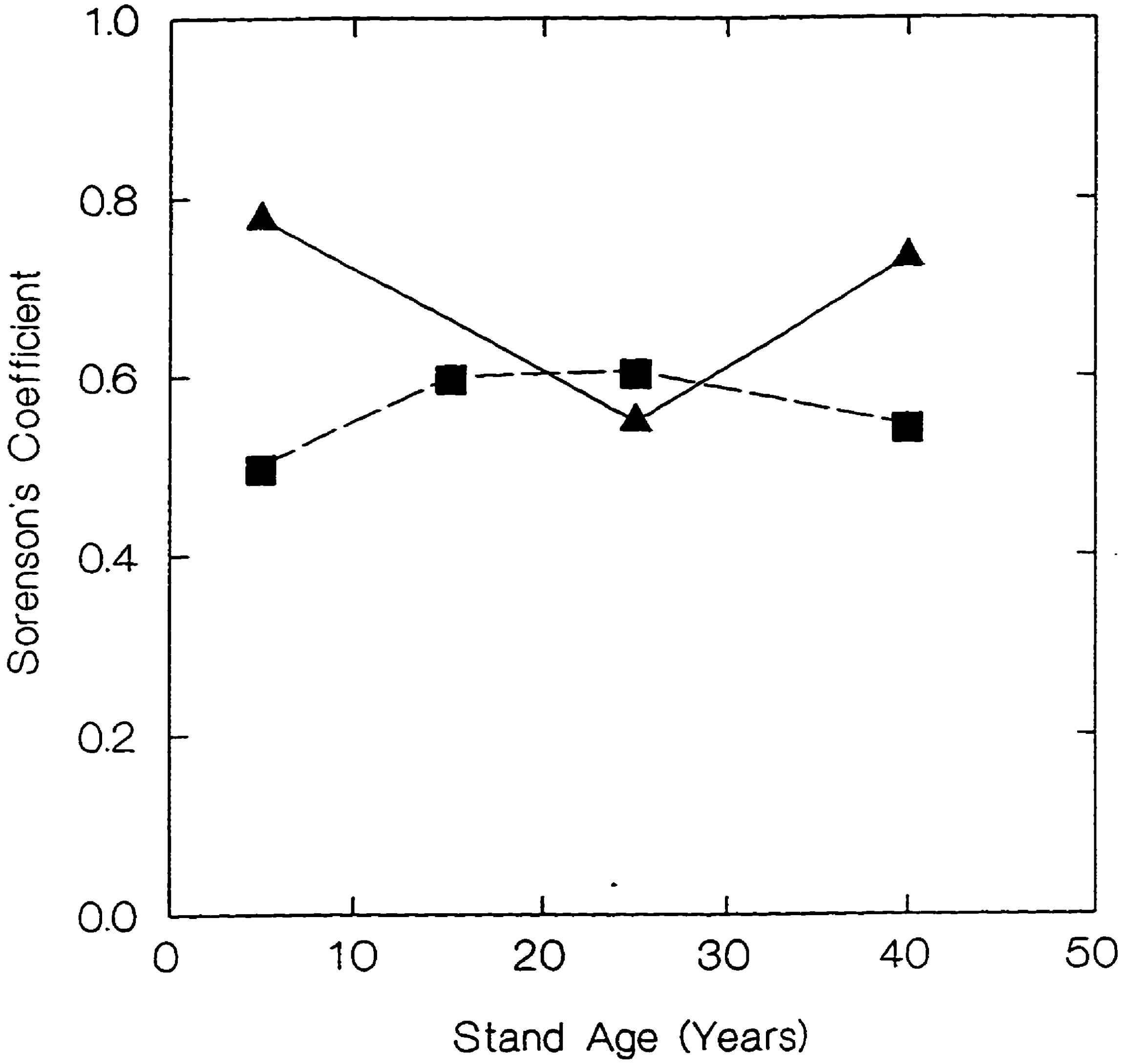

1.0
0.8
0.6
0.4
0.2
0.0
Sorenson's Coefficient
0
10
20
30
40
50
Stand Age (Years)

Figure 32. The effects of stand age on Sørenson's coefficient of similarity for butterflies and skippers in planted (■---) and naturally regenerated (▲—) stands in 1994.

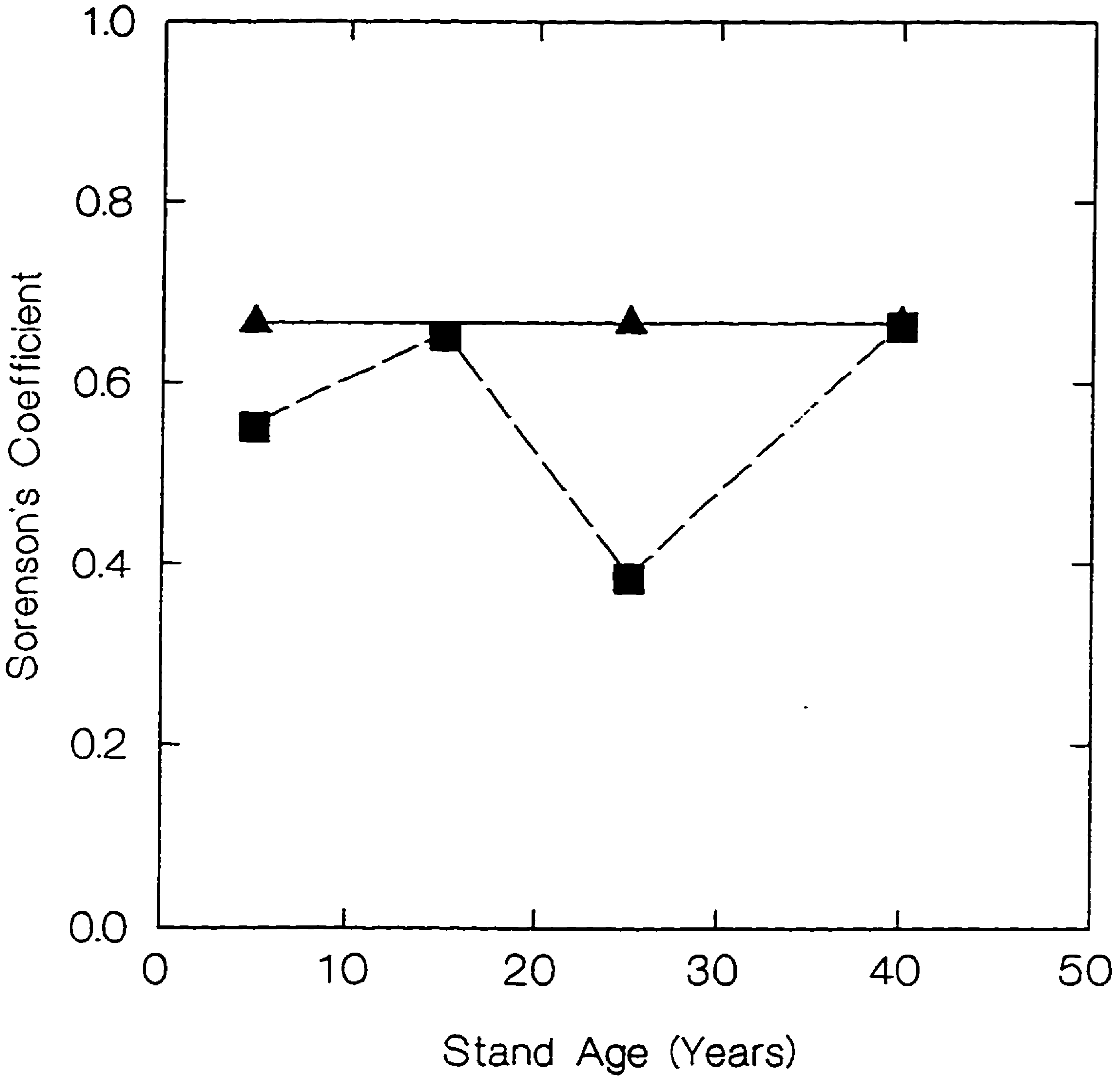

1.0
0.8
0.6
0.4
0.2
0.0
0
10
20
30
40
50
Sorenson's Coefficient
Stand Age (Years)

Figure 33. Butterfly and skipper data (1993). CA ordination diagram with site scores (◆) and species scores (●); first axis (horizontal) has an eigenvalue of 0.225 = 20.1% and the second axis, (vertical) has an eigenvalue of 0.179 = 15.9%.

Key to Lepidoptera species are: ambvia = *Amblyscirtes vialis*, carpal = *Carterocephalus palaemon*, celarg = *Celastrina argiolus*, cerpeg = *Cercyonis pegala*, danple = *Danaus plexippus*, enoant = *Enodia anthedon*, eryice = *Erynnis icelus*, erymar = *Erynnis martialis*, eucaus = *Euchloe ausonides*, eveamy = *Everes amyntula*, hartit = *Harkenclenus titus*, limarc = *Limenitis archippus*, limart = *Limenitis arthemis*, nymant = *Nymphalis antiopa*, papgla = *Papilio glaucus*, phymor = *Phyciodes morpheus*, phytha = *Phyciodes tharos*, pienap = *Pieris napi*, pierap = *Pieris rapae*, poahob = *Poanes hobomok*, polpro = *Polygonia progne*, satlip = *Satyrium liparops*, speaph = *Speyeria aphrodite*.

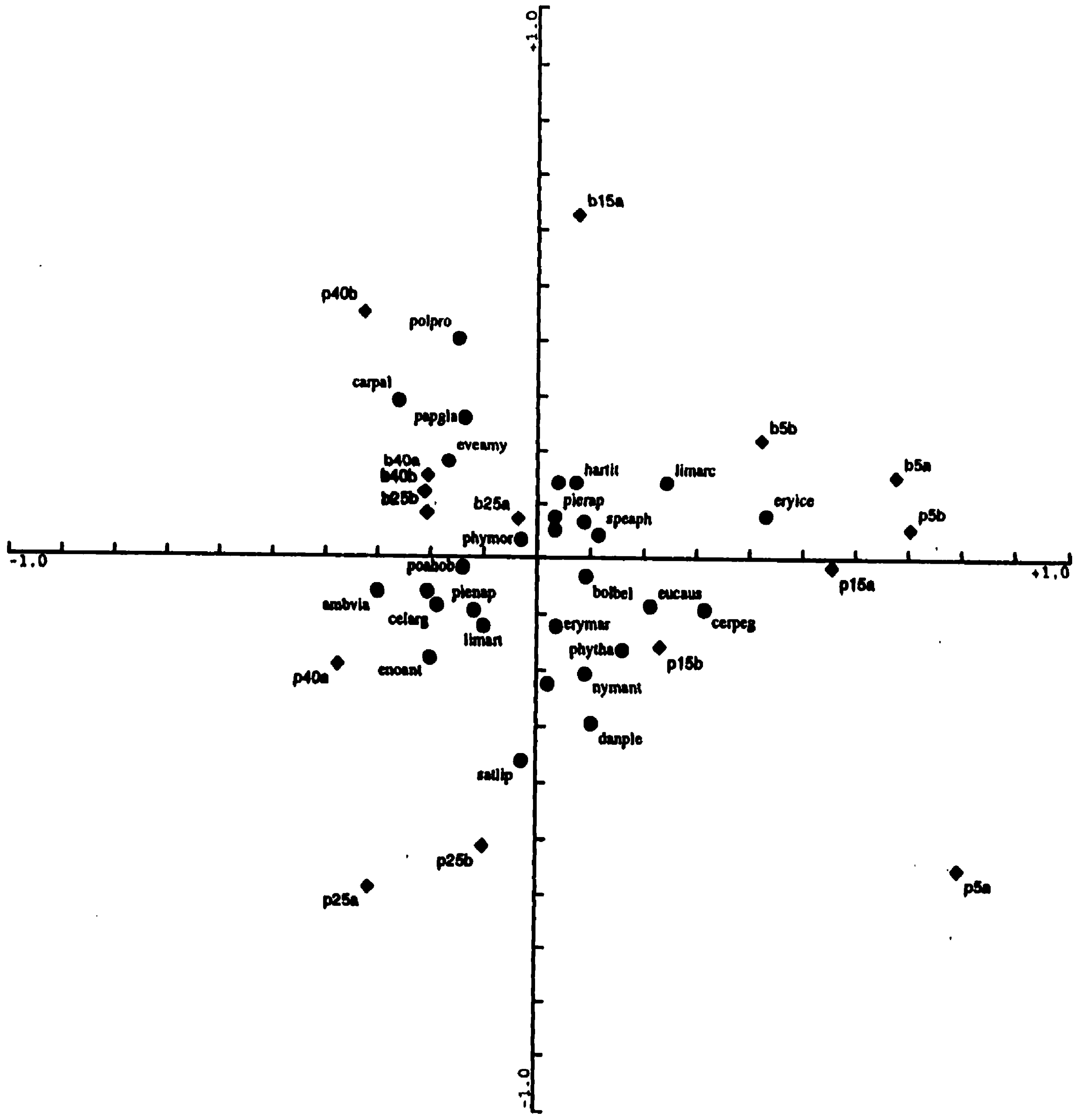

+1.0
-1.0
-1.0
+1.0
b15a
p40b
polpro
carpal
papgla
eveamy
b40a
b40b
b25b
b25a
phymor
hartit
pierap
speaph
limarc
b5b
b5a
erylce
p5b
poabob
ambvia
plenap
celarg
limart
p40a
enoant
bolbel
eucaus
cerpeg
erymar
phytha
p15b
nymant
danple
p15a
satlip
p25b
p25a
p5a

Figure 34. Butterfly and skipper data with 5 year old sites removed (1993). CA ordination diagram with site scores (◆) and species scores (●); first axis (horizontal) has an eigenvalue of 0.156 = 31.1% and the second axis, (vertical) has an eigenvalue of 0.102 = 20.3%.

Key to Lepidoptera species are: celarg = *Celastrina argiolus*, cerpeg = *Cercyonis pegala*, colint = *Colias interior*, enoant = *Enodia anthedon*, glalyg = *Glaucopsyche lygdamus*, limart = *Limenitis arthemis*, nymant = *Nymphalis antiopa*,phybat = *Phyciodes batesii*, poahob = *Poanes hobomok*, satlip = *Satyrium liparops*, speatl = *Speyeria atlantis*, specyb = *Speyeria cybele*.

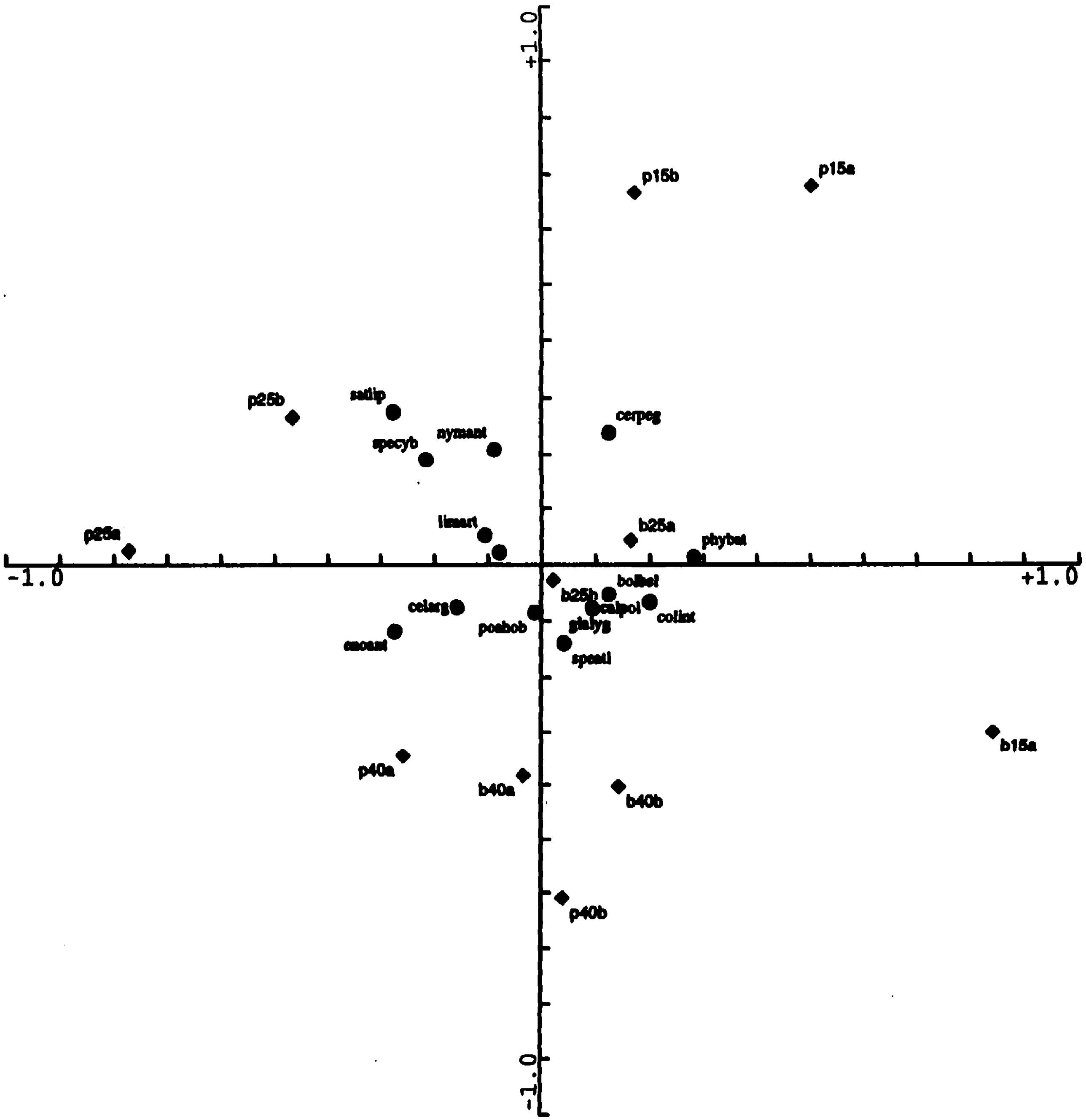

+1.0
-1.0
-1.0
+1.0
p15b
p15a
p25b
satlip
specyb
nymant
cerpeg
p25a
limart
b25a
phybat
bolbel
b25b
calpol
colint
celarg
poabob
gialyg
speatl
encant
b15a
p40a
b40a
b40b
p40b

Figure 35. Butterfly and skipper data (1994). CA ordination diagram with site scores (◆) and species scores (●); first axis (horizontal) has an eigenvalue of 0.268 = 27.6% and the second axis, (vertical) has an eigenvalue of 0.138 = 14.3%.

Key to Lepidoptera species are: ambvia = *Amblyscirtes vialis*, carpal = *Carterocephalus palaemon*, cerpeg = *Cercyonis pegala*, colphi = *Colias philodice*, enoant = *Enodia anthedon*, erybri = *Erynnis brizo*, eryice = *Erynnis icelus*, fentar= *Feniseca tarquinus*, hartit = *Harkenclenus titus*, nymant = *Nymphalis antiopa*, nymmil = *Nymphalis milberti*, oenmac = *Oeneis macounii*, phymor = *Phyciodes morpheus*, poahob = *Poanes hobomok*, polfau = *Polygonia faunus*, polpro = *Polygonia progne*, speaph = *Speyeria aphrodite*, vanata = *Vanessa atalanta*.

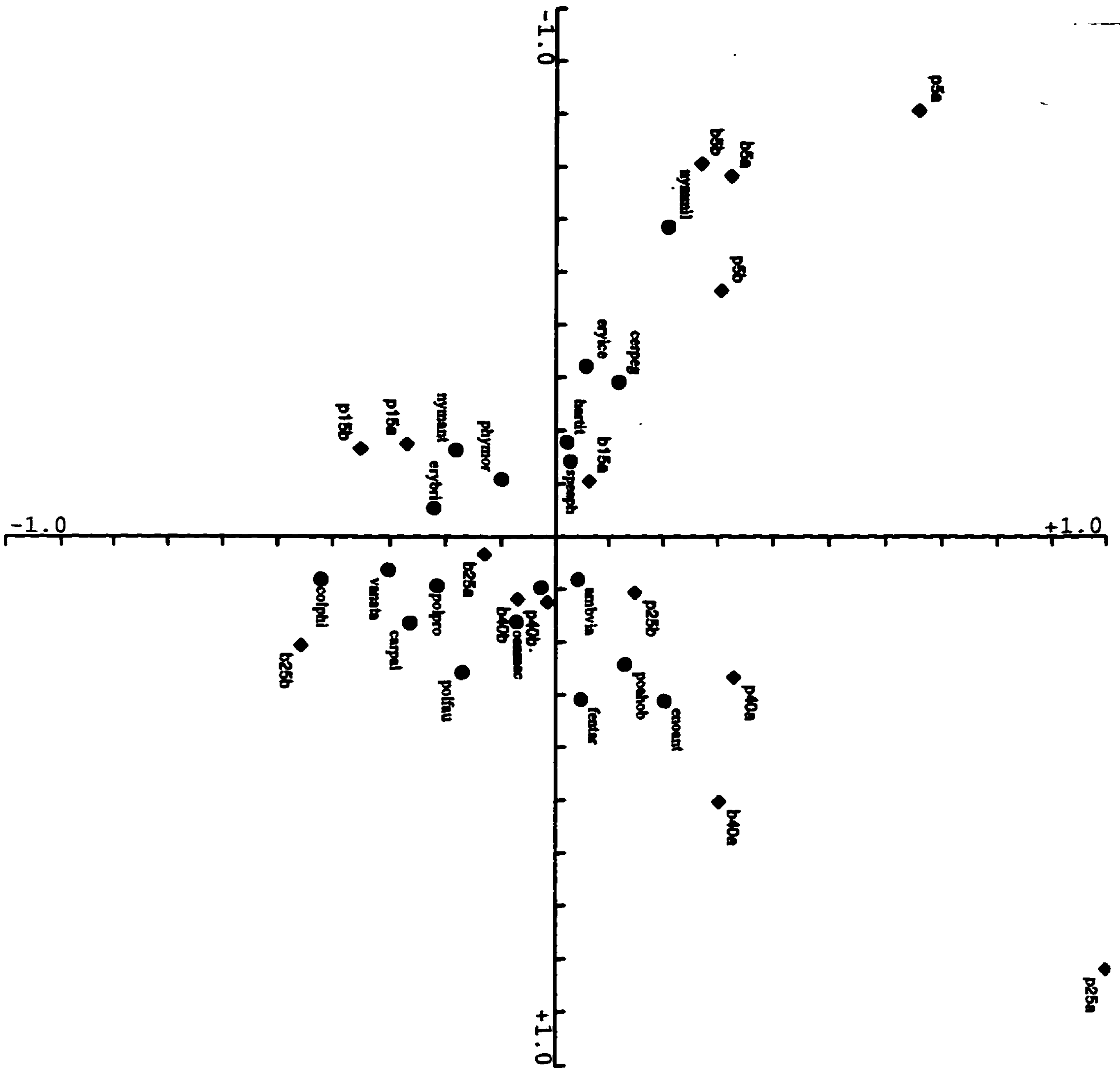

-1.0
+1.0
-1.0
+1.0
p5a
b5b
b5a
nymmil
p5b
erylce
cerpeg
hardit
b15a
sppnph
p15b
p15a
nymant
phymor
erybri
b25a
colphi
vansta
polpro
carpal
b25b
p40b
cesmac
b40b
umbvia
p25b
polfnu
poahob
festar
enoant
p40a
b40a
p25a

Figure 36. Butterfly and skipper data with 5 year old sites removed (1994). CA ordination diagram with site scores (◆) and species scores (●); first axis (horizontal) has an eigenvalue of 0.186 = 38.2% and the second axis, (vertical) has an eigenvalue of 0.116 = 24.0%.

Key to Lepidoptera species are: celarg = *Celastrina argiolus*, cerpeg = *Cercyonis pegala*, colint = *Colias interior*, enoant = *Enodia anthedon*, glalyg = *Glaucopsyche lygdamus*, hartit = *Harkenclenus titus*, nymant = *Nymphalis antiopa*, pienap = *Pieris napi*, poahob = *Poanes hobomok*, speatl =*Speyeria atlantis*.

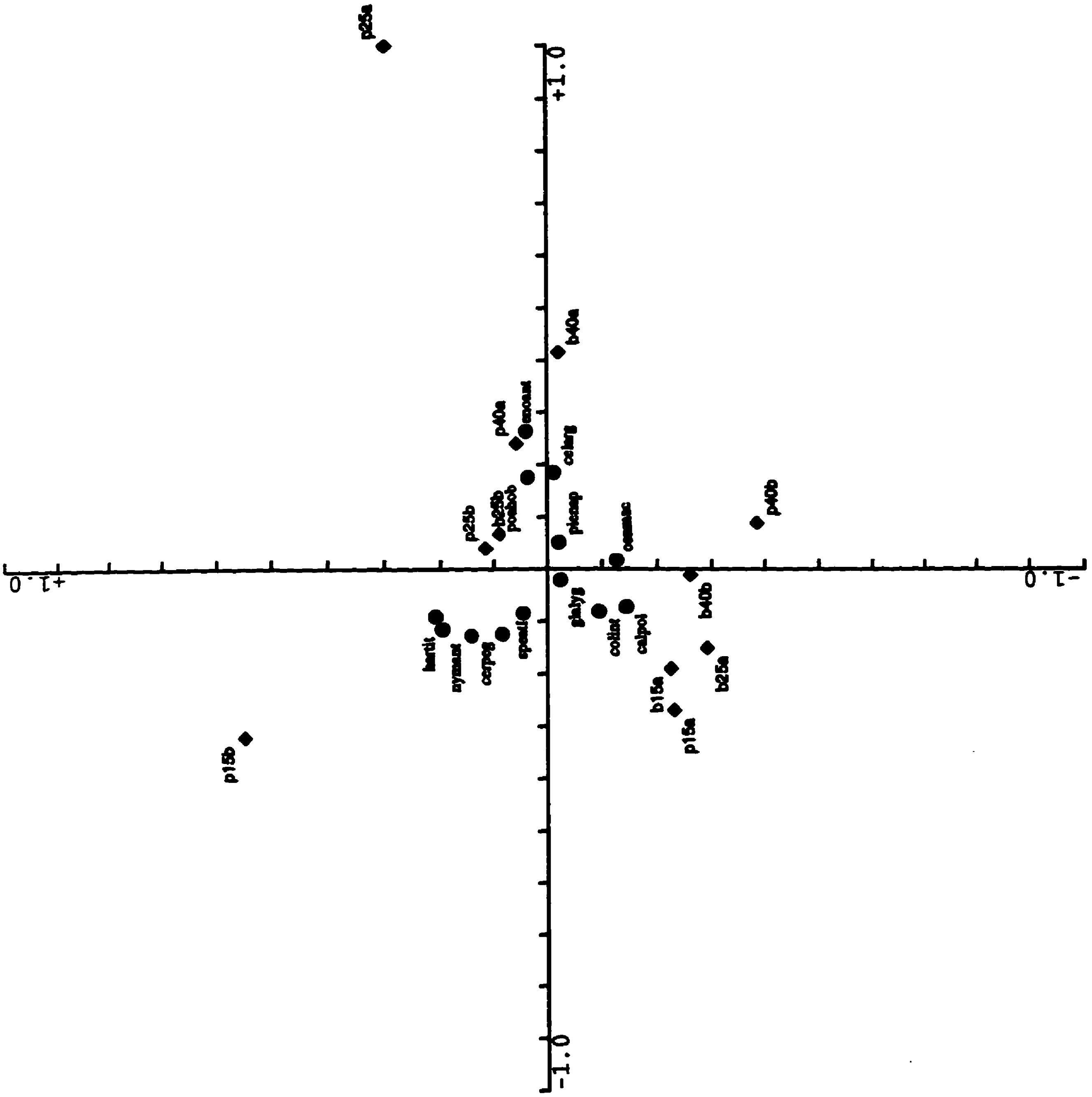

p25a
+1.0
b40a
p40a
snoaut
celarg
p25b
b25b
poahob
plenap
cassac
p40b
+1.0
-1.0
platyg
colint
calpol
b40b
hardit
nymaut
carpeg
spealb
b25a
b15a
p15a
p15b
-1.0

Figure 37. Butterfly, skipper and vegetation data (1993). CCA ordination diagram with site scores (◆), butterfly species scores (●) and environmental variables (arrows); first axis (horizontal) has an eigenvalue of 0.189 = 35.6% and the second axis (vertical) has an eigenvalue of 0.083 = 15.6%

Key to Lepidoptera species are: bolbel = *Boloria bellona*, calpol = *Callophrys polios*, celarg = *Celastrina argiolus*, cerpeg = *Cercyonis pegala*, colint = *Colias interior*, enoant = *Enodia anthedon*, eucaus = *Euchloe ausonides*, limart = *Limenitis arthemis*, nymant = *Nymphalis antiopa*, phybat = *Phyciodes batesii*, pienap = *Pieris napi*, satlip = *Satyrium liparops*, speatl = *Speyeria atlantis*, specyb = *Speyeria cybele*.

The vegetation species are: ceanoth = *Ceanothus ovatus*, c.mitis = *Cladina mitis*, o.pung = *Oryzopsis pungens*, pleuroz = *Pleurozium schreberi*, vaccin = *Vaccinium angustifolium*.

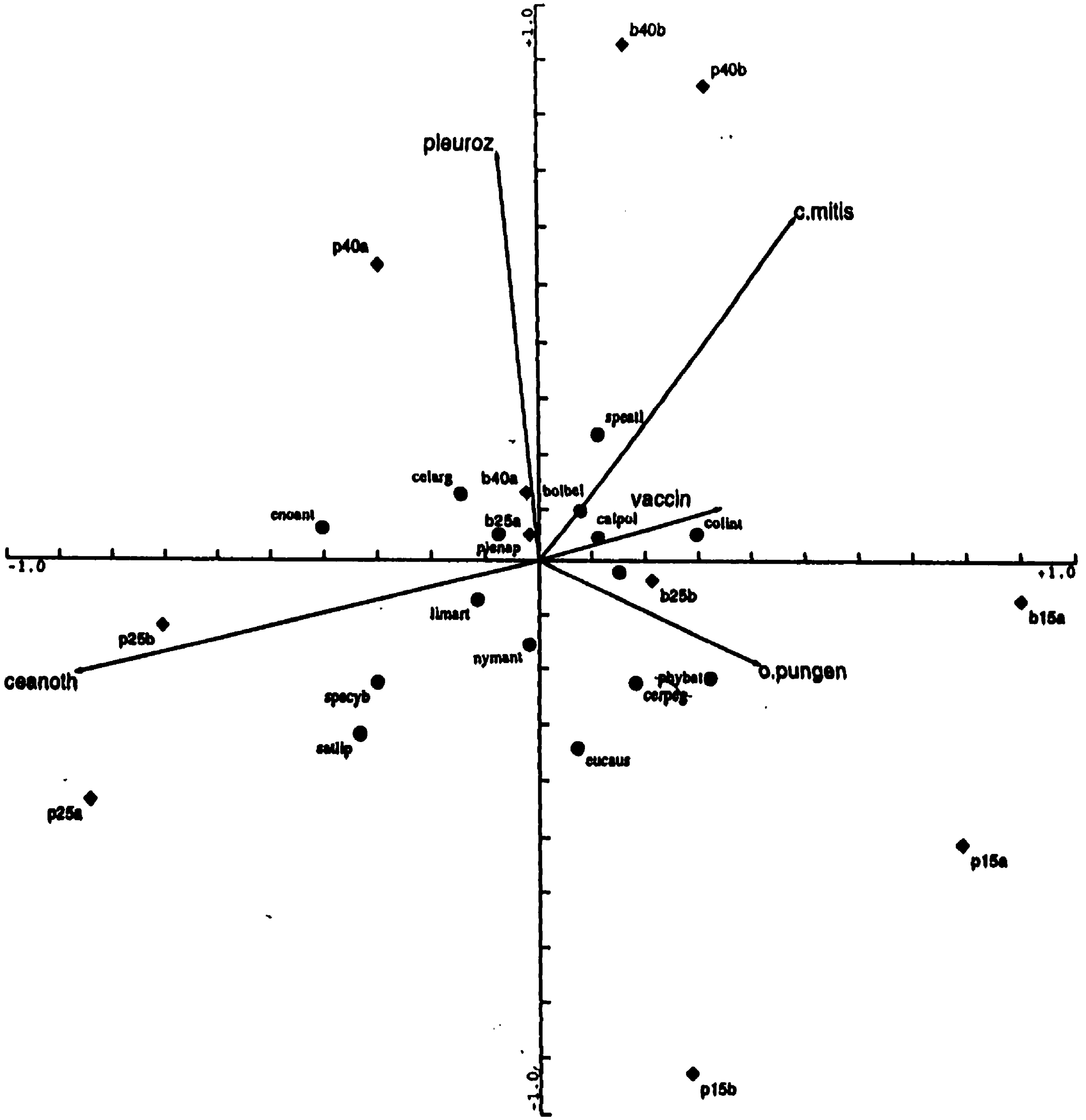

+1.0
b40b
p40b
pleuroz
c.mitis
p40a
speall
celarg
b40a
bolbel
vaccin
cnoant
b25a
calpol
colint
plenap
-1.0
+1.0
b25b
b15a
limart
p25b
nymant
ceanoth
o.pungen
phybat
cerpeg
specyb
satlip
eucaus
p25a
p15a
-1.0
p15b

Figure 38. Butterfly, skipper and vegetation data (1994). CCA ordination diagram with site scores (◆), butterfly species scores (●) and environmental variables (arrows); first axis (horizontal) has an eigenvalue of 0.189 = 35.6% and the second axis (vertical) has an eigenvalue of 0.083 = 15.6%

Key to Lepidoptera species are: bolbel = *Boloria bellona*, calpol = *Callophrys polios*, celarg = *Celastrina argiolus*, cerpeg = *Cercyonis pegala*, colint = *Colias interior*, enoant = *Enodia anthedon*, hartit = *Harkenclenus titus*, limart = *Limenitis arthemis*, nymant = *Nymphalis antiopa*, poahob = *Poanes hobomok*, speaph = *Speyeria aphrodite*, vanata = *Vanessa atalanta*.

Key to vegetation species are: c.mitis = *Cladina mitis*,pleuroz = *Pleurozium schreberi*, solidago = *Solidago nemoralis*, vaccin = *Vaccinium angustifolium*.

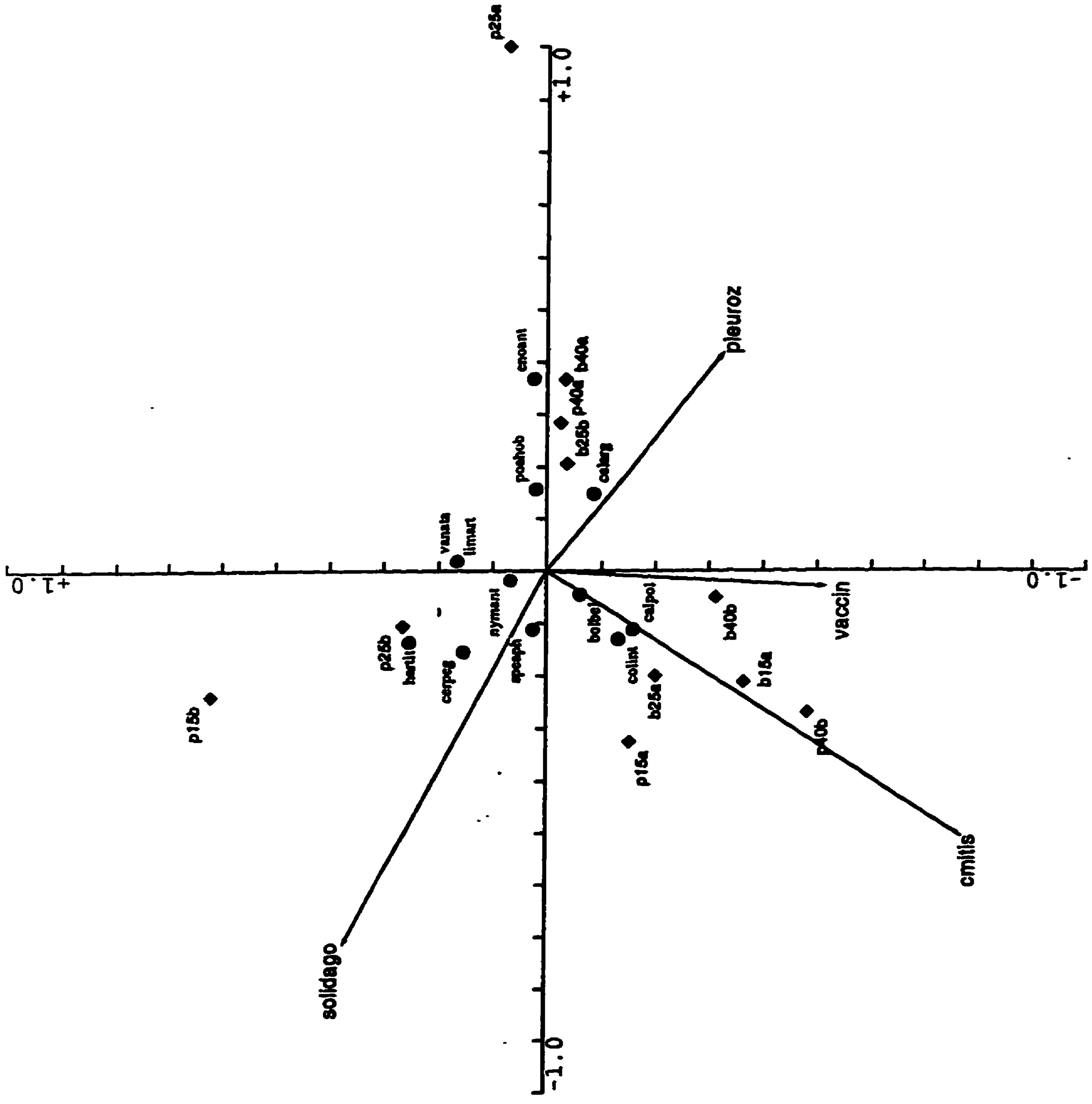

+1.0
-1.0
+1.0
-1.0
p25a
cnoant
b40a
p40a
b25b
calarg
poahob
vanata
linart
pleuroz
vaccin
cmitis
solidago
symant
speaph
bolbel
calpol
colinf
b40b
b15a
b25a
p15a
p40b
p25b
bartli
carpeg
p15b

Figure 39. Butterfly, skipper and environmental data (1993). CCA ordination diagram with site scores (◆), species scores (●) and environmental variables (arrows); first axis (horizontal) has an eigenvalue of 0.083 = 16.5% and the second axis (vertical) has an eigenvalue of 0.068 = 13.5%

Key to Lepidoptera species are: bolbel = *Boloria bellona*, celarg = *Celastrina argiolus*, colint = *Colias interior*, enoant = *Enodia anthedon*, glalyg = *Glaucopsyche lygdamus*, limart = *Limenitis arthemis*, nymant = *Nymphalis antiopa*, satlip = *Satyrium liparops*, speaph = *Speyeria aphrodite*.

The environmental variables are: litemean = mean light intensity, treemean = mean tree density per m^2.

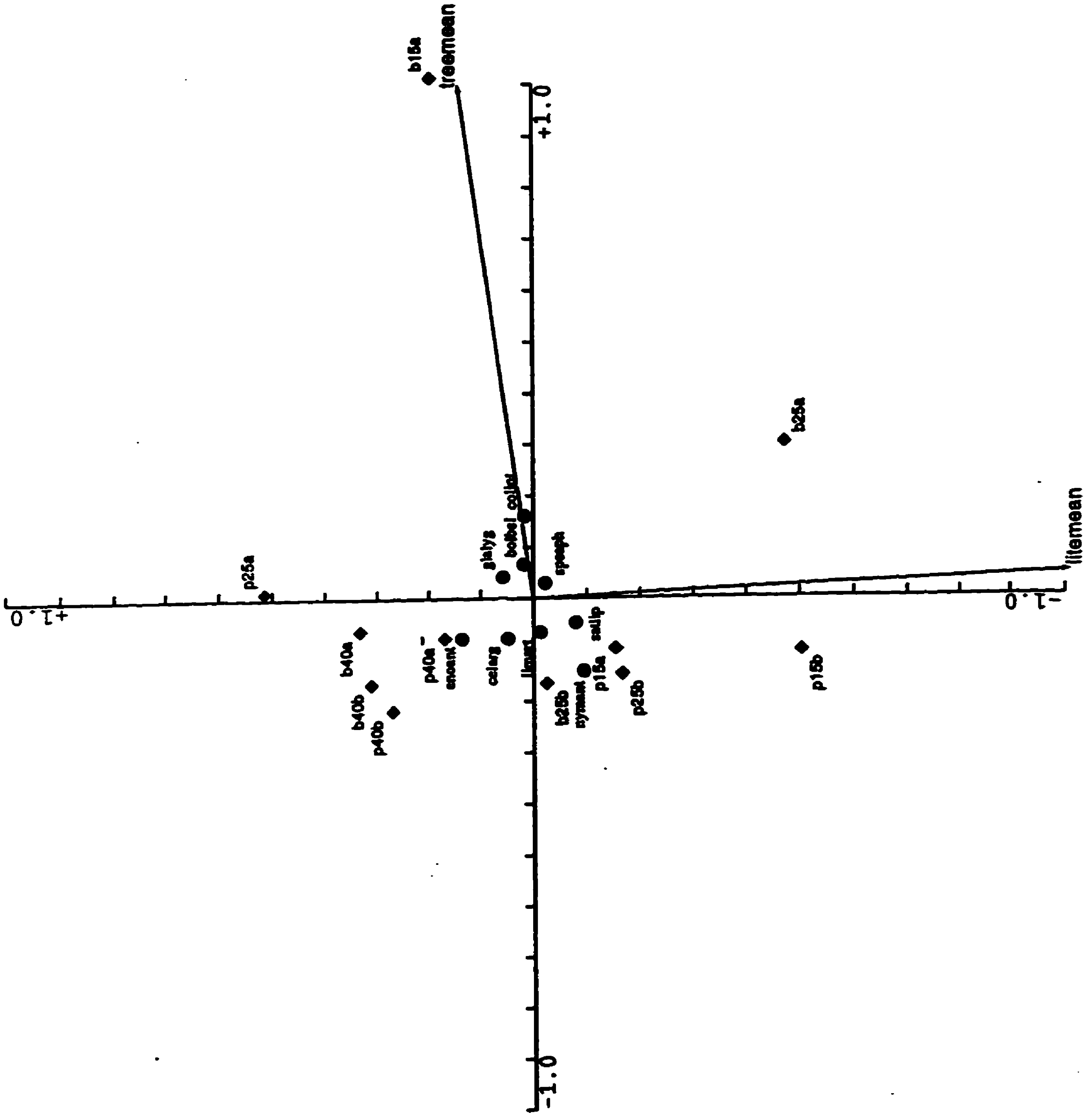

b15a
treemean
+1.0
-1.0
b25a
litemean
p25a
glalys
bolbei
collat
spaaph
b40a
b40b
p40b
p40a
encant
celarg
lithsd
b25b
symant
p15a
salip
p25b
p15b
+1.0
-1.0

Figure 40. Butterfly, skipper and environmental data (1994). CCA ordination diagram with site scores (◆), species scores (●) and environmental variables (arrows); first axis (horizontal) has an eigenvalue of 0.116 = 23.9% and the second axis (vertical) has an eigenvalue of 0.033 = 6.8%.

Key to Lepidoptera species are: celarg = *Celastrina argiolus*, colint = *Colias interior*, enoant = *Enodia anthedon*, hartit = *Harkenclenus titus*, limart = *Limenitis arthemis*, nymant = *Nymphalis antiopa*, nymmil = *Nymphalis milberti*, oenmac = *Oeneis macounii*, pierap = *Pieris rapae*, poahob = *Poanes hobomok*, specyb = *Speyeria cybele*.

The environmental variables are: litemean = mean light intensity, treemean = mean tree density per m^2.

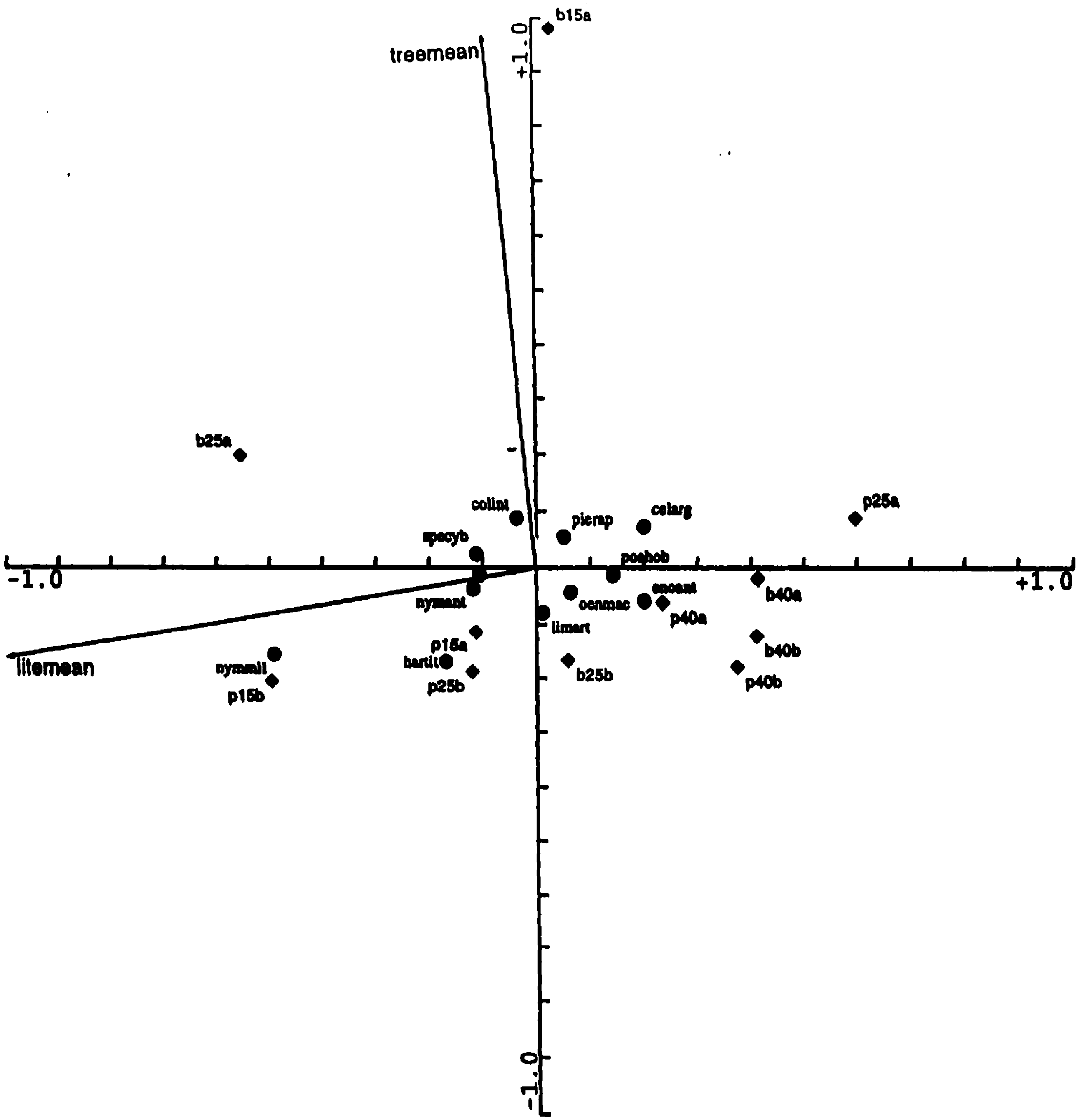

b15a
treemean
+1.0
b25a
colint
picrap
celarg
p25a
specyb
poshob
-1.0
+1.0
nymant
oenmac
encaat
b40a
p40a
limart
litemean
p15a
b40b
nymsil
bartit
b25b
p40b
p15b
p25b
-1.0

Figure 41. The effects of stand age on mean number of moths collected per site in planted (■---) and naturally regenerated (▲—) stands in 1993. (Error bars represent standard error; no replication of 15 year old naturally regenerated stand.)

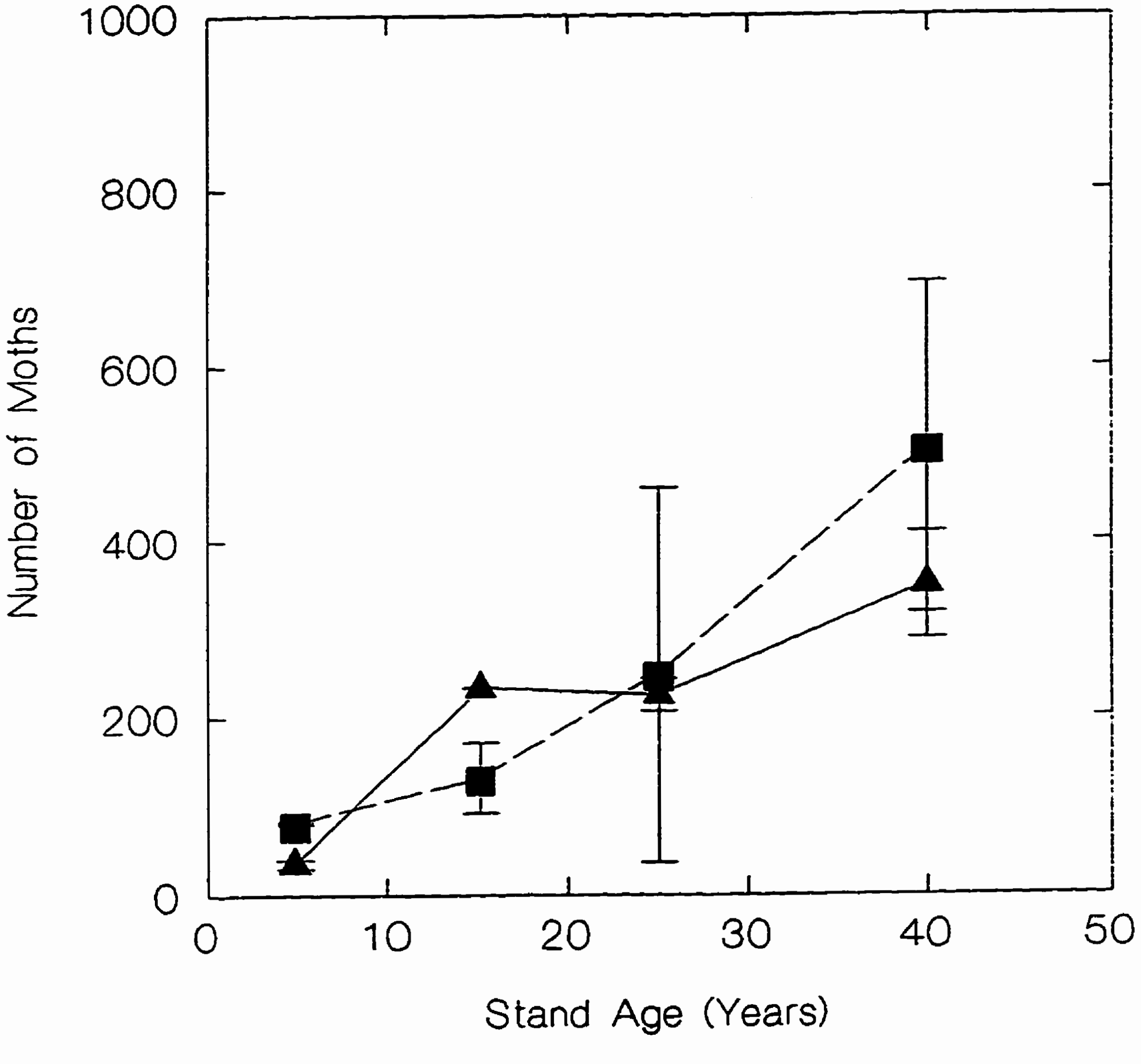

1000
800
600
400
200
0
Number of Moths
0
10
20
30
40
50
Stand Age (Years)

Figure 42. The effects of stand age on mean number of moths collected per site in planted (■---) and naturally regenerated (▲—) stands in 1994. (Error bars represent standard error; no replication of 15 year old naturally regenerated stand.)

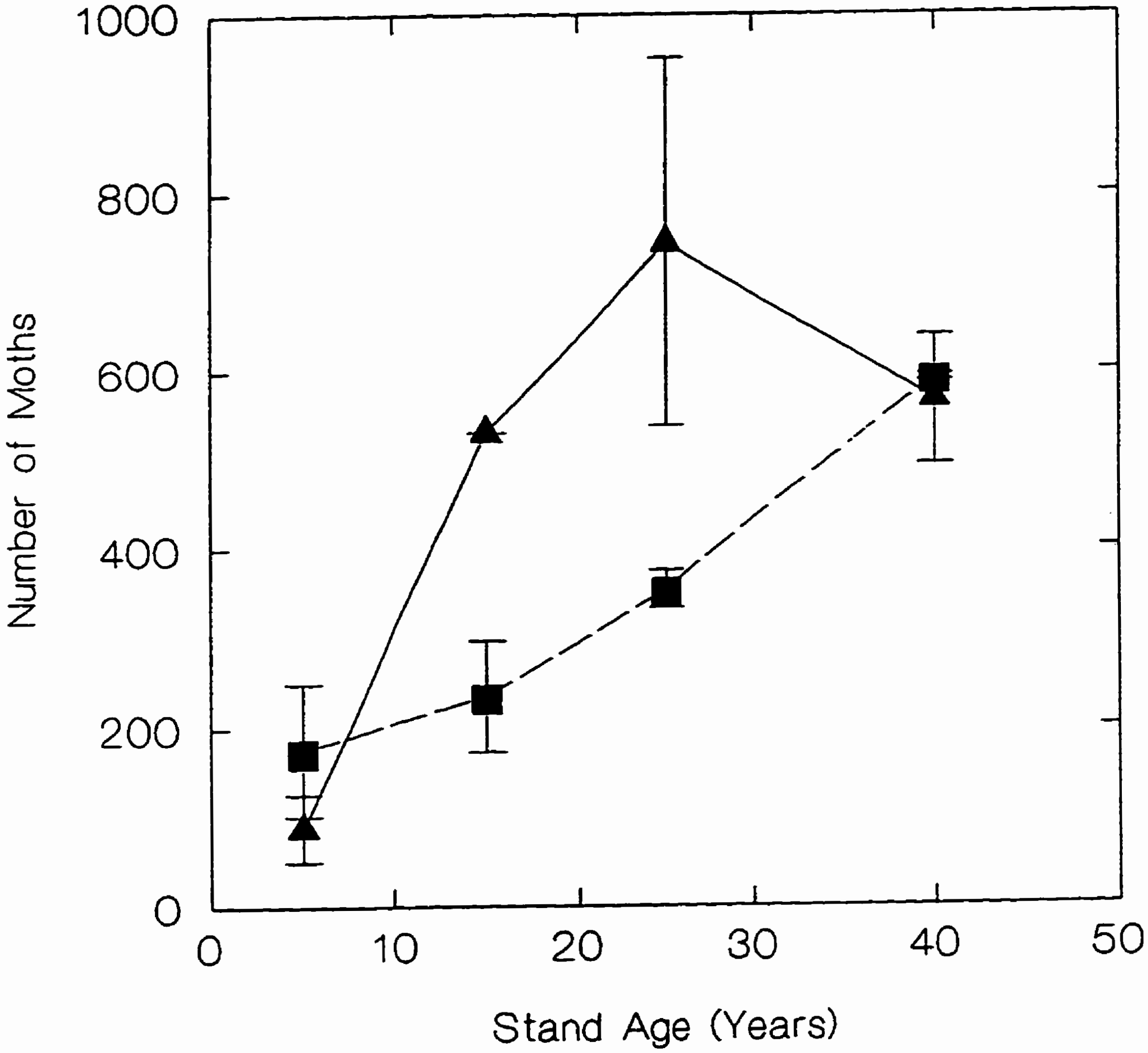

1000
800
600
400
200
0
Number of Moths
0
10
20
30
40
50
Stand Age (Years)

Figure 43. The effects of stand age on mean number of moth species collected per site in planted (■—) and naturally regenerated (▲—) stands in 1993. (Error bars represent standard error; no replication of 15 year old naturally regenerated stand.)

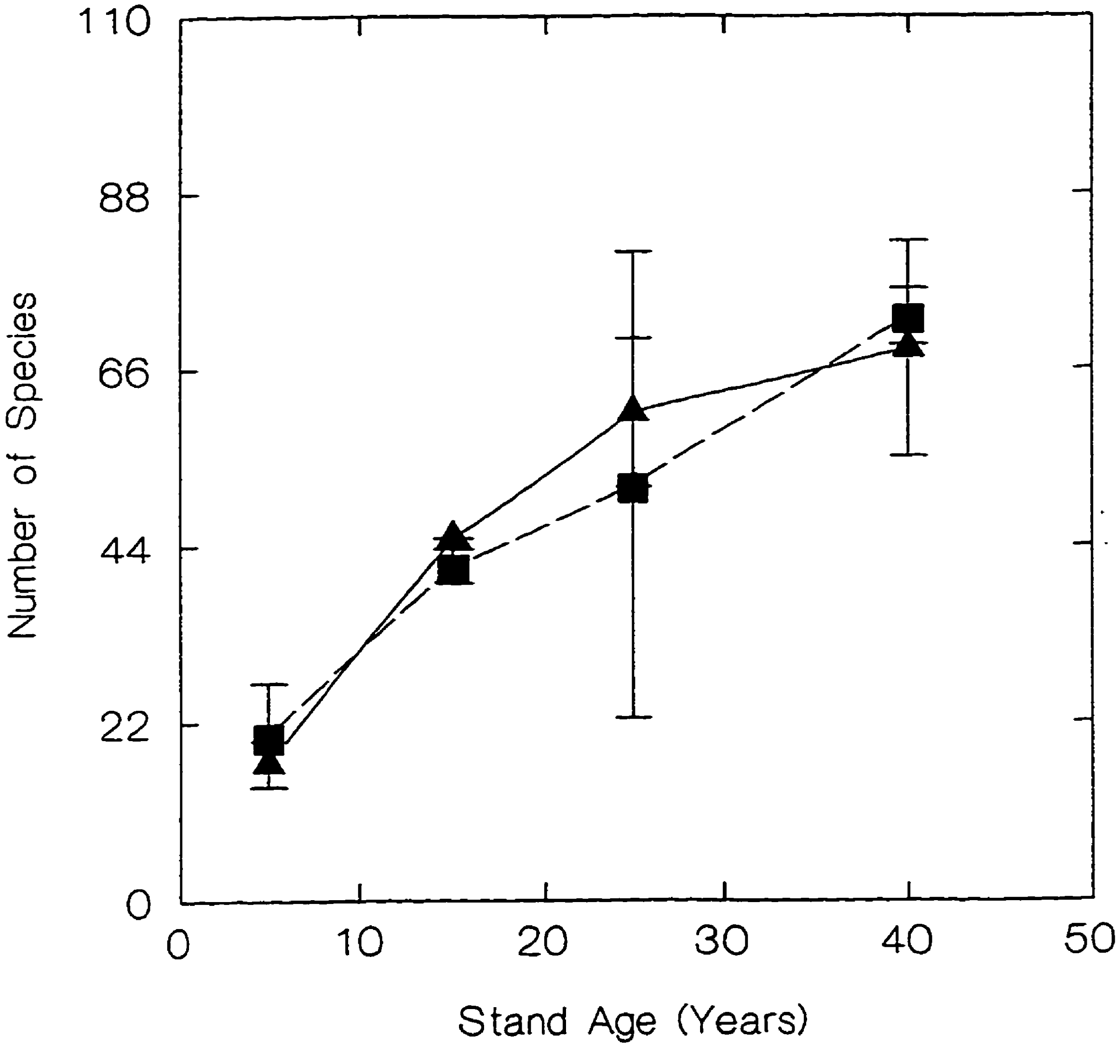

110
88
66
44
22
0
Number of Species
0
10
20
30
40
50
Stand Age (Years)

Figure 44. The effects of stand age on mean number of moth species collected per site in planted (■---) and naturally regenerated (▲—) stands in 1994. (Error bars represent standard error; no replication of 15 year old naturally regenerated stand.)

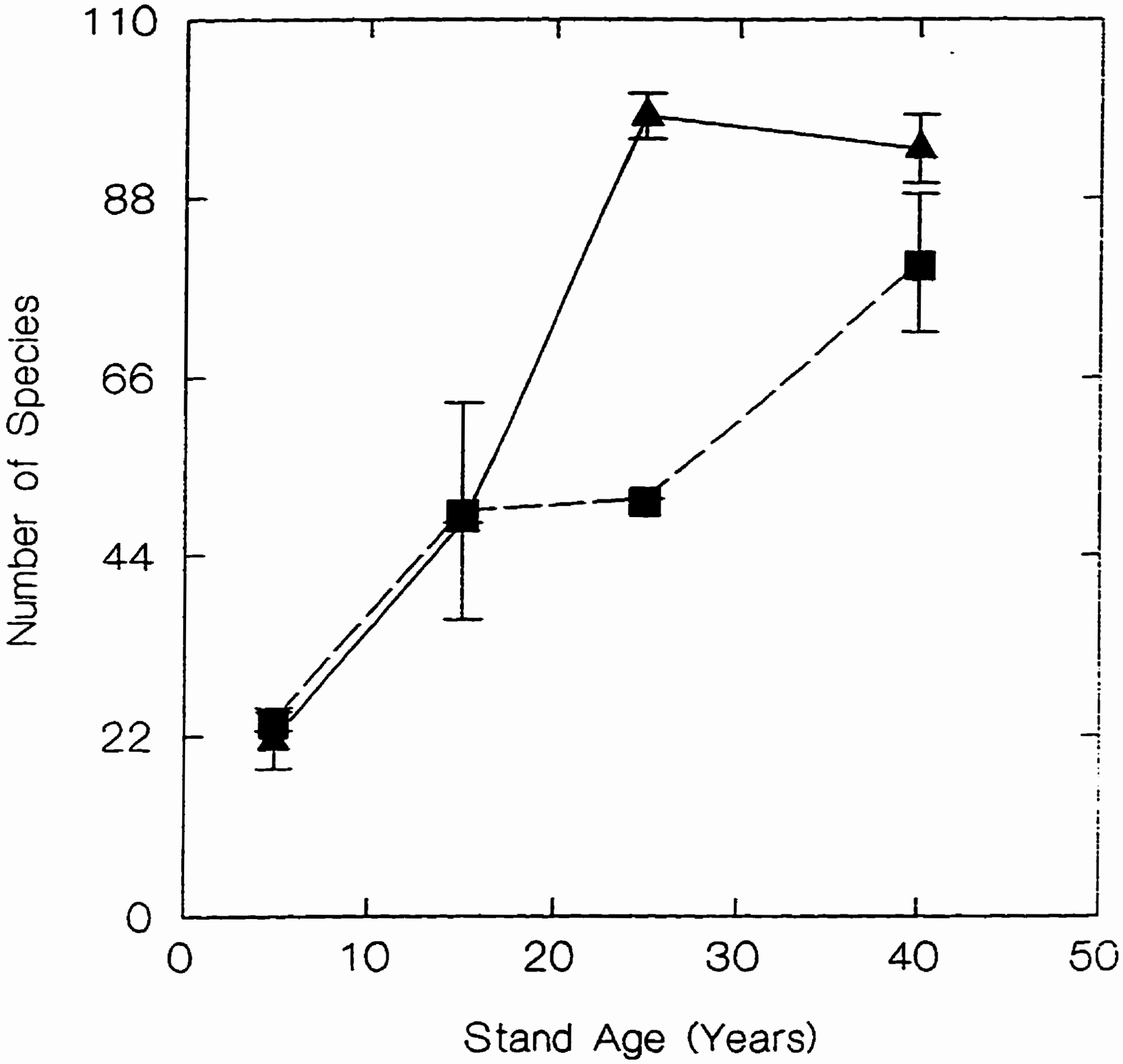
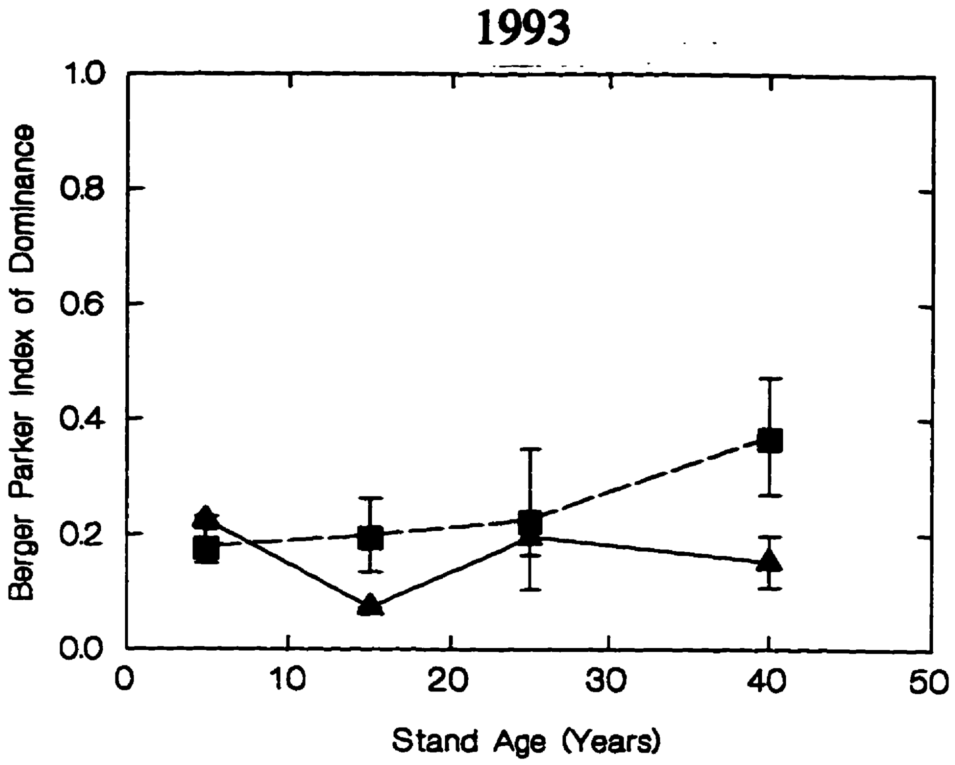
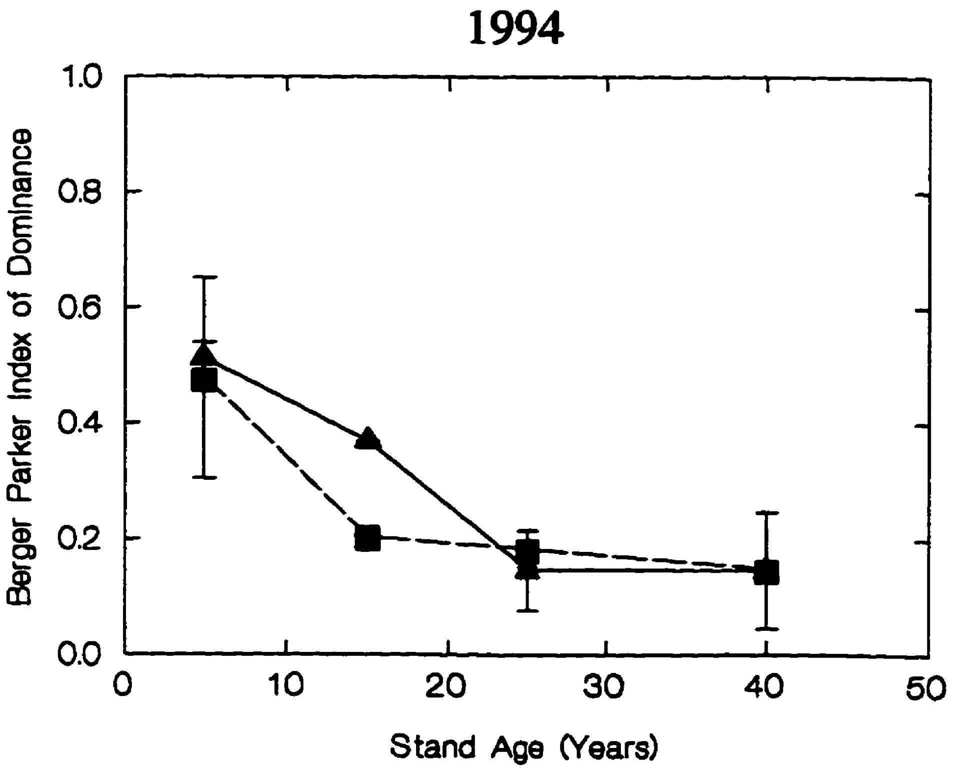

110
88
66
44
22
0
0
10
20
30
40
50
Number of Species
Stand Age (Years)

Figure 45. The effects of stand age on the Berger Parker index of dominance for moths collected in planted (■---) and naturally regenerated (▲—) stands in 1993 and 1994. (Error bars represent standard error; no replication of 15 year old naturally regenerated stand.)



1993

Berger Parker Index of Dominance
1.0
0.8
0.6
0.4
0.2
0.0
0
10
20
30
40
50
Stand Age (Years)



1994

Berger Parker Index of Dominance
1.0
0.8
0.6
0.4
0.2
0.0
0
10
20
30
40
50
Stand Age (Years)

Figure 46. The effects of stand age on the log series α index for moths in planted (■---) and naturally regenerated (▲—) stands in 1993. (Error bars represent standard error; no replication of 15 year old naturally regenerated stand.)

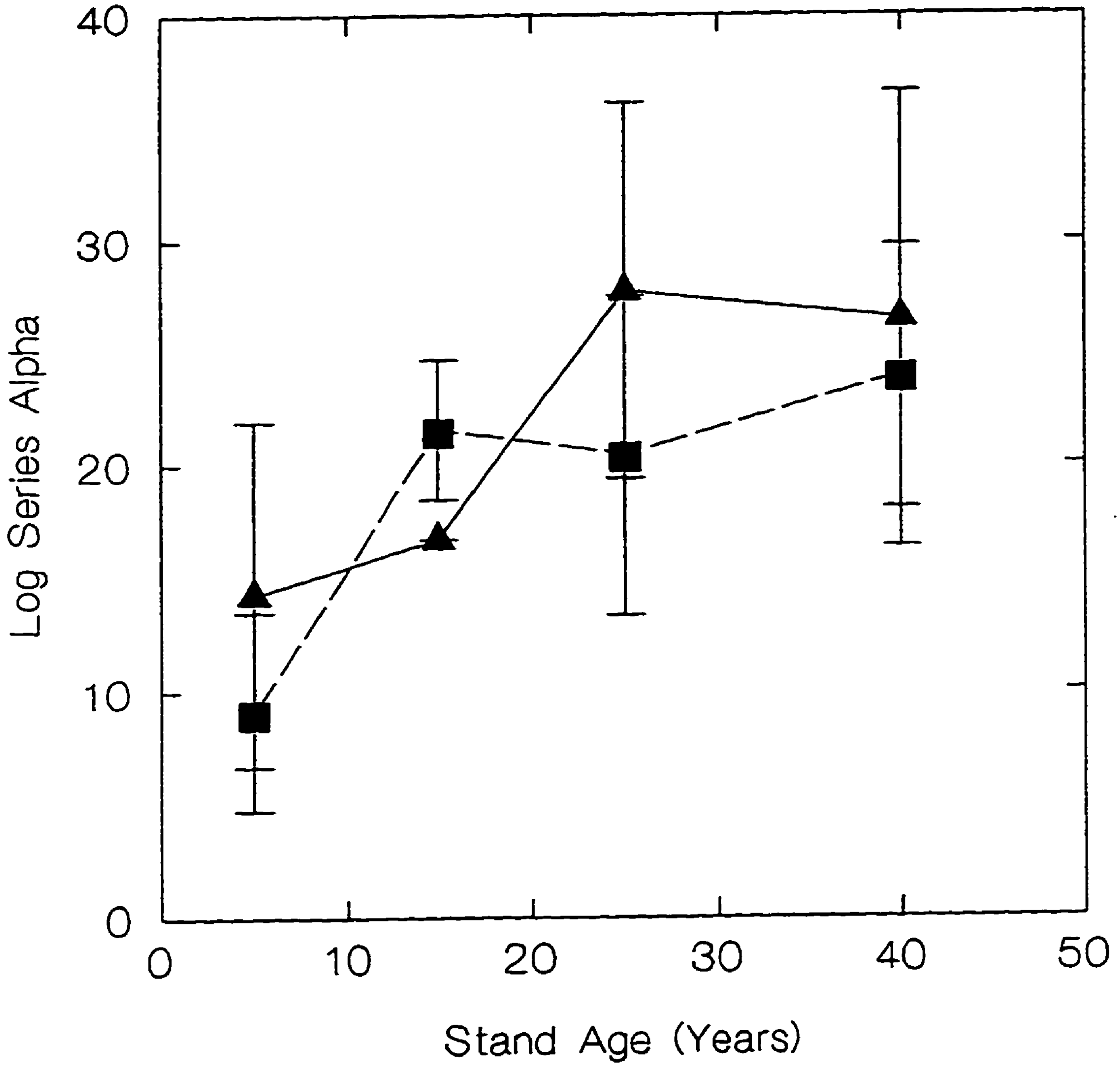

Log Series Alpha
0
10
20
30
40
0
10
20
30
40
50
Stand Age (Years)

Figure 47. The effects of stand age on the log series α index for moths in planted (■---) and naturally regenerated (▲—) stands in 1994. (Error bars represent standard error; no replication of 15 year old naturally regenerated stand.)

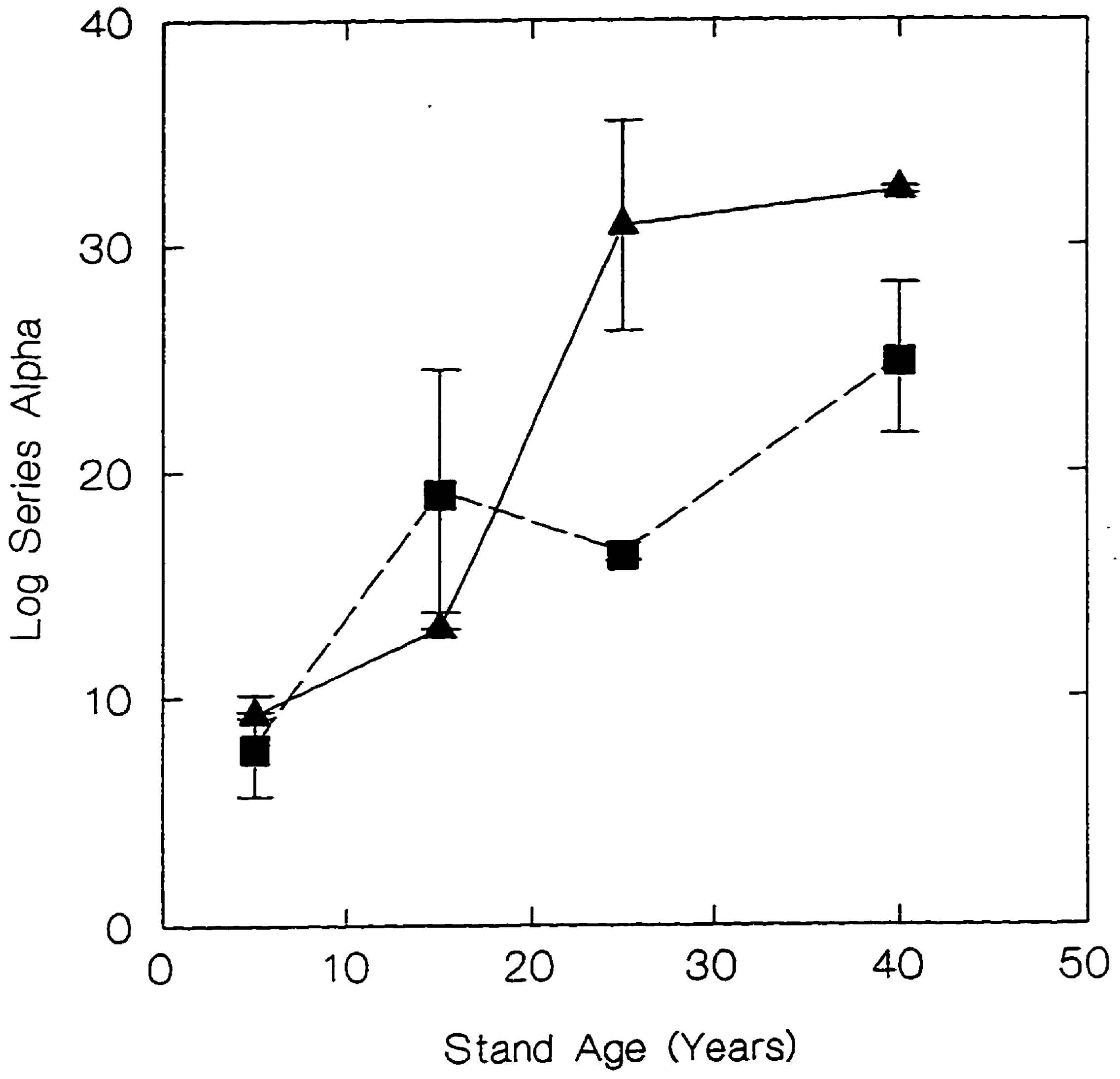

Log Series Alpha
0
10
20
30
40
Stand Age (Years)
0
10
20
30
40
50

Figure 48. The effects of stand age on Kendall's τ index of similarity for moths in planted (■---) and naturally regenerated (▲—) stands in 1993.

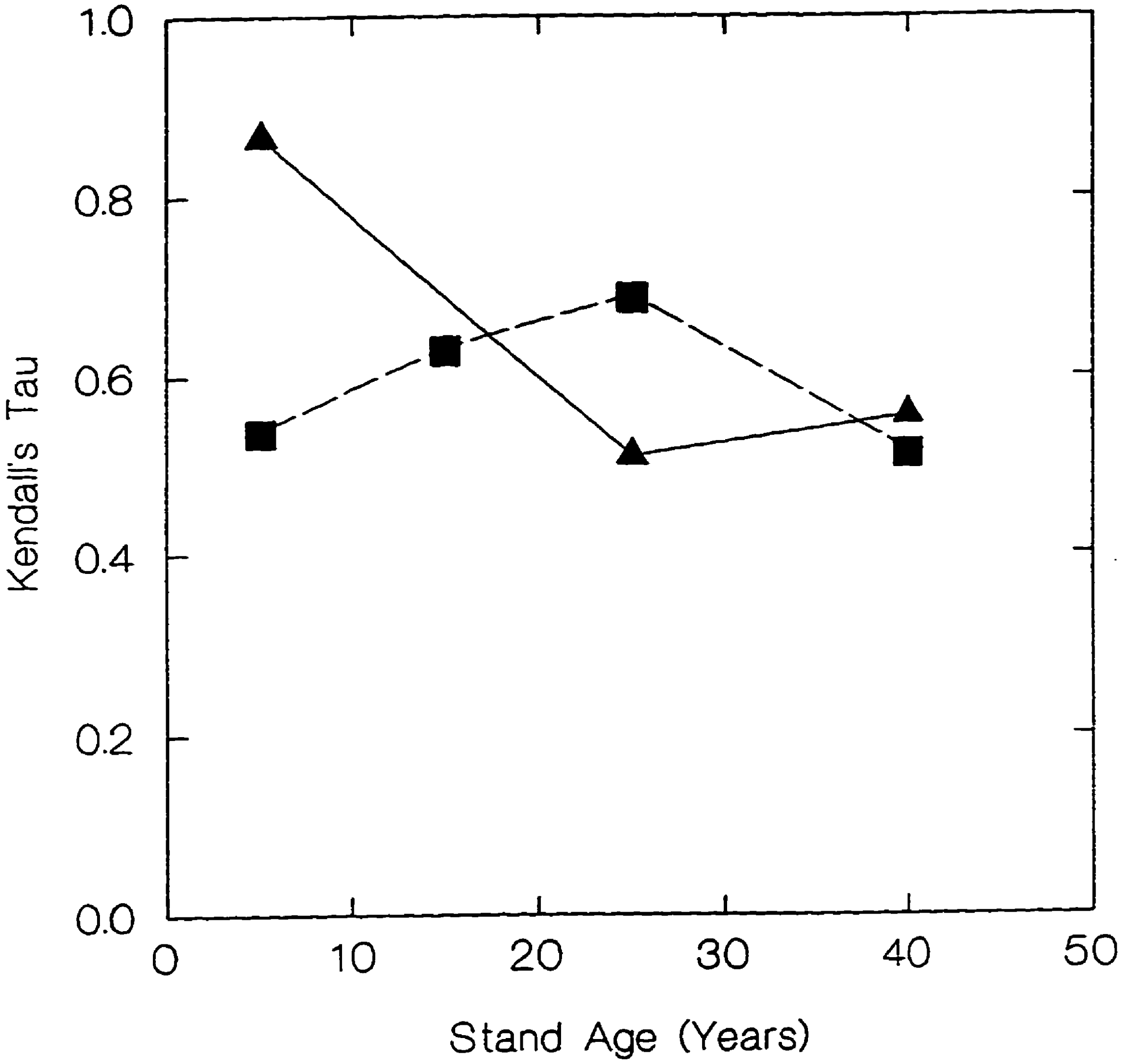

1.0
0.8
0.6
0.4
0.2
0.0
Kendall's Tau
0
10
20
30
40
50
Stand Age (Years)

Figure 49. The effects of stand age on Kendall's τ index of similarity for moths in planted (■—) and naturally regenerated (▲—) stands in 1994.

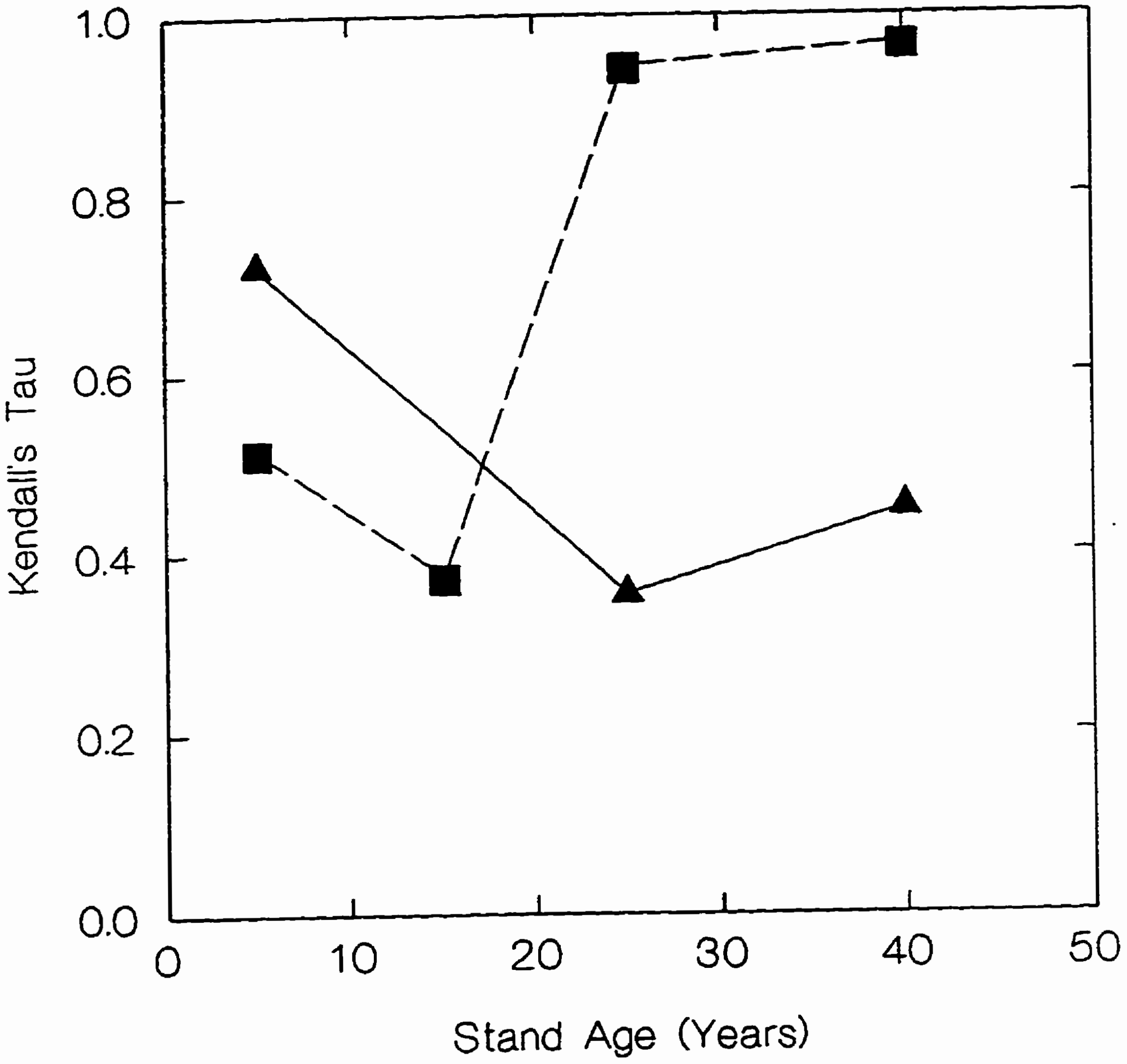

1.0
0.8
0.6
0.4
0.2
0.0
Kendall's Tau
0
10
20
30
40
50
Stand Age (Years)

Figure 50. The effects of stand age on Sørenson's coefficient of similarity for moths in planted (■---) and naturally regenerated (▲—) stands in 1993.

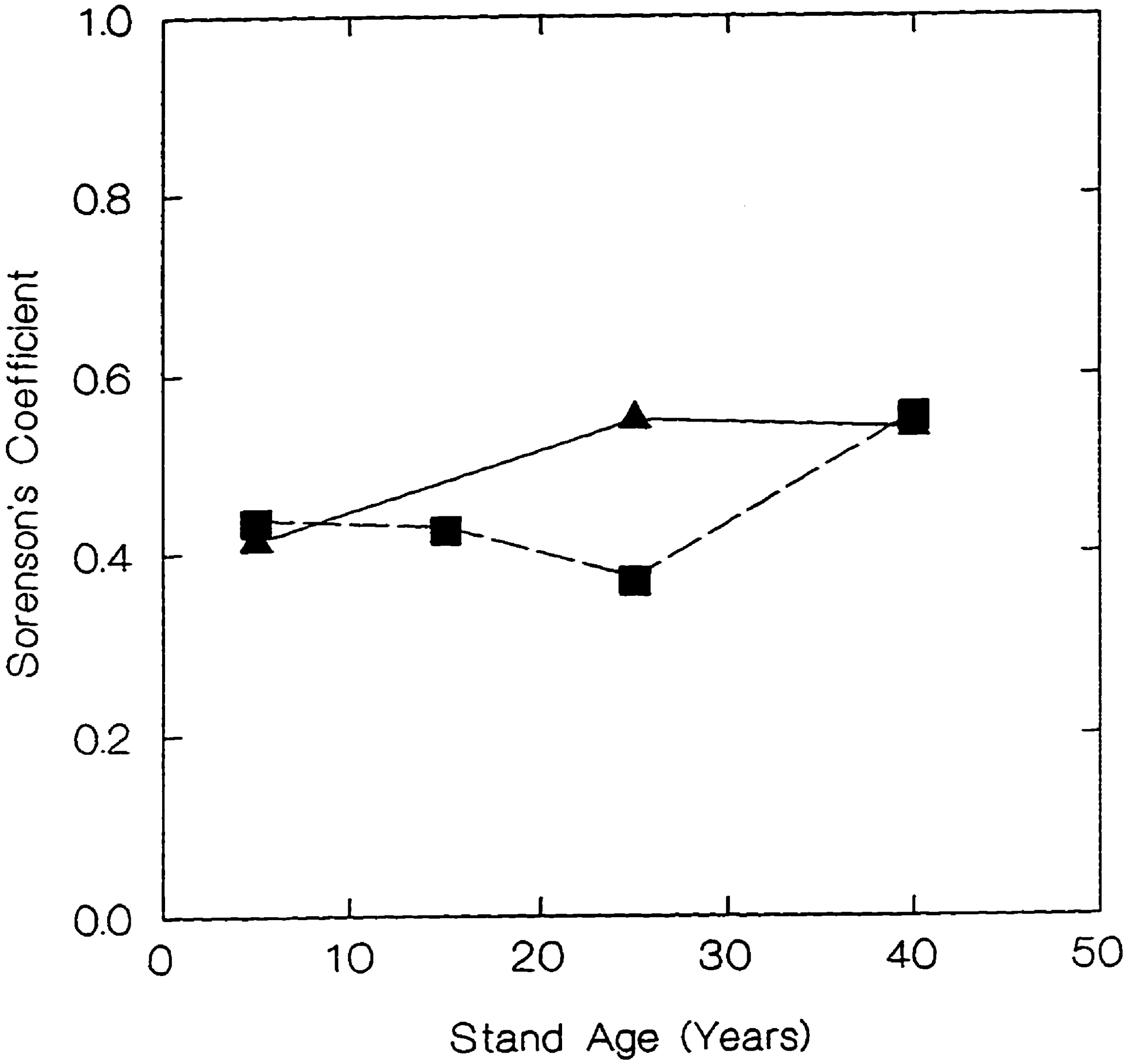

1.0
0.8
0.6
0.4
0.2
0.0
Sorenson's Coefficient
0
10
20
30
40
50
Stand Age (Years)

Figure 51. The effects of stand age on Sørenson's coefficient of similarity for moths in planted (■—) and naturally regenerated (▲—) stands in 1994.

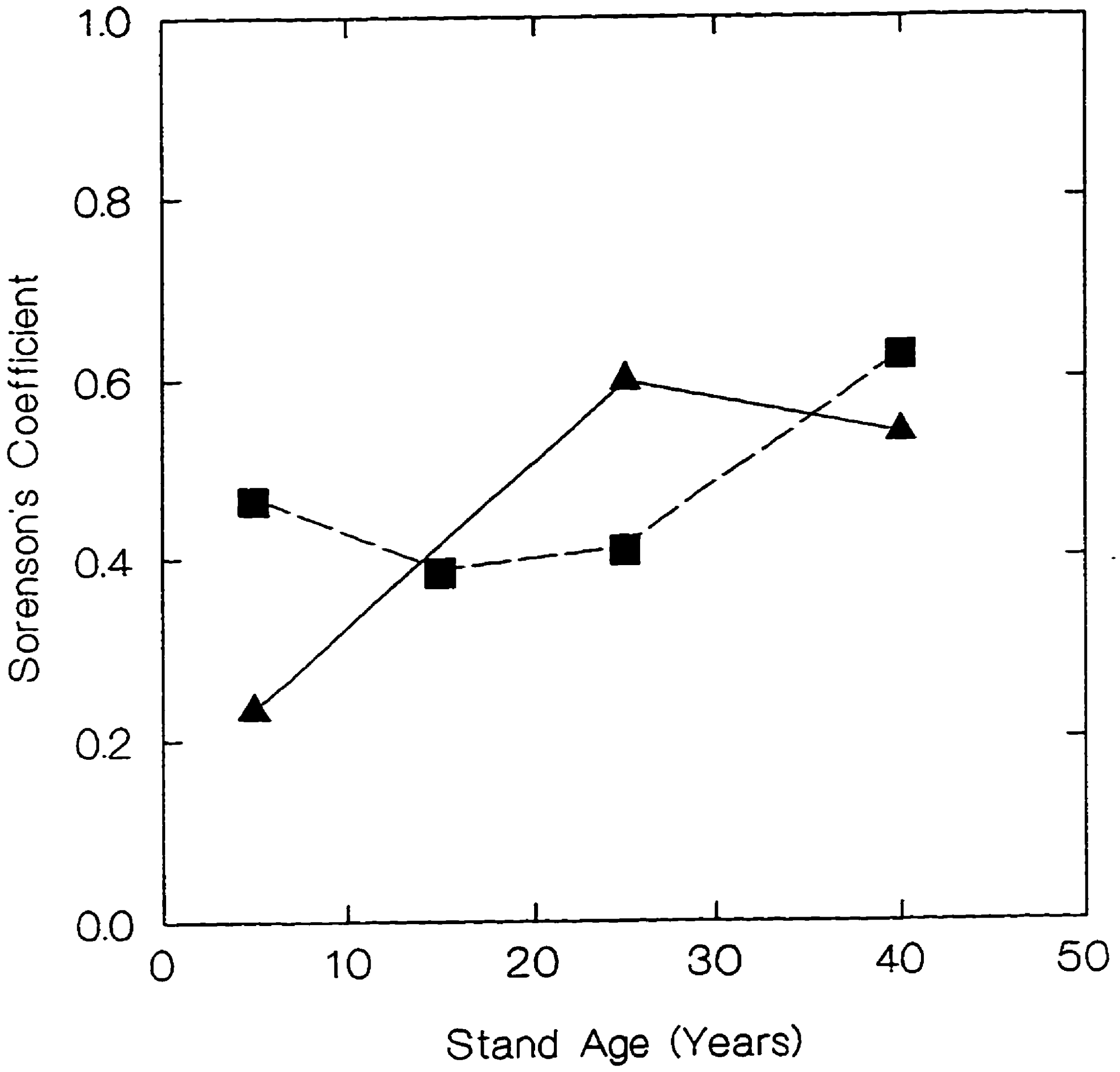

1.0
0.8
0.6
0.4
0.2
0.0
Sorenson's Coefficient
0
10
20
30
40
50
Stand Age (Years)

Figure 52. Moth data (1993). CA ordination diagram with site scores (◆) and species scores (●); first axis (horizontal) has an eigenvalue of 0.286 = 14.4% and the second axis, (vertical) has an eigenvalue of 0.254 = 12.8%.

Key to moth species are: abaalt = *Abagrotis alternata*, abapla = *Abagrotis placida*, acrtri = *Acronicta tritona*, anapre = *Anaplectoides pressus*, apacom= *Apamea commoda*, aphpur = *Apharetra purpurea*, eucjoh = *Echlaena johnsonaria*, eucpam = *Eucirrhodea pampina*, holfer = *Holomelina ferruginosa*, laclor = *Lacinipolia lorea*, lamfis = *Lambdina fiscellaria*, leucom = *Leucania commoides*, lomsem = *Lomographa semiclarata*, polnim = *Polia nimbosa*, pyrsoc = *Pyrausta socialis*, rhyanc = *Rhynchagrotis anchoceliodes*, sicmac = *Sicya macularia*, synepi = *Syngrapha epigaea*, xylcur = *Xylena curvimacula*, xyldol = *Xylomyges dolosa*.

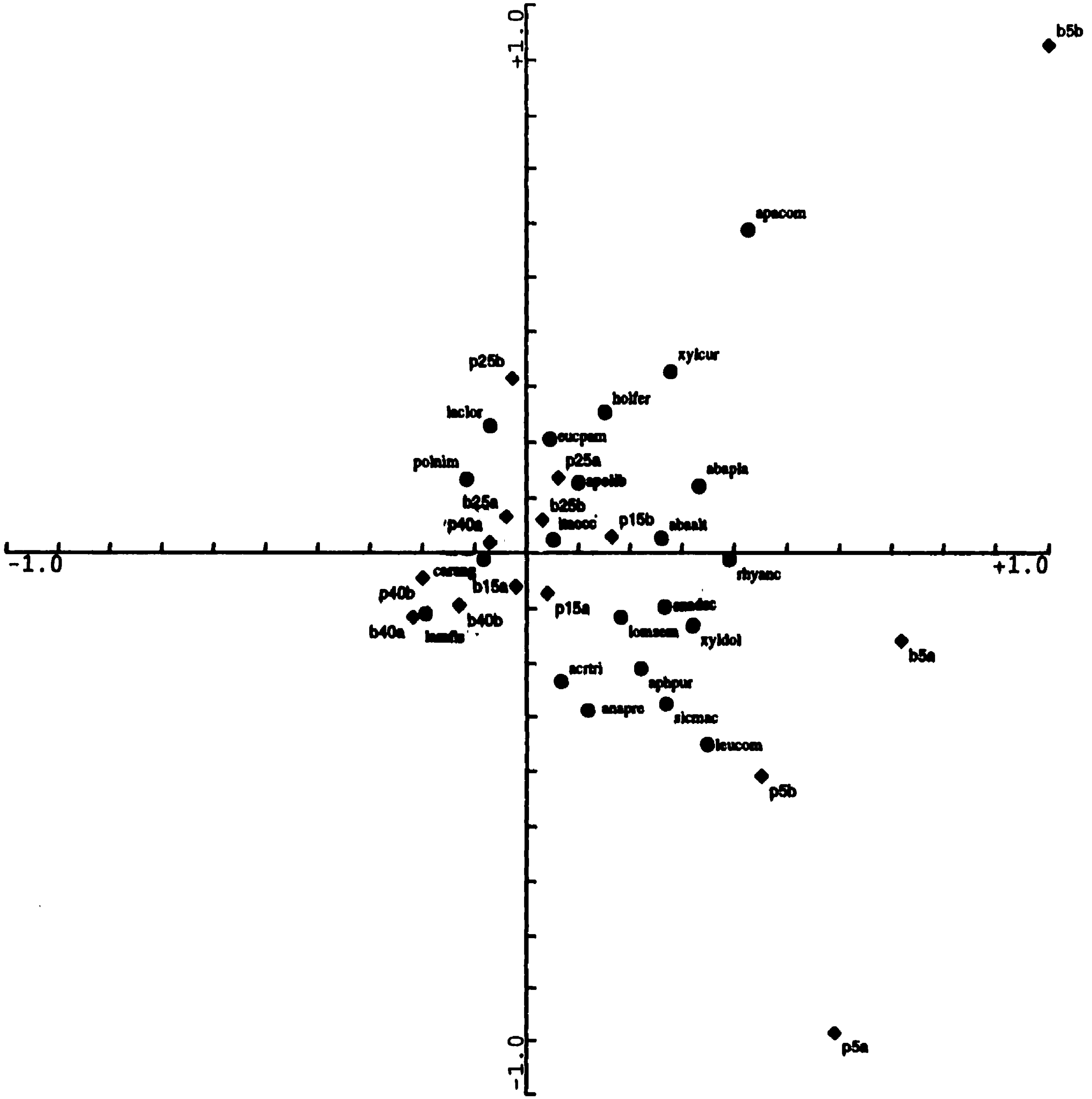

+1.0
-1.0
-1.0
+1.0
b5b
apacom
xylcur
p25b
bolfer
laclor
eucpam
p25a
polnim
apelib
abapla
b25a
b25b
p40a
lnocc
p15b
abaalt
rhyanc
carung
b15a
p40b
p15a
b40b
b40a
lamfis
anadec
lomsem
xyldol
b5a
acrtri
aphpur
anapre
sicmac
leucom
p5b
p5a

Figure 53. Moth data with 5 year old sites removed (1993). CA ordination diagram with site scores (◆) and species scores (●); first axis (horizontal) has an eigenvalue of 0.158 = 42.7% and the second axis, (vertical) has an eigenvalue of 0.067 = 17.9%.

Key to moth species are: abaalt = *Abagrotis alternata*, amacol = *Amathes collaris*, carang = *Caripeta angustiorata*, eulexp = *Eulithis explanata*, itaocc = *Itame occiduaria*, lapbom = *Lapara bombycoides*, nepcan = *Nepytia canosaria*, nycfri = *Nycteola frigidana*, plavid = *Platysenta videns*, polpur = *Polia purpurissata*, protra = *Prochoerodes transversuta*, scoind = *Scopula inductata*.

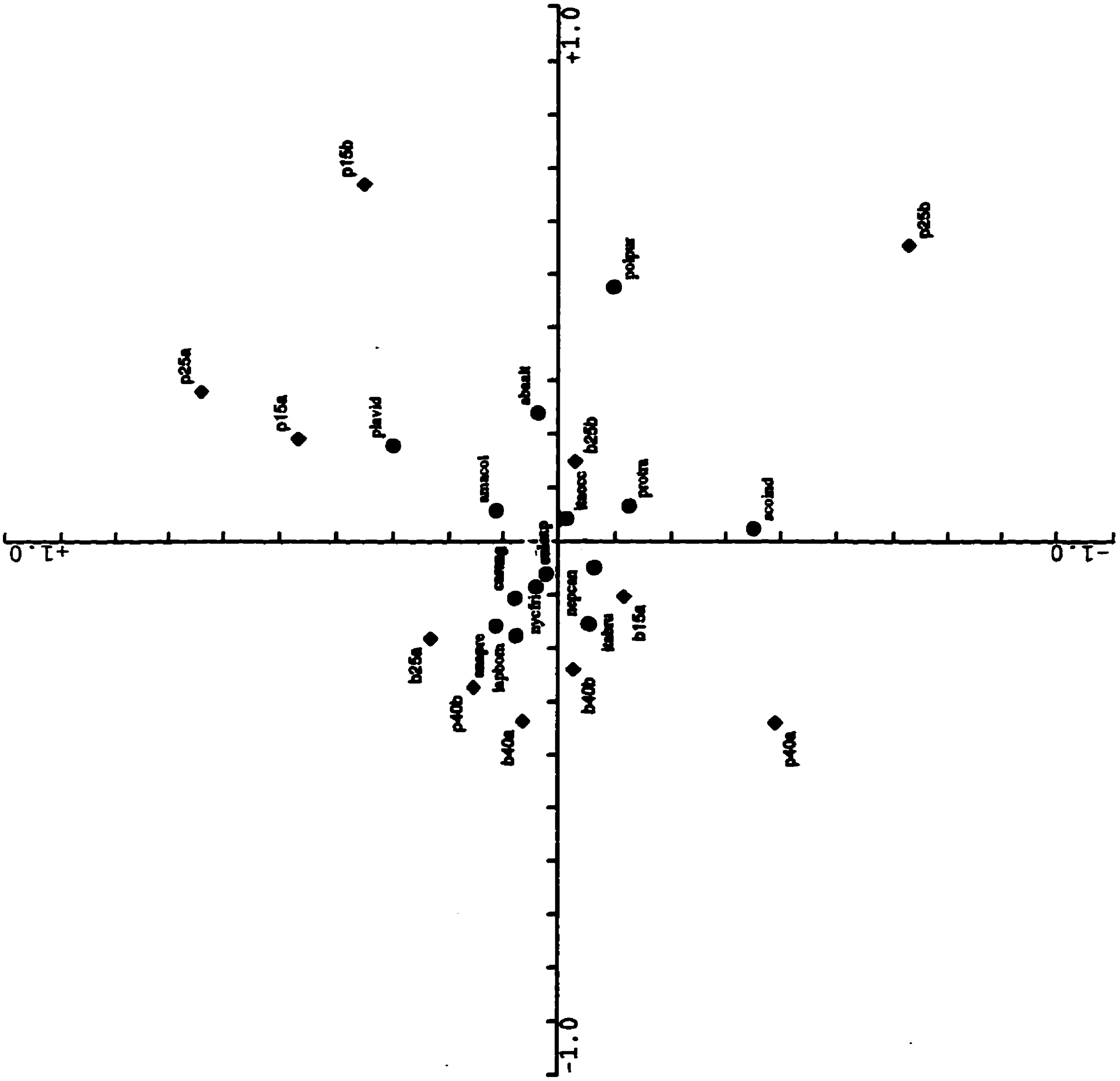

+1.0
-1.0
+1.0
-1.0
p15b
p25b
polpur
p25a
p15a
plavid
abaalt
b25b
lasecc
prolm
acolnd
amacol
carmag
calacp
nycfri
nepcan
lasbru
b15a
b25a
amspre
lapbom
p40b
b40a
b40b
p40a

Figure 54. Moth data (1994). CA ordination diagram with site scores (◆) and species scores (●); first axis (horizontal) has an eigenvalue of 0.254 = 15.5% and the second axis, (vertical) has an eigenvalue of 0.187 = 11.3%.

Key to moth species are: abaapp = *Abagrotis apposita*, agrmol = *Agrotis mollis*, amacol = *Amathes collaris*, amppyr = *Amphipyra pyramidoides*, aphpur = *Apharetra purpurea*, autbim = *Autographa bimaculata*, autmap = *Autographa mappa*, cabvar = *Cabera variolara*, catbla = *Catocala blandula*, catrel = *Catocala relicta*, clalim = *Cladara limitaria*, cycpen = *Cyclophora pendulinaria*, enadec = *Enargia decolor*, eucobt = *Euchlaena obtusaria*, eueatt = *Eueretagrotis attenta*, eulexp = *Eulithis explanata*, eurast = *Eurois astricta*, grapar = *Grammia parthenice*, gravir = *Grammia virgo*, hessul = *Hesperumia sulphuraria*, holfer = *Holomelina ferruginosa*, hominf = *Homohadena infixa*, lomsem = *Lomographa semiclarata*, *plaanc* = *Platypolia anceps*, plavid = *Platysenta videns*, polimb = *Polia imbrifera*, polnim = *Polia nimbosa*, protra = *Prochoerodes transversuta*, pyrsoc = *Pyrausta socialis*, sicmac = *Sicya macularia*, synepi = *Syngrapha epigaea*, xylaca = *Xylotype acadia*, xyldol = *Xylomyges dolosa*, zalaer = *Zale aeruginosa*.

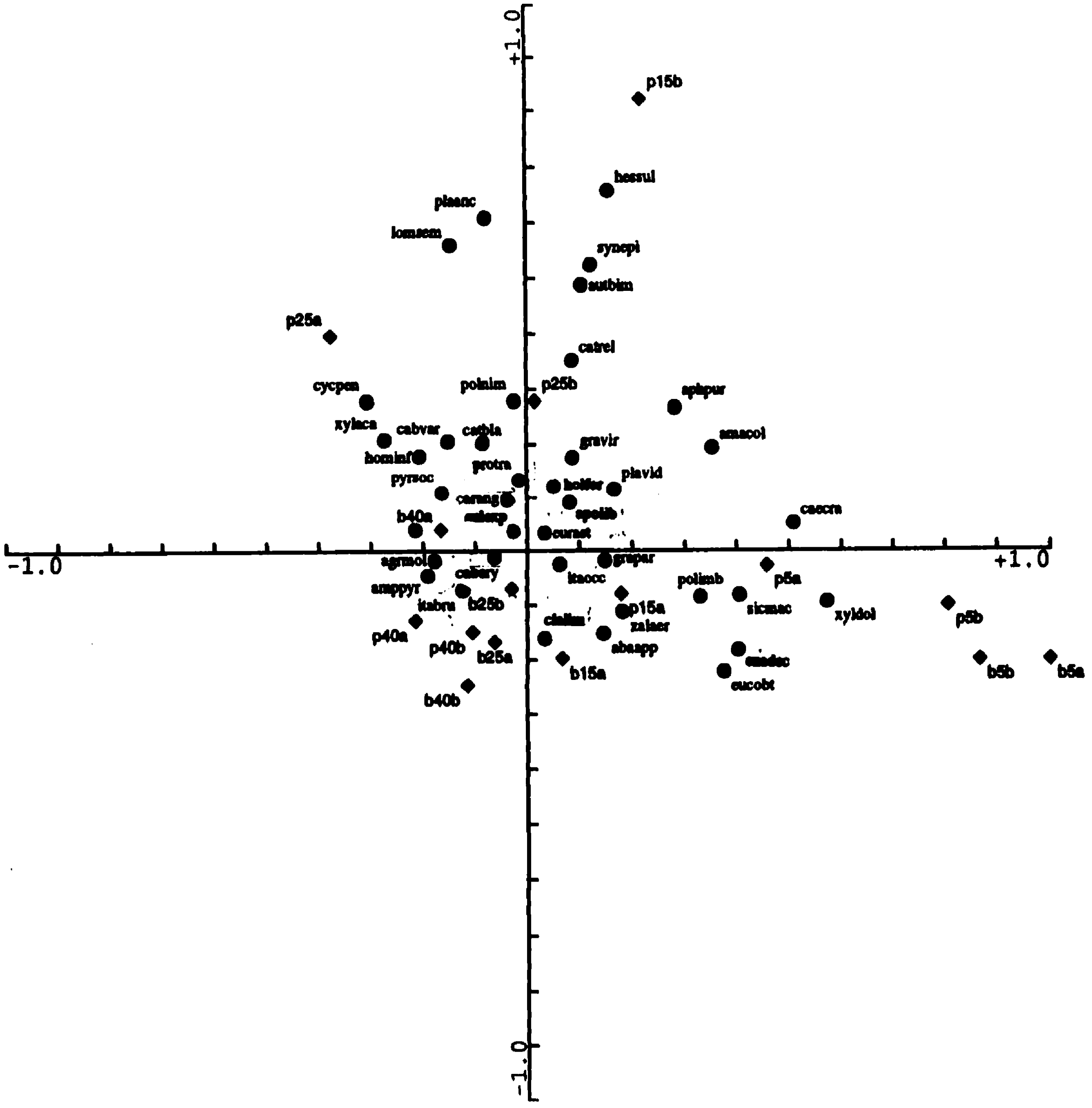

+1.0
-1.0
-1.0
+1.0
p15b
hessul
plaanc
lomsem
synepi
autbim
p25a
catrel
cycpen
polnim
p25b
aphpur
xylaca
cabvar
catbla
amacol
hominf
gravir
protra
plavid
pyrsoc
holfer
carang
caecra
b40a
spelib
curast
agrmol
grapar
calary
itaocc
polimb
p5a
amppyr
itabra
b25b
p15a
sicmac
xyldol
p5b
cialim
zalaer
p40a
p40b
abaapp
b25a
b15a
eucobt
b5b
b5a
b40b

Figure 55. Moth data with 5 year old sites removed (1994). CA ordination diagram with site scores (◆) and species scores (●); first axis (horizontal) has an eigenvalue of 0.081 = 33.5% and the second axis, (vertical) has an eigenvalue of 0.051 = 21.1%.

Key to moth species are: anapre = ***Anaplectoides pressus***, apolib = ***Apodrepanulatrix liberaria***, carang = ***Caripeta angustiorata***, clealb = ***Clemensia albata***, eilbic = ***Eilema bicolor***, enadec = ***Enargia decolor***, eulexp = ***Eulithis explanata***, itaana = ***Itame anataria***, itabru = ***Itame brunneata***, itaocc = ***Itame occiduaria***, lomves = ***Lomographa vestaliata***, metfis = ***Metalepsis fishii***, plavid = ***Platysenta videns***, protra = ***Prochoerodes transversuta***, scoind = ***Scopula inductata***.

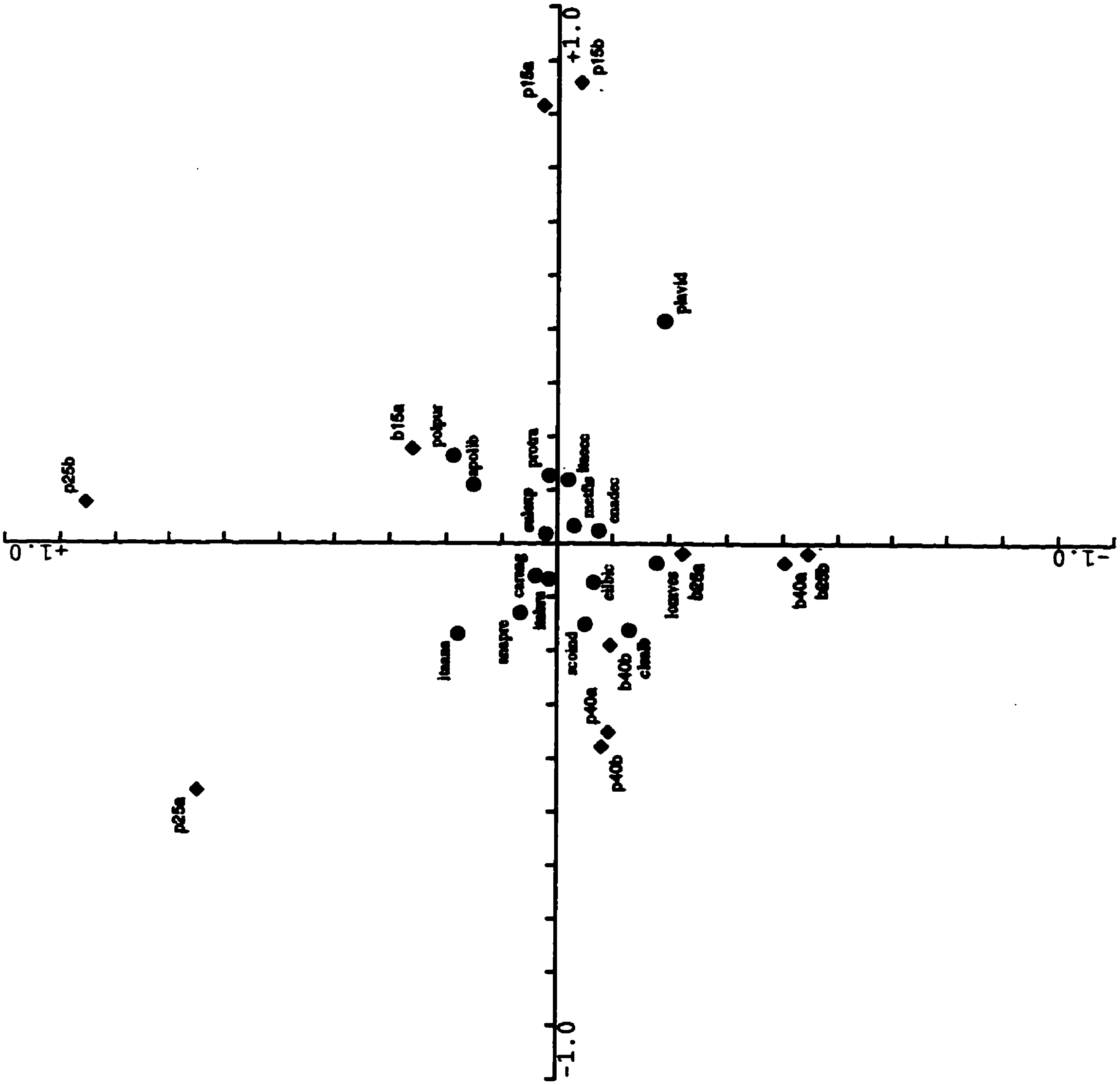
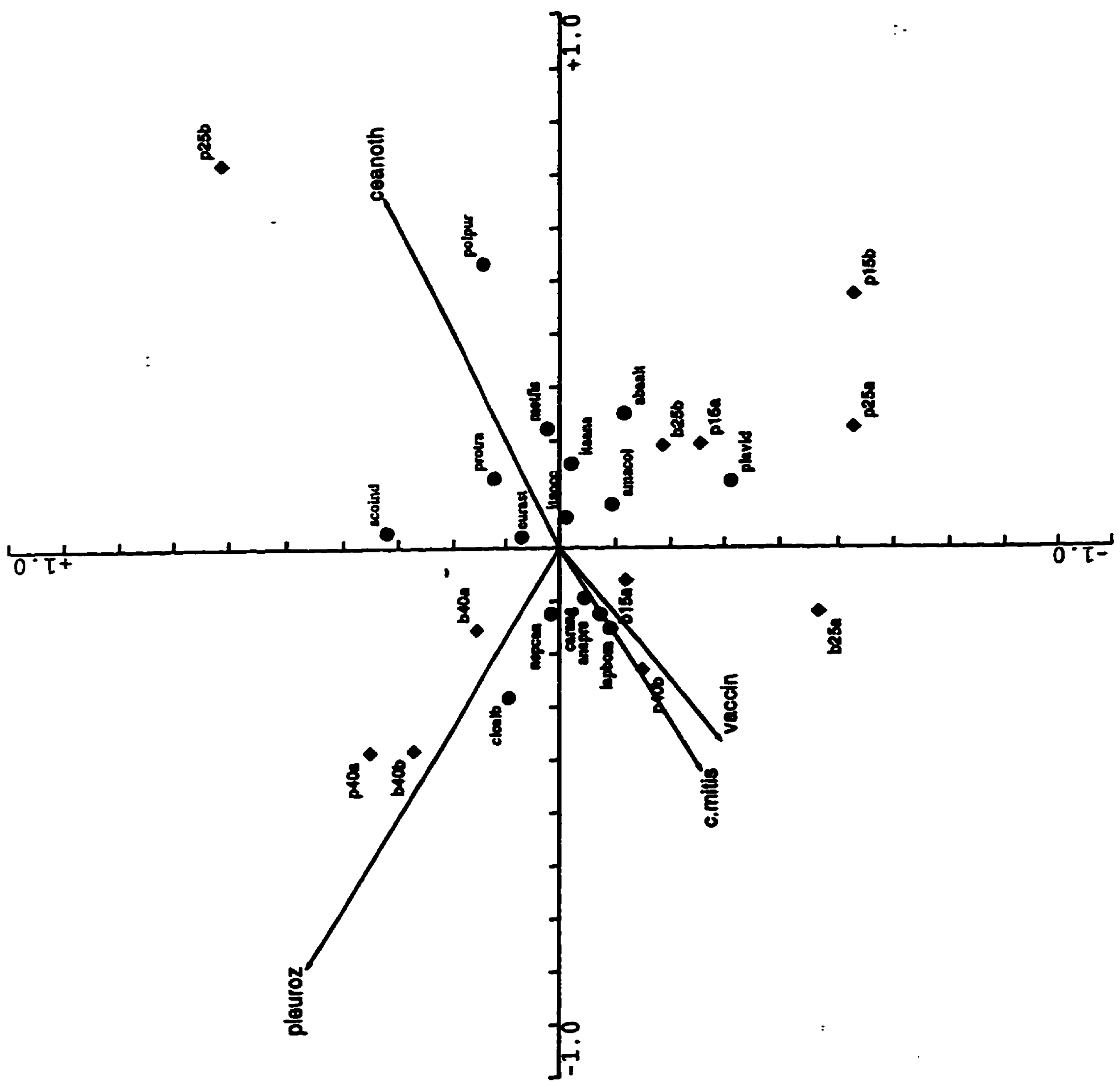

+1.0
-1.0
+1.0
-1.0
p15a
p15b
plavid
b15a
polpur
apolib
p25b
proin
lmeca
metlis
cnadec
calemp
carneg
lnhm
snapre
lmnas
cllbic
lomves
b25a
b40a
b25b
scolsd
b40b
clnab
p40a
p40b
p25a

Figure 56. Moth and environmental data (1993). CCA ordination diagram with site scores (◆), species scores (●) and environmental variables (arrows); first axis (horizontal) has an eigenvalue of 0.170 = 42.0% and the second axis (vertical) has an eigenvalue of 0.056 = 24.0%.

Key to moth species are:abaalt = *Abagrotis alternata*, amacol = *Amathes collaris*, anapre = *Anaplectoides pressus*, carang = *Caripeta angustiorata*, clealb = *Clemensia albata*, eurast = *Eurois astricta*, itaana = *Itame anataria*, itaocc = *Itame occiduaria*, lapbom = *Lapara bombycoides*, metfis = *Metalepsis fishii*, nepcan = *Nepytia canosaria*, plavid = *Platysenta videns*, protra = *Prochoerodes transversuta*, scoind = *Scopula inductata*.

Key to vegetation species are: ceanoth = *Ceanothus ovatus*, c.mitis = *Cladina mitis*, pleuroz = *Pleurozium schreberi*, vaccin = *Vaccinium angustifolium*.



+1.0
-1.0
+1.0
-1.0
ceanoth
pleuroz
vaccin
c.mitis
p25b
polpur
p15b
p25a
abealt
metfis
b25b
p15a
kuana
proura
plavid
amacol
scoind
eurast
linnos
b40a
b15a
carusq
nepcas
anapre
laphos
p40b
clatib
p40a
b40b
b25a

Figure 57. Moth and vegetation data (1994). CCA ordination diagram with site scores (◆), moth species scores (●) and environmental variables (arrows); first axis (horizontal) has an eigenvalue of 0.079 = 27.6% and the second axis (vertical) has an eigenvalue of 0.046 = 16.0%.

Key to moth species are: anapre = *Anaplectoides pressus*, apolib = *Apodrepanulatrix liberaria*, cabery = *Cabera erythemaria*, carang = *Caripeta angustiorata*, clealb = *Clemensia albata*, enadec = *Enargia decolor*, eurast = *Eurois astricta*, itaocc = *Itame occiduaria*, plavid = *Platysenta videns*, polpur = *Polia purpurissata*, protra = *Prochoerodes transversuta*.

Key to vegetation species are: cmitis = *Cladina mitis*, opung = *Oryzopsis pungens*, pleuroz = *Pleurozium schreberi*, selagine = *Selaginella rupestris*, vaccin = *Vaccinium angustifolium*.

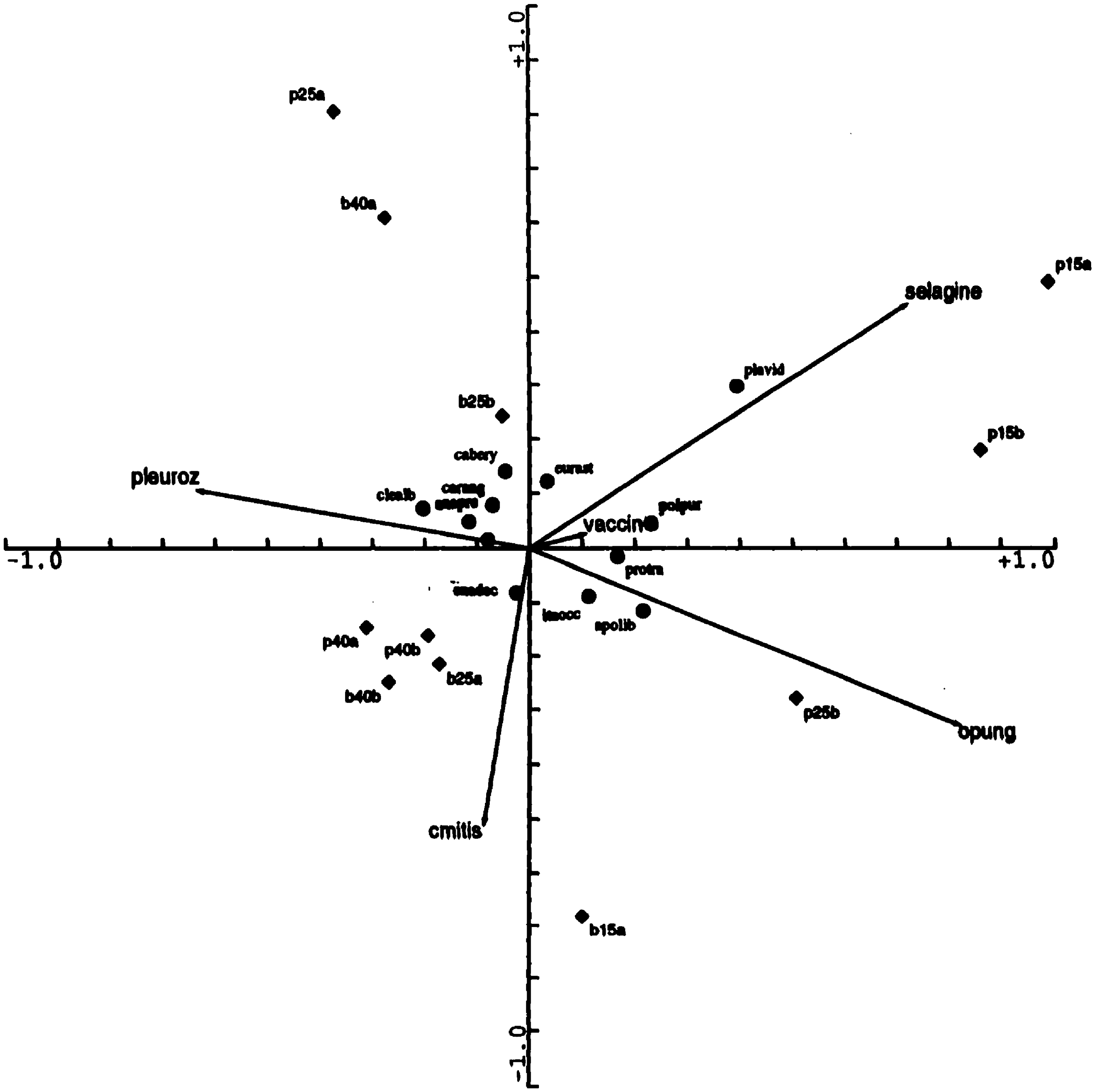

+1.0
-1.0
-1.0
+1.0
p25a
b40a
p15a
selagine
plavid
p15b
b25b
cabery
curust
pleuroz
clealb
carmag
polpur
vaccin
protra
spolib
p40a
p40b
b25a
b40b
p25b
opung
cmitis
b15a

Figure 58. Moth and environmental data (1993). CCA ordination diagram with site scores (◆), moth species scores (●) and environmental variables (arrows); first axis (horizontal) has an eigenvalue of 0.057 = 15.4% and the second axis (vertical) has an eigenvalue of 0.023 = 6.3%.

Key to moth species are: amacol = *Amathes collaris*, apolib = *Apodrepanulatrix liberaria*, carang = *Caripeta angustiorata*, clealb = *Clemensia albata*, eilbic = *Eilema bicolor*, itaana = *Itame anataria*, itaocc = *Itame occiduaria*, lapbom = *Lapara bombycoides*, metfis = *Metalepsis fishii*, plavid = *Platysenta videns*, polpur = *Polia purpurissata*.

The environmental variables are: litemean = mean light intensity, treemean = mean tree density (100 m^2).

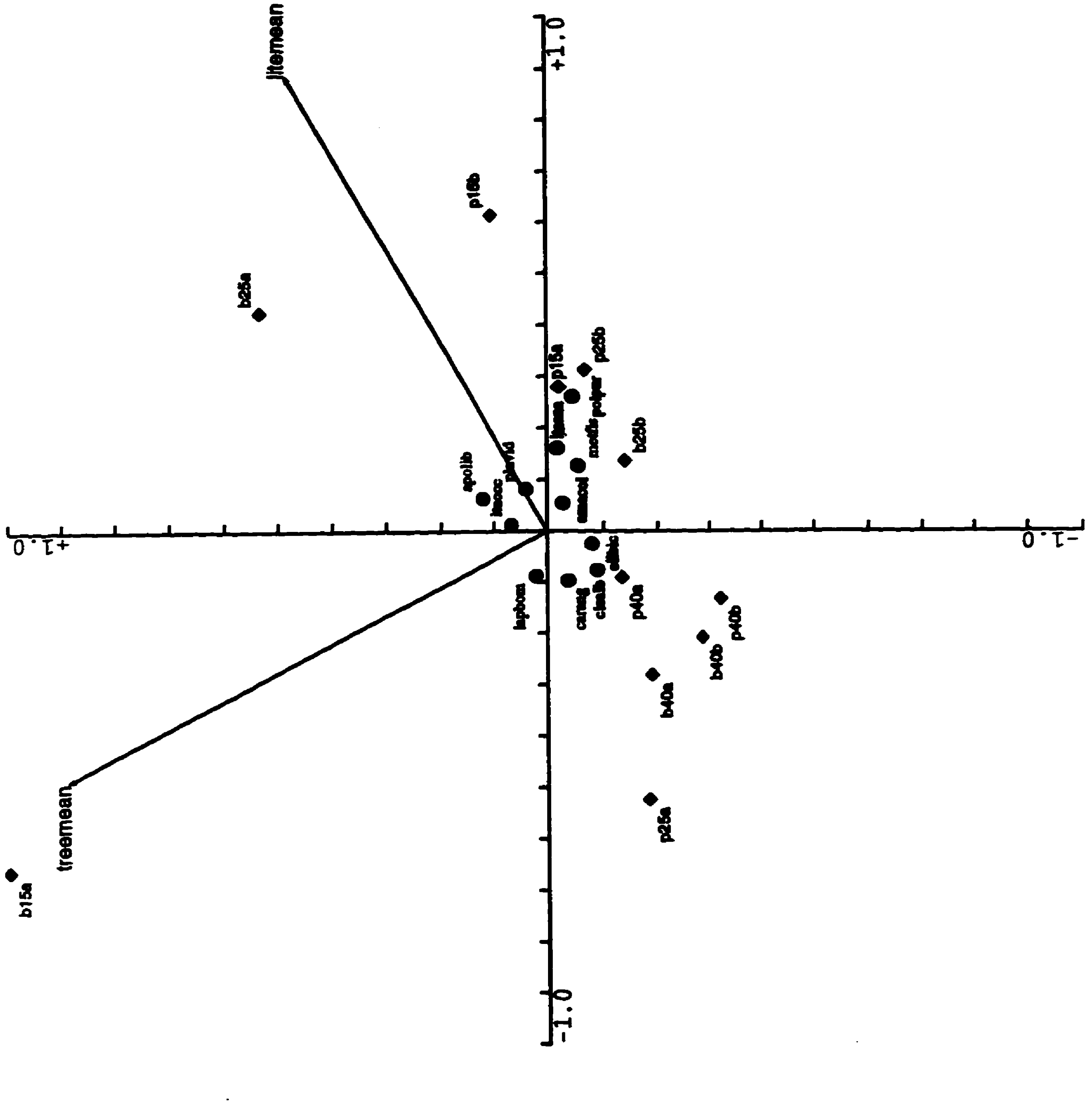
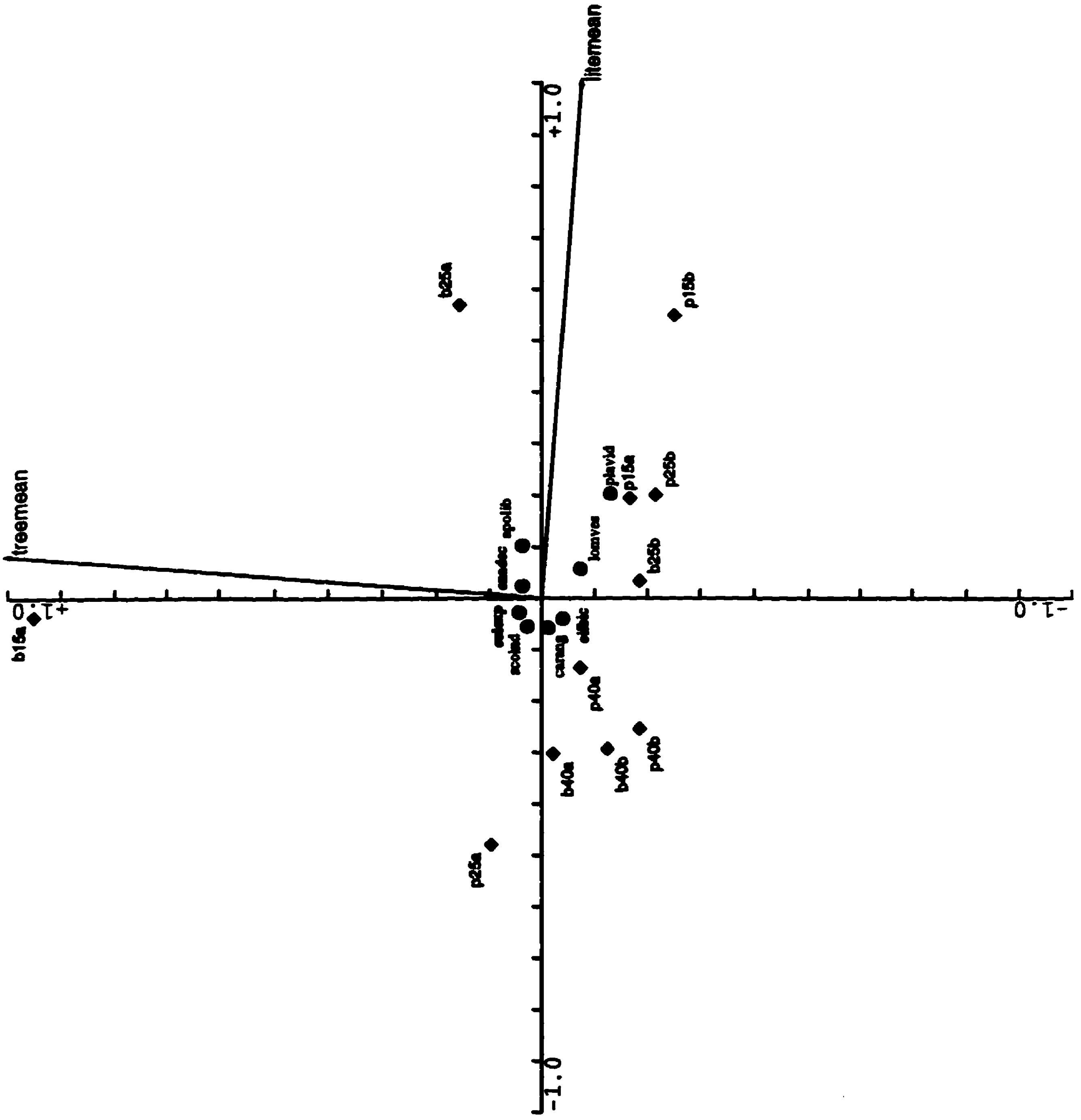

litemean
treemean
+1.0
-1.0
+1.0
-1.0
p15b
b25a
b15a
p15a
p25b
b25b
polpar
motfis
smacol
plavid
spolib
lasocc
lapbor
carsag
p40a
p40b
b40b
b40a
p25a

Figure 59. Moth and environmental data (1994). CCA ordination diagram with site scores (◆), moth species scores (●) and environmental variables (arrows); first axis (horizontal) has an eigenvalue of 0.044 = 18.0% and the second axis (vertical) has an eigenvalue of 0.017 = 6.8%.

Key to moth species are: apolib = *Apodrepanulatrix liberaria*, carang = *Caripeta angustiorata*, eilbic = *Eilema bicolor*, enadec = *Enargia decolor*, eulexp = *Eulithis explanata*, lomves = *Lomographa vestaliata*, plavid = *Platysenta videns*, scoind = *Scopula inductata*.

The environmental variables are: litemean = mean light intensity, treemean = mean tree density (100 m^2).


treemean
litermean
+1.0
-1.0
+1.0
-1.0
b25a
p15b
p25b
p15a
plavid
lomves
b25b
apolib
amadec
calacp
scolad
caraug
olbic
p40a
p40b
b40b
b40a
p25a
b15a

DISCUSSION

Relationships of regeneration type and stand age to physical habitat characteristics

The two years encompassed by this study differed climatically. There were differences in monthly precipitation, hours of bright sunshine and mean monthly temperatures. July and August were considerably wetter in 1993 than 1994 (Figure 4) and 1993 was significantly cloudier than 1994, with less hours of bright sunshine in all months from April through September (Figure 5). Mean monthly temperatures were generally lower in 1993 than in 1994 (Figure 6). When combined, these factors indicate that 1993 was a less favourable year in terms of climate for a number of the Lepidoptera collected, resulting in the numbers of species and individuals being lower in 1993 than in 1994 (Appendices II - VI). Gilbert and Singer (1975) suggested that climatic factors may have a direct influence on populations of Lepidoptera.

The five year old sites were very similar in light intensity, with three of the four sites having maximum averages for mean light intensity (Table 2). The remaining site was a naturally regenerating site in which light intensity was marginally lower due to the presence of young *Populus tremuloides* Michx., illustrating a difference between the two treatment types. Planted sites are scarified before planting, which may remove young poplar trees, that are early colonizers following fire (Heliovara and Varsonen, 1984; Zoladeski *et al.*, 1995). Within this age class, the natural stands were warmer during both daytime and over a 24 hour period (Table 3; Figure 9, 10). The differences between the two treatment types may be attributed to the greater amount of slash present in the natural stands. The slash may aid in retaining heat at night time by reducing the outgoing radiation and by reducing the quantity of energy consumed in evaporation by blocking the transport of vapour out of the soil (Rosenberg *et al.*, 1983). In terms of measurable differences, the five year old stands did not differ in terms of vegetation composition. Perceptually, the natural stands had more exposed areas of bare sand than did the planted stands. The planted stands had a higher proportion of grasses than did the natural stands (Appendix I). In general, the replicates within each treatment type were quite similar.

Tree density in the natural stand at 15 years of age was very high and resulted in a site much darker than the replicates of the planted stands (Table 2; Figure 11, 13). As a result of crowding within an area, there is a resultant increase in tree mortality as a stand ages (Zoladeski *et al.*, 1995; Johnson *et al.*, 1995). The 15 year old natural stand was still quite young and, as such, little tree mortality had occurred. The very strong stand regeneration in the natural site was interspersed with open patches. Trees in the planted stands in this age class are very evenly spaced as is the case in plantations, resulting in a more uniformly open site at this stage of development (Figure 11, 13). Perceptually, the planted replicates were quite similar to each other in terms of stand development and vegetation composition.

The natural replicates in the 25 year old age class were quite similar to each other, although one replicate had been manually thinned (B25A). The replicates of the planted stands were quite different from each other. The first replicate (P25A), had undergone a much stronger regeneration with little tree mortality resulting in a very uniformly dark site. The second replicate had some areas with very strong regeneration, but retained some open glades and may be more similar to the natural stands in terms of light intensity and tree density (Table 2). There was no significant difference in terms of mean light intensity or variability. One factor which does not show up in the results but was visually evident was the surrounding forest area of one site. B25B was dominated by jack pine within the site. Within two hundred metres to the south was a large stand of *Populus* spp. The remaining 25 year old stands were in areas of almost exclusively jack pine.

The natural stands in the 40 year age class were significantly warmer than the planted stands during both the daytime and night time (Figure 9, 10). The replicates of the natural stands were quite similar in terms of mean light intensity (Table 2) but they differed in other factors. The first replicate (B40A) had no open glades, a large amount of bracken fern (*P. aquilinum*) was present and there was strong shrub undergrowth, particularly *Corylus cornuta*. The other natural replicate (B40B) had several open glades, little bracken fern and very little shrub undergrowth. Like the natural stands, the planted stands differed from each other. The first replicate (P40A) was quite mature, and was dominated by vegetation associated with this age class, particularly *P. schreberi*. The site had two small open glades, but was otherwise closed. The second replicate differed from the first in a number of ways. The site was much more open in the understorey as evidenced by the tree density (Table 2). The vegetation of the second replicate was also quite different. The dominant vegetation, *Cladina* spp., is typically found in jack pine stands of intermediate age. The expected dominant moss, *P. schreberi*, was found only in small amounts and there was little in the way of shrub growth. In terms of vegetation composition, this replicate was more similar to the 15 year old stands than to its replicate.

The abiotic environmental factors influence the biota within the sites and changes in these abiotic factors were most strongly associated with differences in stand age. Vegetation species showed distinct associations with particular age groups and therefore with a particular combination of abiotic factors. The five year old stands were dominated by the Graminaceae, the majority of species in this group preferring open, drier habitats. The intermediate sites were dominated by a mixture of plants including grasses, ericaceous species and lichens. Mosses were the dominant vegetation in the 40 year old sites, with the above mentioned exception. This successional trend in vegetation species is associated with the maturation of the stand (Oksonen, 1986). Rowe (1956) observed that the trend in vegetation species as a stand matures is towards plants that prefer cooler, moister habitats.

Light intensity decreases with an increase in stand age (Table 2; Figure 12). This is expected as the stands mature the amount of light penetrating the canopy will decrease as the canopy closes.

The concepts of radiation balance play an important role in discussing the thermal differences between different age classes. For a complete review of these ideas, the reader is referred to Rosenberg *et al.* (1983). A portion of the solar radiation that reaches the earth's surface is reflected and the degree of reflection is a function of wavelength within this region (Rosenberg *et al.*, 1983). The quality of surfaces that results in reflection is termed albedo (Rosenberg *et al.*, 1983). Coniferous forests have albedo values in the range of 16 -18%, dry sandy soils have values in the range of 20 - 40% (Rosenberg *et al.*, 1983). We would therefore expect older forest stands to absorb more radiation and retain it longer than a young site with patches of bare ground. This can be seen in Figure 10, the older stands are warmer at night as they have absorbed more radiation and release it more slowly. The younger sites are warmer during the day, but do not retain the heat (Figure 9).

Relationships of regeneration type and stand age to Lepidoptera species composition

Butterflies

The five year old sites were generally lower in number of butterflies (N) collected and in number of species (S) than the other age classes (Figure 21 - 24). The two treatment types did not differ much in terms of N and S. Butterflies are creatures which tend to prefer patchy habitats. (Peterson, 1954; Warren, 1985). It is not surprising that the five year old sites, being open and providing little cover, are not the preferred habitat for the majority of butterfly species collected during this study. The butterfly species that were collected in the natural stands were predominantly specialists with a limited number of host plants (Table 7). The dominant species in the natural stands, *B. bellona*, was ubiquitous in stands of all ages. Conversely, the butterflies collected in the planted stands were predominantly generalists (Table 7), *C. pegala* being the dominant species in the planted stands. *Cercyonis pegala* was generally abundant in all of the five year old stands (Table 4, 5) but was more abundant in the planted stands (Appendix II) *Cercyonis pegala* exhibited a greater degree of dominance in the planted sites than did the dominant species in the burned sites, *B. bellona*. The most likely reason for this is a greater abundance of its food plants, the Graminaceae (Appendix I). The planted stands undergo a pre-planting process which renders them fairly uniform. This may result in a more uniform habitat and allow for the higher degree of dominance by the grasses. The natural stands in this age class did not have as much grass and *C. pegala* did not show the same degree of dominance in those sites. *Nymphalis milberti* was abundant in one of the natural stands, B5A. Typically this species is found in moist areas (Klassen *et al.*, 1989) but this does not describe the area in which they were collected. It is likely that this species has a larger range of habitats that are acceptable. *Nymphalis milberti* feeds on *Ceanothus* spp. (Tietz, 1972), which was not present in vegetation samples, nor was it noted in the vicinity of the site, where they were collected but does grow in that type of habitat. A possible explanation is that the food plant was present in a nearby area but located outside the study site. The adults collected were likely searching for a nectar source or for suitable oviposition sites.

The planted stands in the 15 year age class were structurally different from the natural stand as discussed earlier. The number of individuals collected in this age class was higher in 1994 and this may be attributed to the differences in climate. The second year of the study was more favourable for butterflies than was 1993. The planted stands in this age class provided the most favourable habitat for butterflies of all the planted stands. With the greatest variety of microhabitats available the number of species was highest in this age class for the planted stands in both years. No butterfly species was consistently dominant for this age class for all sites. The degree of dominance was low in the first flight period for all sites in the 15 year age class (Figure 25, 26). In the second flight period, *C. interior* was very abundant in the natural stand, accounting for 40% of the butterflies collected in the stand in both years. *Colias interior* was abundant in the natural stand and the first planted replicate, but was not so abundant in the other planted replicate. The food plant of this species is *Vaccinium* spp. (Tietz, 1972) which is abundant throughout the study sites (Appendix I). The butterfly is most commonly collected in the intermediate age classes (Appendix II) indicating that its distribution is driven both by presence of food plant and preference for a particular habitat, characterized by patchy sites. The Pieridae were most abundantly collected in the 15 year age class (Table 6). This is due the preference of two species for this age class, *C. interior* as mentioned earlier, and *Euchloe ausonides* (Lucas). *Euchloe ausonides* feeds on a variety of crucifers (Tietz, 1972), although they were not noted in the vegetation sample as being particularly abundant, the species was collected in quite high numbers in P15B (Appendix II). A third pierid that was abundant in 1994 was *Pieris rapae* (Linnaeus). This species also feeds on crucifers (Tietz, 1972) but the species was ubiquitous in stands of all ages. One species was collected only in site P15A, *Boloria selene* (Dennis & Schiffermüller). This species prefers wet, boggy habitat, which while common in the Sandilands area, was not common in the immediate area of the study sites. The exception was P15A which was fringed by a boggy poplar stand. Several species were collected in the second replicate of the planted stands (P15B) that were not nearly so abundant in the other sites in this age class; these included a number of species that are attracted to the bait traps (Appendix IV). For reasons which are unclear, the bait trap within P15B collected a much higher number of butterflies than were collected in the other sites in this age class. The area immediately surrounding the bait traps in all three sites appeared quite similar in vegetation and other characteristics. One complex of species that was frequently collected in the bait traps belongs to the genus *Speyeria* (Appendix III). I observed these butterflies use the nectar of *Monarda fistulosa* L., which was particularly abundant in P15B. *Monarda fistulosa* was also quite abundant in P25B where *Speyeria* spp. was also abundant. *Monarda fistulosa* is very aromatic by human standards and attractive to species of *Speyeria*, and this may be the reason for the latter's pattern of abundance. The ordination analysis (Figure 33, 35) places the 15 year old sites around the centre of the ordination diagram. The butterfly species of these sites are a combination of species which prefer open sites, closed sites and the majority of species, that prefer sites intermediate between open and closed. In the natural stand and P15A, the majority of the species were specialists with respect to their feeding patterns (Table 7). The majority of the butterflies collected in P15B were generalists (Table 7). A trend seems be that generalists prefer planted stands while the specialists are preferring the natural stands. In three of the four planted stands discussed to this point, the generalists are dominant. The exception is P15A, the site located near the boggy poplar stand. This may explain the increase in the number of specialist species collected in P15A. The stand uniformity of P15B may account for the high number of generalists collected for the same reasons as were discussed for the five year old stands.

In the 25 year old planted stands, the dominant species was clearly *E. anthedon* (Table 4, 5), a generalist feeder with grasses as host plants (Tietz, 1972). In the natural stands, the dominant species were similar to those that were dominant in the 15 year age class, including *C. interior*, and *Limenitis arthemis* (Table 4, 5). This helps illustrate a difference between the two treatment types. The planted stands at this age have more complete canopy closure and the butterfly species which prefer these stands are those which are found in the older age class as well. The literature classifies the preferred habitat of *E. anthedon* as along forest margins and forest roads (Klassen *et al.*, 1989). Indeed it is true that they can be collected in this location. However, the majority of collectors learn quite early that the majority of butterflies are heliotherms (Shapiro, 1970) and prefer to fly in open glades. It is also easier for the collector to give chase in an open area than in dense forest. *Enodia anthedon* appears to have a very strong preference for strongly shaded sites and may be collected in even greater numbers within dense forest than along forest margins.

In the 25 year old stands there was a high degree of variability in number of species within treatments and between treatments. Typically B25B had the highest number of species while P25A had the lowest. There was a high degree of variability between the two study years as well and this can be attributed to the differences in weather between the two years. Number of species peaked in this age class for the natural stands. This is probably because natural sites in this age class offered the greatest number of available microhabitats for the butterflies. The 15 year old natural stand was quite a bit darker and more closed, resulting a lower degree of site variability and a lower number of butterfly species.

The planted stands in this age class had a much higher degree of dominance than did the natural stands (Fig. 25, 26). In 1993, the planted stands were dominated by *E. anthedon*, which accounted for almost 75% of the butterflies collected in those sites (Fig. 25). By comparison, the dominant species accounted for only about 20-30% of the species collected in the natural stands (Figure 25). In 1994, P25A had a higher degree of dominance, about 97%, but P25B was similar to the natural stands at approximately 25% (Figure 26). The second replicate of the planted stands was structurally similar to the natural stands with a number of open patches. This site did differ from the natural stands by having a much stronger understorey growth of vegetation, that led to what was perceived to be a higher level of humidity in the site. In 1993, this led to the site being a more preferable and suitable habitat for *E. anthedon*. In 1994, it was warmer and sunnier and the perceived levels of humidity seemed to decrease within the site making it a less favourable location for *E. anthedon*. The change in conditions was not as drastic in the other planted replicate due to the much higher degree of canopy closure and the conditions remained favourable.

In general, the 40 year old stands were similar. The degree of dominance by butterfly species was similar in both treatment types, although it was more variable in the planted stands (Figure 25, 26). Typically, the sites in this age class were dominated by *E. anthedon* (Table 4, 5). Exceptions occurred in both years. In 1993, the second replicate of the natural stands was dominated by *C. interior*, a species that prefers more open sites and is typically dominant in the intermediate age classes. Its abundance can be explained by the greater openness of this site combined with an abundance of *Vaccinium*, the food plant of this species. The second exception occurs in 1994 in the second replicate of the planted stands. In this stand *C. interior* is the dominant species. This is explained by the same reasons as mentioned above. In both years this species was abundant in both sites. This leads to the conclusion that the species is influenced not only by the presence and relative abundance of its food plant (which is comparatively abundant in the other stands of this age class) but also by the habitat in which its larval food resource is found.

Both the number of individuals and the number of species collected in the two treatments of this age class are quite similar (Figure 21-24). The number of species collected remained constant in both years (Figure 23, 24) but the number of individuals increased in 1994 (Figure 21, 22). This may be attributed to differences in climatic factors between the two years with 1994 being the more favourable for butterfly flight.

There is an apparent shift in the dominant species with an increase in stand age. In the youngest sites, species such as *B. bellona*, and *C. pegala* dominate. The next two age classes are dominated by a complex of species which depends on the degree of openness of the site. In generally more open sites, *C. interior*, *L. arthemis* and *B. bellona* dominate. In the intermediate sites that have a more closed canopy and a higher degree of shade, *E. anthedon* dominates. The 40 year old stands are dominated by shade preferring species, especially *E. anthedon*. A second species which shows a preference for increased shade is *Pieris napi (L.)*. The numbers of this species increase in the older, darker sites (Appendix II). Peterson (1954) observed that the shade-loving species *P. napi* and the sun-loving species *P. rapae* feed on similar host plants. He suggested that they evolved different habitat preferences to avoid competition. Peterson (1954) also observed that there were thermal and host plant differences between the two habitat types and these may be the factors that account for the differences rather than competition. Courtney and Chew (1987) observed that habitat type determines the amount of host plant variance that will be experienced and that the Pierinae evolve to become adapted to the food plants available in their habitats. Shapiro and Cardé (1970) suggested that an evolved habitat preference among two species of Satyridae may be the result of interspecific competition. This may be the case for the two abundant species of Satyridae collected in this study. Both feed on members of the Graminaceae, however, one species *E. anthedon* has a strong preference for dark forested sites, while the other species *C. pegala*, is only found in open areas and is abundant in the very young sites. These species that are considered polyphagous, have probably developed preferences for specific species of Graminaceae associated with their habitat preferences.

Ordination analysis indicates that there is an association between some monophagous butterfly species, such as *C. interior* and *E. martialis*, and their food plants.

Larvae have a greater range of host acceptance than would be indicated by oviposition preference exhibited by the adult females (Gilbert and Singer, 1975). Adult butterflies are not as specific about food resources and are more opportunistic in feeding than are their larvae. Where adult butterflies are collected likely has more to do with habitat preference than with locality of suitable oviposition material. Butterflies are highly mobile as adults. As such, they are able to search fairly large areas for suitable oviposition sites. Adult butterflies seem to be more strongly influenced by abiotic factors such as light intensity and patchiness in their habitat than by biotic factors such as the presence or absence of suitable oviposition material. If their food plants for oviposition occur in the same habitat, they will be strongly associated with those habitats.

Moths

Like that of the butterflies, the moth species composition in planted and naturally regenerated stands was quite similar. The moths, unlike the butterflies, are mostly nocturnal. With the moths the strongest influencing factor would appear to be the amount of vegetation cover associated with a site. As the stands increase in age, there is a concurrent increase in the structural and architectural diversity in above ground plant parts which serve as food sources and refugia for the moths (Lawton, 1983). The moths seem to respond to the level of cover and its structural diversity. Both the number of individuals and the number of species collected increased with increasing stand age.

The five year old sites were much more open than the other age classes and there was little protection from the wind in these sites. It would be expected that stronger flying moths would dominate the light trap catch in these sites (Muirhead-Thomson, 1991). The dominant species in this age class were members of the Noctuidae, which are a group of strong flying moths. Several species were restricted almost exclusively to this age class, including *Leucania commoides* Guenée, which feeds on grasses (Tietz, 1972) and *Oncocnemis piffardi* (Walker), whose host plant is not known (Appendix V). *Enargia decolor* was the dominant species in this age class (Table 6, 9). The degree of dominance in this age class was similar in both treatment types and was the highest of all age classes in 1994 (Figure 45). This may be attributable to the weather conditions and reasons similar to those influencing the butterflies. The climatic conditions were better for the Lepidoptera in general and the dominant species became even more dominant under preferable conditions and this effect was more pronounced in the open sites. Other species that were dominant in this age class included *I. occiduaria*, which was abundant in all age classes. *Itame occiduaria* feeds on a variety of host plants including *Ribes* spp., *Amelanchier* spp. and a variety of tree species (Tietz, 1972) and its ubiquitous presence is not surprising. The other dominant species in this age class is *N. frigidana*, another ubiquitous species, whose host plants include *Populus* spp. and *Salix* spp. (Tietz, 1972). Both of these trees are found in the study area, especially *Populus*.

The 15 year old stands were dominated by species including *I. occiduaria* and *E. explanata* (Table 9). *Eulithis explanata* feeds on blueberry, *Vaccinium* spp., as its host plant. One species which was most abundantly collected in this age class was *Platysenta videns* (Guenée) (Appendix V). The larval host plants of this species, asters and goldenrods, were most abundant in this age class (Appendix I). This may indicate a high level of dependence on the larval food resource. These plants are located in other age classes but the moth was not as frequently collected. The total number of individuals collected in this age class was similar between the two treatments in 1993 (Figure 41). In 1994, the number of moths collected in the natural site was much higher than in the planted sites (Figure 42). There may be several reasons for this. In the 15 year old stands, tree density was much higher in the natural site and there is an increase in the amount of above ground plant parts in this site resulting in increased structural diversity. There may also be a greater degree of protection from the elements (eg. wind) that allowed for a greater number of moths to reach the light trap (Muirhead-Thomson, 1991). The dominant family of moths in B15A was the Geometridae. In almost all sites where the geometrids were dominant, their numbers were lower in 1993 (Table 9). The weather conditions of 1993 may not be favourable for geometrid flight or they may have been more affected by the weather conditions more than the other dominant family, the Noctuidae. The more favourable conditions experienced in 1994 may have allowed for an increase in moth numbers especially in the weaker flying Geometridae. The number of Geometridae collected in the natural site, B15A, was much higher than in the planted stands (Appendix V). The number of species was similar between treatments and between years (Figure 43, 44). This lends further support to the idea that an increase in vegetative material leads to an increase in numbers. The differences in numbers of individuals would then be attributed to the increased level of cover due to the clumping of the trees in the area of the light trap, giving more protection from the elements and allowing more of the weaker flying moths to reach the traps. This trend is true for this study (Appendix V; Table 9). It is difficult or impossible to quantitatively measure structural diversity. The level of dominance in this age class was similar between treatments (Figure 45). The degree of dominance remained constant for the planted stands in both years. The level of dominance in the natural stand increased quite substantially in 1994. As discussed earlier, this may be due to the more favourable weather conditions occurring in that year. The dominant species in the natural site in 1994, *E. explanata*, was also prevalent in 1993. The improved weather conditions may have allowed for the increase in numbers. Conversely, in the 40 year old stands, where *E. explanata* was also abundant, there was not a concurrent increase in the number of individuals of this species collected. It may simply be natural variation in the population levels of this insect that accounts for the difference in abundance.

In 1993, the number of moths collected in the 25 year old age class was quite similar, although it was considerably more variable in the planted sites (Figure 41). There may have been a malfunction in the light trap in one of the planted sites (P25A), as the numbers for these sites were quite similar in 1994 (Figure 42). Numbers increased in 1994, particularly for the natural sites, although they were more variable (Figure 42). The number of species were quite similar in 1993 (Figure 43) and more variable in the planted stands, likely for the same reasons as the number of individuals. in 1994, within treatments the number of species were quite similar (Figure 44). The natural stands had a considerably higher number of species than did the planted stands. The planted and natural stands did not differ substantially in herbaceous vegetation composition. The key difference may be attributed to the area surrounding the sites. The planted stands are within large, relatively homogeneous areas of forest, while the natural stands tend to be in heterogeneous forest areas. As mentioned earlier, the second natural replicate has a large stand of *Populus* spp. within 200 m. The area near the other planted replicate was also of mixed forest. A large number of species may have been dispersing/migrating in the area. A large number of the species not collected in the planted stands that were collected in the natural stands feed on *Populus* spp. and may have been moving through the natural stands, accounting for the differences in the number of species collected in the different treatment types. The degree of dominance in the 25 year old stands was quite similar within treatments and between treatments as well as between study years (Figure 46). Dominant species in the 25 year old age class were the most variable of all age classes and included *C. angustiorata, E. explanata* and *I. occiduaria* (Table 8). The latter two species are ubiquitous in the three older age classes. *Caripeta angustiorata* feeds on various species of pines (Tietz, 1972) and its increased abundance in this age class may indicate that it has a preference for older trees. A species that was abundant in the natural sites is *Lomographa vestaliata* (Guenée). Its host plant is *A. uva-ursi*, or snowberry (Tietz, 1972). From Appendix I, it is observed that snowberry is more abundant in the natural stands than in the planted stands. Snowberry is most frequently found in open woods in dry habitats (Johnson *et al.*, 1995). The natural sites were on average more open (Fig. 11) than were the planted sites.

In both years of the study, the number of moths collected peaked for the planted stands in the 40 year age class (Figure 41, 42). The natural stands had the highest number of moths collected in 1993 but not in 1994. The numbers collected in 1994 were lower than those of the 25 year old natural stands but were higher than any of the other age classes (Figure 41, 42). The high numbers collected in these sites is similar to those of the previous age class. An increase in the amount of available food resources as a result of increased vegetative growth may account for the increase in number of moths collected (Lawton, 1983). These sites also offer considerable protection from the wind, allowing for an increase in the number of poorly flying species able to reach the light trap. The geometrid moths, which are considered weak fliers (Holloway and Stork, 1991), and were more frequently collected in sites which afford them more protection from the wind (Table 9). As such, the number of geometrid species collected is highest in the oldest sites. The number of species in general collected also peaked in this age class for the moths (Figure 43, 44) and were comparable between the treatments. As stand age increases there is an increase in the number of types of food plants available and the degree of cover also increases, allowing more of the poorer flying species, such as the geometrids, to reach the light traps. The dominant species in this age class were members of the Geometridae (Tables 6, 9; Appendix V). *Eulithis explanata* was the dominant species overall in both years. Its food plant, *Vaccinium* spp., is abundant in these sites. The degree of dominance remained consistent in the natural stands (Figure 45) in both years. The planted stands were quite similar to the natural stands in dominance in 1994, but had a higher level of dominance in 1993. Examination of the data did not reveal any explanation for this. The dominant species, *E. explanata*, showed an increase in numbers and dominance in the 15 year old natural site from 1993 to 1994, so a change in weather does not serve as an explanation for the concurrent decrease in dominance in the 40 year old stands over the same time period. It is likely that the decrease in dominance may be attributed to a natural decrease in numbers occurring over a long term cycle of the moth numbers within those sites.

In general there is an increase in both number of individuals and number of species collected with an increase in stand age. This is due to the increase in both the structural and architectural diversity that occurs with increasing stand age (Southwood *et al.*, 1979; Lawton, 1983). There is a shift in the composition of the dominant species at the familial level. The young sites are dominated by strong flying Noctuidae (Table 9; Appendix V). As stand age increases there is an increase in the number of poor flying species resulting in an increase in the number of Geometridae that are collected by the light traps. Similarly, a poor flying species of the family Ethmiidae, *Ethmia monticola* (Walsingham) increased in numbers collected as stand age increases (Appendix V). The Noctuidae and Geometridae were clearly the dominant families of moths accounting for greater than 70 percent of the moths collected in all sites (Table 9).

The height of the trap may also play a role in species composition. The traps in this study were at a height of two metres. In the open sites this may have been too high for the weak flying species to reach. Had the traps been placed closer to the ground, more weak flying species may have been collected in the open sites. The trap height may have also affected the number of very strong flying species collected. Sphingidae are quite abundant in the Sandilands Provincial Forest region (B. Elliott, pers. obs.) and more species and individuals were expected in the collections. The Sphingidae fly quite high (Taylor et al., 1979) and as such, the trap height may have been too low to attract many of these species. The trap opening is also quite small, and some members of the Sphingidae are quite large. They may have reached the trap, but with wings outspread, were unable to enter the trap.

In terms of feeding strategy among the moths, generalist species dominated the fauna that was collected (Table 10). This may provide an explanation for the low eigenvalues obtained during ordination analysis of the moth species. Since the majority of species collected are polyphagous, it is unlikely that they would be strongly linked to a particular habitat by host plant requirements (Lawton, 1983). There was a slight increase in the number of specialist species as stand age increased (Table 10). This is the opposite of the trend observed in the butterflies as the number of specialists decreased with an increase in stand age. It may be that the monophagous moth species are poorer flying species that need the increased protection from the elements that is afforded to them by the older, more closed sites.

Controlling factors affecting Lepidoptera alpha and beta diversity

The butterflies and moths exhibited patterns of species diversity that differed from each other. In the five year old stands, both butterflies and moths exhibited low values of α compared to stands in other age classes (Figure 27, 28; 46, 47). The youngest sites were expected to have the lowest species diversity values. In general, sites that are architecturally simple in terms of vegetation structure are expected to have less diverse faunas associated with them than are sites which are architecturally diverse (Southwood, 1979; Lawton, 1983). Components of architectural diversity include the size and growth form of the vegetation, which may be thought of as spatial diversity, and architecture which describes the variety of above ground parts (Lawton, 1983). Sites with an abundance of herbaceous vegetation combined with a well developed shrub layer and a high number of trees have a high degree of structural architecture (Lawton, 1983). By comparison, an architecturally simple site would be one in which there is little vegetation cover and no shrubs or trees (Lawton, 1983). The five year old sites had little in the way of shrub cover and the trees are still quite small and hence architecturally simple at this age. The butterflies present in this age class are typically generalists that are found in other age classes. One exception is *C. pegala*, which seems to have a distinct preference for the open sites and may fall into the category that Holloway and Barlow (1992) refer to as gap phase specialists; species which specialize in colonizing the early stages of a succession. This species was not abundant in the natural stands. The reason for this may have been the higher abundance of grasses, the food plant for this species (Tietz, 1972), in the planted stands. The moths collected in this age class were mostly generalists although several species which may be gap phase specialists were collected. The species include *L. commoides*, and *O. piffardi*, both of which are members of the Noctuidae. Holloway and Barlow (1992) observed that members of the Noctuidae and Arctiidae comprise a high proportion of the open habitat specialists in the tropics. This seems to be true in this study for some species of the Noctuidae, but the Arctiidae collected in this study would have to be considered as generalists, as they showed no particular preference for any habitat type nor any particular age class (Appendix V; Table 9).

Both groups of Lepidoptera increased in α diversity in the 15 year age class (Figure 27, 28; 46, 47). Diversity was higher in the planted stands in both groups. The butterflies' diversity was likely lower in the natural stands due to the high density of the trees which created a comparatively dark habitat. Butterflies prefer a patchy habitat and this was more available in the planted stands and the resultant diversities were higher in those stands. The moth diversity may be due to the increased architectural diversity in the planted stands. Although the natural stand was more dense in terms of trees, the trees in the planted stands were more robust in development with abundant foliage on all branches. In the natural stand the trees were comparatively bare and there was abundant needle die-off on lower branches. In the areas around the planted stands were stands of *Populus*, a host plant for a large number of the moth generalist species.

Relative to that in the 15 year age class, α diversity of both butterflies and moths increased in the natural stands for the 25 year age class and decreased for the planted stands (Figure 27, 28; 46, 47). The increase in diversity in the natural stands can be attributed to several factors. The area surrounding the natural sites was more heterogeneous than those around the planted stands. There was likely a higher number of lepidopteran species that were travelling through the sites as they were searching for oviposition sites, searching for mates or in the process of migration. The planted stands were more closed compared to the natural stands and as has been stated earlier the butterflies have a preference for patchy habitats. The trees in the natural stands were comparatively more robust and healthy with fully developed foliage. There was also a stronger shrub layer in the natural stands compared to the planted stands. The planted stands were dominated by a single species to a much greater extent than were the natural stands. This species, *E. anthedon*, is predominant in the next age class and is associated with the more mature, closed sites (Table 5, 6).

The patterns of α diversity differed for the two groups of Lepidoptera in the 40 year old stands. Relative to the 25 year age class, diversity decreased in this age class for the butterflies (Figure 27, 28) and increased for the moths (Figure 46, 47). The general theory that insect diversity increases with increasing architectural diversity holds true for the moths. The 40 year old stands had the most structurally diverse architecture of all the age classes. The trees were most well developed in terms of height and foliage development. The shrub layer was the most well developed in these sites and the herb layer was comparable in number of species and architecture with the younger species (Figure 15, 16). The majority of butterflies, as has been mentioned earlier have a preference for patchy habitats in which they can easily obtain access to sunlit areas, an obvious requirement for heliotherms. As such, many find the habitat of a 40 year old stand unsuitable. Some species do show a preference for the shaded areas of this age class and include *E. anthedon* and *P. napi*. The patterns of α diversity follow the expected pattern according to diversity theories put forth by Southwood (1979) and Lawton (1983).

In general, neither planted nor naturally regenerated stands exhibited a greater degree of β diversity than the other treatment, for either butterflies or moths. Only in 1994 were planted stands significantly more similar in terms of values for Kendall's Tau for the butterflies. The butterflies showed no clear pattern in terms of β diversity with respect to age class. The moths showed a decrease in β diversity with an increase in stand age when Sørenson's coefficient was used. This may be due to canopy closure as stands age, resulting in a more uniform habitat. The same trend was noted in the moths with respect to α diversity, number of individuals and number of species. The same patterns were not noted in the butterflies. The butterflies prefer patchy habitats (Gilbert and Singer, 1975) and do not respond to an increase in vegetative cover in the same manner as the moths.

CONCLUSIONS

Butterflies prefer patchy habitats (Gilbert and Singer, 1975) and in this study the five year old stands were too open while the 40 year old stands were too closed: butterfly abundance and diversity were greatest in the 15 or 25 year old stands. Overall, planting did not significantly reduce butterfly α diversity between planted and naturally regenerated jack pine stands of similar age and composition. However, in both years diversity peaked in 15 year old planted stands and at 25 years in the natural stands. This effect was statistically significant in one year only. However, statistical analysis is a conservative process with the goal of excluding effects of random variation. Thus, the consistent pattern and the statistically significant result in one year suggest that the advancing of the age of maximum α diversity is a real effect of planting.

Moth α diversity increased with increasing stand age. The moths seem to respond strongly to the increased structural and architectural diversity that accompanies an increase in stand age (Lawton, 1983). Overall, planting did not significantly reduce moth α diversity between planted and naturally regenerated jack pine stands of similar stand age and composition. However, α diversity of moths increased with stand age more rapidly in natural stands than in planted stands. This trend occurred in both years, although it was only statistically significant in one of the years. It is likely therefore that planting reduces the rate of increase of α diversity of moths. There is a need to determine if this trend extends beyond the 40 year age class: the differences between treatments increased as stand age increased and so studies on older stands should be performed.

Planted and naturally regenerated stands do not differ significantly in terms of β diversity for either butterflies or moths. No discernable trend in β diversity was observed for the butterflies. For the moths, there was a decrease in habitat heterogeneity with increasing stand age. This study was limited in its ability to assess β diversity. There were few replicates for comparison and only one replicate of the 15 year old natural stand. A study with a greater number of replicates would give a better indication of trends in β diversity. However, more replicates would include more work in an already labour intensive study.

The majority of Lepidoptera are phytophagous and coevolution with their host plants is well established (Ehrlich and Raven, 1964). Ordination analysis illustrated that there is a strong degree of association between certain butterfly species and their host plants. In this study there was no relationship between a moths and their food plants that could be established using ordination analysis. For the most part there appeared to be a lack of association between the majority of species and their host plants in the ordinations. The degree of host plant association for both butterflies and moths was unaffected by regeneration type. Ordination analysis did not reveal any effects of planting on the assemblages of Lepidoptera.

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Appendix I. Summary of vegetation transect sampling in all sites in 1993 & 1994 (percent cover).

		5 year old				15 year old				25 year old				40 year old			
		Natural		Planted		Natural		Planted		Natural		Planted		Natural		Planted	
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	
Ophioglossaceae																	
Botrychium multifidum	1993	2.50	.	.	.	.	.	.	.	.	.	.02	.	.	.	.	
(Gmel.) Rupr.	1994	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
Polypodiaceae																	
Pteridium aquilinum	1993	.	.	.	.	.	.	.	.	.	.	1.31	.	.	.	.02	
(L.) Kuhn	1994	1.95	.	.	.	.	.	.	.	.	.	.	6.43	.	.	.	
Equisetaceae																	
Equisetum hyemale	1993	.12	.02	.	.02	.10	1.91	.	.11	.	.02	.	.02	.19	.02	.10	
L.	1994	.10	.02	.	.	.	1.01	.	.08	.	.02	.	.	.31	.01	.03	
Lycopodiaceae																	
Lycopodium annotinum	1993	.25	.42	.	.02	.	.86	.20	.	.	.32	.10	.	.	.	.	
L.	1994	.	.	.	.	.	.	.	.	.	.	.	.	.44	.	.	
Selaginellaceae																	
Selaginella rupestris	1993	.	.30	.04	.	.	.56	.02	.10	.	.	.	.	.	.	.	
(L.) Spring	1994	.	.35	.	.02	.	.34	.15	.	.	.	.	.08	.	.	.	
Gramineae																	
Agrostis scabra	1993	.	.	.12	.12	.02	.	.91	.09	.	.	.12	.	.	.	.	
Willd.	1994	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
Andropogon gerardi	1993	10.34	7.95	7.56	6.08	4.14	.10	21.66	5.60	6.99	8.54	8.26	.94	2.63	3.39	5.04	
Vitman	1994	16.40	10.79	12.14	7.35	2.95	10.78	22.56	5.01	14.22	12.75	7.56	2.69	2.20	5.26	5.38	
Calamovilfa longifolia	1993	.	.72	1.59	14.28	.	.	.91	.	.84	.	.99	.	.	.	.	
(Hook.) Scribn.	1994	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	

Appendix I (continued)

		5 year old				15 year old			25 year old				40 year old			
		Natural		Planted		Natural	Planted		Natural		Planted		Natural		Planted	
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B
Elymus canadensis	1993	.	.	.	.	.	.	.	.	.	.	.	.02	.	.	.
L.	1994	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Koeleria gracilis	1993	1.22	3.02	17.00	3.01	.	8.77	.02	.02	.	.	.	.	.	.	.
Pers.	1994	5.89	5.77	21.92	8.41	.42	4.41	2.49	.07	.	.	3.45	.	.	.86	.
Oryzopsis asperifolia	1993	.	.	.	.	.	1.94	.22	4.47	2.64	3.55	5.57	14.92	3.45	15.34	.67
Michx.	1994	.11	.	8.68	.	.10	.	.	.	.40	.97	.	4.71	.47	.13	.45
Oryzopsis pungens	1993	1.71	4.33	.12	.22	3.58	2.86	.20	.19	.	.50	1.29	.	.59	.	.43
(Torr.) Hitchc.	1994	4.13	5.43	.43	15.93	8.84	8.66	8.96	5.19	5.45	5.53	9.53	1.71	4.22	3.95	4.56
Poa compressa	1993	.	.02	2.09	2.38	.	.02	.	.02	.	.	1.90	.	.09	.	.22
L.	1994	.	.	.	.88	.	.	.	.	.	.	.	.	.	.	.
Stipa comata	1993	.	.	.10	.	.	.	.	.57	.02	.	.	.	.09	.	.
Trin. & Rupr.	1994	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cyperaceae																
Carex pensylvanica	1993	.	.	5.17	.	.	.	.	.	.	.	.	.	.89	.	.
Lam.	1994	1.18	1.80	4.66	2.07	.	.	.23	.	.24	.	.	.	.	.	.
Carex richardsonii	1993	3.79	.40	4.87	5.13	.29	.08	.36	.38	.49	.60	.36	.28	1.12	.	.55
R. Br.	1994	3.09	.35	.	.09	2.17	2.66	2.60	3.51	.	5.02	4.94	3.95	3.54	7.26	.
Carex rossii	1993	1.57	1.59	.74	2.16	.12	.02	.10	.	.20	.	.30	.02	.	.	.
Boott	1994	.63	.	.	.53	.	.	.	.	.	.	.	.	.	.	.
Liliaceae																
Maianthemum canadense	1993	.14	.10	.14	.18	1.68	.04	.02	2.40	1.02	1.43	.04	4.40	8.40	2.89	7.08
Desf.	1994	.09	.44	.01	.	1.11	.18	.02	5.28	.69	5.83	.	3.60	8.52	8.00	6.24
Polygonatum canliculatum	1993	.	.08	.42	.61	.37	.	.02	.08	.	.	.	.	.40	.	.98
(Muhl.) Pursh	1994	.	.18	.38	.14	.91	.	.	.91	.61	.	.	.02	.	.	.12

Appendix I (continued)

		5 year old				15 year old				25 year old				40 year old			
		Natural		Planted		Natural	Planted			Natural		Planted		Natural		Planted	
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B		B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B
Betulaceae																	
Corylus cornuta	1993	.	.	.	.	.	.	.		.	.	.	.	.28	.	.	.
Marsh.	1994	.	.	.	.	.	.	.		.	.	.	.41	.62	.	.	.
Polygonaceae																	
Polygonum convolvulus	1993	.	.	.26	.02	.	.	.		.	.	.	.	.	.	.	.
L.	1994	.	.	.02	.	.	.	.		.	.	.	.	.	.	.	.
Chenopodium album	1993	.	.	.24	.	.	.	.		.	.	.	.	.	.	.	.
L.	1994	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.
Chenopodium leptophyllum	1993	.02	.	.	.67	.	.	.		.	.	.19	.	.	.	.	.
Nutt.	1994	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.
Caryophyllaceae																	
Arenaria lateriflora	1993	.	.	1.17	.18	.	.	.		.	.	.	.	.	.	.	.
L.	1994	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.
Ranunculaceae																	
Anemone canadensis	1993	.08	.	.	.	.	.	.		.	.09	.	.04	.	.	.	.
L.	1994	.58	.	.	.	.10	.	.		.32	.30	.	.	.	.	.	1.76
Anemone cylindrica	1993	.04	.	.	.	.02	.	.		.06	.40	.	.12	.	.	.	.04
A. Gray	1994	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.
Anemone nemorosa	1993	.10	.	.	.	1.25	.51	2.00		1.46	1.25	7.20	.44	2.98	11.39	4.13	.06
L.	1994	.	.	.	.	1.97	.08	1.29		1.65	1.95	4.02	.25	3.56	.33	1.75	.
Anemone patens	1993	.	.	.42	1.23	2.91	.	.02		.42	.67	.10	.	.	.66	.	.
L.	1994	.11	.	.17	1.63	1.54	.	.08		.97	1.26	.	.	.	.49	.	.21

Appendix I (continued)

		5 year old				15 year old			25 year old				40 year old			
		Natural		Planted		Natural	Planted		Natural		Planted		Natural		Planted	
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B
Thalictrum dasycarpum	1993	.	.	.	.	.21	.	.	.42	.	.21	1.68	.24	.54	.29	.
Fisch. & Lall.	1994	.	.02	.	.	.	.	.	.07	.42	.	.	.29	.15	.	.
Cruciferae																
Arabis drummondii	1993	.17	.14	.12	.	.	.14	.	.02	.02	.	.	.	.	.	.
A. Gray	1994	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Saxifragaceae																
Heuchera richardsonii	1993	.37	.	.	.	.	.	.	.	.	.04	.14	.06	.10	.16	.
R. Br.	1994	.49	.	.	.	.18	.	.	.	.	.	.02	.	.01	.17	.
Ribes glandulosum	1993	.	.	.	.	.	.	.	.	.	.02	.	.	.	.	.
Grauer	1994	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rosaceae																
Amelanchier alnifolia	1993	.04	.	.	.06	.04	.	1.64	.02	.04	.	.44	.04	.	.02	.
Nutt.	1994	.	.	.26	.	.	.	.73	.	.18	.53	.85	.	.	.17	.
Fragaria virginiana	1993	.92	.02	.	.02	.54	.02	3.03	.53	.56	.68	1.64	1.35	1.19	.36	.06
Dcne.	1994	2.69	.	.	.35	.35	.	9.49	1.37	.29	1.08	5.23	.53	.82	1.44	.28
Potentilla tridentata	1993	.02	.22	.	.	.02	.	.	.	.31	.10	.	.	.	.	.
Ait.	1994	.	.53	.	.	.	.	.	.	.27	.	.	.	.	.	.
Prunus pensylvanica	1993	.	.	.	.	.	.	.	.	.55	.	.	.	.	.	.
L.	1994	.11	.02	.	.	.	.	.23	.	.	.08	.10	.	.	.	.
Prunus pumila	1993	.14	.40	2.88	2.12	.10	.29	2.32	.97	.	.38	.02	.30	.45	.50	1.31
L.	1994	.	1.50	.71	1.15	.21	.09	2.44	.50	1.20	.65	.57	.02	.56	.	.70
Prunus virginiana	1993	.02	.04	.10	.20	.	.04	.24	.66	.05	.02	.	.	.	.	.
(L.) Kuhn	1994	.09	.09	.28	.18	.08	.40	.97	.44	.58	.81	1.17	.	.12	.04	.28

Appendix I (continued)

		5 year old				15 year old			25 year old				40 year old			
		Natural		Planted		Natural	Planted		Natural		Planted		Natural		Planted	
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B
Rosa acicularis	1993	1.38	.30	.46	2.18	.60	.10	.40	.27	.09	.77	2.77	2.67	.65	.45	.26
Lindl.	1994	2.48	2.28	.02	1.06	1.81	3.21	3.71	2.95	.24	.32	2.66	4.88	.34	1.05	.99
Rubus idaeus	1993	.	.	.	.	.	.	.30	.	.	.	.	1.43	.	.	.
Regel & Tiling	1994	.	.	.	.	.	.02	.	.	.	.	.08	.59	.	.	.
Spiraea alba	1993	.	1.53	1.63	2.20	.	1.49	.02	.	.	.	.	.	.	.02	.12
Du Roi	1994	.	3.22	1.54	5.34	.	.46	.	.	.	.	.	.	.	.	.
Leguminosae																
Amorpha canescens	1993	.	.	.	.	.	.	7.62	.	.	.	1.09	.	.	.	.
Pursh	1994	.	.	.	.	.	.	10.34	.	.	.	.20	.	.	.	.
Lathyrus ochroleucus	1993	1.67	.72	.	.	.	.	.53	1.14	.16	1.26	.95	.54	.	2.04	.
Hook.	1994	.96	1.06	.	.	.	.08	1.90	.97	2.69	.99	4.44	.71	.01	.60	.35
Vicia americana	1993	.	.	.	.	.	.	.	.	.69	.02	.	.04	.	.11	.
Muhl.	1994	.18	.	.	.	.	.09	.	.	.10	.	.	.	.	.	.
Anacardiaceae																
Rhus radicans	1993	.	.	.	.	.	.	.	.	.	.	4.80	.	.	.	.
L.	1994	.	.	.	.	.	.	.15	.09	.48	.	7.09	.	.	.	.
Rhamnaceae																
Ceanothus ovatus	1993	.20	.	.	.01	.	.	.	1.04	.02	5.45	5.57	.	.	.90	.
Desf.	1994	.18	.	.	.	.	.	.	.	.	.80	5.94	.51	.32	.50	.
Cistaceae																
Hudsonia tomentosa	1993	.	.54	.	.	.	.	.	.	.	.	.	.	.	.	.
Nutt.	1994	.	.99	.	.	.	.	.	.	.	.	.	.	.	.	.

Appendix I (continued)

		5 year old				15 year old				25 year old				40 year old			
		Natural		Planted		Natural		Planted		Natural		Planted		Natural		Planted	
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B
Violaceae																
Viola adunca	1993	.29	.	.	.	1.25	.51	2.00	1.46	1.25	.02	.14	.28	.12	.09	.39
J.E. Smith	1994	.35	.21	.23	.09	1.19	.25	.20	1.16	.78	2.85	.16	.02	.35	.17	.71
Onagraceae																
Epilobium angustifolium	1993	.	.70	.	.	.	.	.	.	.04	.	.	1.58	.	.	.
L.	1994	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Oenothera biennis	1993	.	.04	.10	.02	.	.	.	.	.	.	.	.	.	.	.
L.	1994	.	.	.03	.12	.	.	.	.	.	.	.	.	.	.	.
Araliaceae																
Aralia nudicaulis	1993	.	.	.	.	.	.	.95	.55	.	.	1.43	.	.	.	.
L.	1994	.	.	.	.	.	.	.	.	.	.	.	2.47	.	.	.
Umbelliferae																
Zizia aptera	1993	.	.02	.	.02	.79	.	.	.04	.	.	.	.	.19	.02	.
(Gray) Fern.	1994	.	.	.	.	.32	.	.	.04	.	.	.	.27	.02	.	.
Cornaceae																
Cornus canadensis	1993	.	.	.	.	.	.19	.	.	.	.	.	.94	.	.	.
L.	1994	.	.	.	.	.	.	.	.	.	.	.	3.10	.	.	.
Pyrolaceae																
Pyrola asarifolia	1993	.	.	.	.	.	.	.	.	.	.	.	.04	.	.	.
Michx.	1994	.	.	.	.	.	.	.	.	.	.08	.	.	.	.	.
Pyrola virens	1993	.	.	.	.	.	.	.	.	.	.02	.	.50	.	.	.
Schweigg.	1994	.	1.61	.	.	.	.	.	3.95	.	.40	.	.	5.41	8.06	3.32

Appendix I (continued)

		5 year old				15 year old				25 year old				40 year old			
		Natural		Planted		Natural		Planted		Natural		Planted		Natural		Planted	
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B
Ericaceae																	
Arctostaphylos uva-ursi	1993	2.79	11.35	3.96	6.40	11.85	8.75	3.94	9.08	28.59	3.11	2.79	.51	10.02	7.08	5.96
(L.) Spreng.	1994	.	.18	.	.	.45	.24	2.55	.75	.58	1.55	10.21	.59	1.34	2.13	.
Gaultheria procumbens	1993	.53	.87	.	.06	.10	.	.	2.20	.	.33	.	.34	.64	6.06	1.41
L.	1994	.	.	.	.	.	.	.	.	.	.	.	.	1.50	.	.
Vaccinaceae																	
Vaccinium angustifolium	1993	.77	6.74	3.16	2.46	19.54	14.21	1.15	9.71	1.04	13.75	2.42	4.13	8.64	7.23	7.46
Ait.	1994	.36	4.60	4.50	3.41	11.35	14.86	1.23	5.69	1.84	11.67	.21	1.36	4.31	3.78	4.01
Primulaceae																	
Trientalis borealis	1993	.	.	.	.	.	.	.	.	.	.	.	.09	.	.	.
Raf.	1994	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Apocynaceae																	
Apocynum androsaemifolium	1993	.	.	.24	.79	.02	.02	.02	.28	.	.68	.	.	.	.	.
L.	1994	.02	.02	.47	.19	.	.03	.47	.32	.08	.16	.36	.17	.01	.	.
Labiatae																	
Monarda fistulosa	1993	.	.	.	.	.	.	.65	.47	.02	.02	1.53	.	.	.	.
L.	1994	.	.	.	.	.	.	1.44	.	.	.08	3.58	.	.	.	.
Scrophulariaceae																	
Melampyrum lineare	1993	.	.	.02	.02	.04	.39	.	.	.38	.02	.	.43	.26	.65	.53
Desr.	1994	.	.	.	.	.	.	.12	.	.	.	.02	.	.	.	.

Appendix I (continued)

		5 year old				15 year old			25 year old				40 year old			
		Natural		Planted		Natural	Planted		Natural		Planted		Natural		Planted	
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B
Rubiaceae																
Galium boreale	1993	.45	.	.65	.10	.81	1.69	3.33	1.32	3.20	1.29	1.86	1.16	1.91	.27	.
L.	1994	.75	.	.73	.	.96	1.49	2.43	1.03	1.89	1.69	2.12	.94	1.20	.85	.
Galium triflorum	1993	.	.	.	.	.	.	.	.	.	.	.28	.02	.	.34	.
Michx.	1994	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Caprifoliaceae																
Linnaea borealis	1993	.	.	.	.	.	.	.	.	.	.52	.	1.20	.	.	.
L.	1994	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lonicera dioica	1993	.	.	.	.79	.	.	.10	.	.	.	2.08	.34	.	.	.
L.	1994	.	.26	.12	1.32	.	.	.	.	.	.	.	.12	.	.22	.
Symphoricarpos albus	1993	.02	.02	.82	.73	.91	.29	6.65	.80	.29	4.54	13.79	1.05	2.31	.43	.53
(L.) Blake	1994	.18	.	.	.	.45	.25	2.55	.75	.58	1.58	10.21	.59	1.34	2.13	.
Campanulaceae																
Campanula rotundifolia	1993	.	.	.10	.04	.08	.14	.	.01	.11	.04	.02	.02	.02	.02	.
L.	1994	.	.09	.09	.02	.	.	.	.	.	.	.	.	.	.03	.
Compositae																
Crepis tectorum	1993	.	.02	.34	.06	.	.	.	.	.	.	.	.	.	.	.
L.	1994	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sonchus arvensis	1993	.	.	.	.	.	.	.	.	.	.02	.	.02	.	.	.
L.	1994	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tragopogon pratensis	1993	.	.	.	.	.	.02	.	.	.	.	.	.09	.03	.	.02
L.	1994	.	.04	.	.39	.	.	.	.	.	.	.	.	.	.01	.10

Appendix I (continued)

		5 year old				15 year old				25 year old				40 year old			
		Natural		Planted		Natural		Planted		Natural		Planted		Natural		Planted	
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B
Achillea millefolium	1993	.	.	.	.	.	.	.	.	.02	.	.	.	.	.	.
L.	1994	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Antennaria neodioica	1993	9.22	.52	.06	.02	1.75	.02	.22	1.25	6.76	3.38	.20	.19	.77	.11	5.31
Greene	1994	14.67	.11	.02	.	4.46	.23	.68	1.87	3.76	6.39	.	.17	3.13	.29	4.11
Artemesia campestris	1993	.02	.	.	.	.	.04	.	.	.	.	.40	.	.	.	.
L.	1994	.	.	.	.	.	.	.	.	.	.	.02	.	.	.	.
Aster ciliolatus	1993	.	.02	.	.	.22	.21	.	.	.31	.02	.40	.	.	.	.
Lindl.	1994	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aster laevis	1993	.75	.04	.10	.36	2.89	.52	1.27	.34	.69	.21	.24	.04	.28	.43	.53
L.	1994	2.35	.65	.	.71	3.55	1.52	3.46	2.71	2.562	1.28	2.23	.03	1.83	1.24	1.44
Cirsium arvense	1993	.	.	.	.	.	.19	.	.	.	.	.	.	.	.	.
(L.) Scop.	1994	.	.	.	.	.	.08	.	.	.	.	.	.02	.	.	.
Erigeron acris	1993	.	.	.02	.	.02	.17	.02	.02	.	.	.04	.	.05	.	.18
L.	1994	.	.	.	.	.16	.08	.	.	.08	.	.08	.	.	.	.10
Erigeron canadensis	1993	.	.02	.08	.02	.	.	.	.	.	.	.	.	.	.	.
L.	1994	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Erigeron glabellus	1993	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.04
Nutt.	1994	.	.	.02	.	.	.	.	.	.	.	.	.	.	.	.
Liatris ligulistylis	1993	.02	.	.	.	.	.	.	.02	.	.	.	.	.	.	.
(A. Nels.) K. Schum.	1994	.	.	.	.	.	.	.	.	.	.	.	.30	.	.	.
Petasites palmatus	1993	.	.	.	.	.	.	.	.	.	.02	.	.02	.	.	.
(Ait.) A. Gray	1994	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Solidago nemoralis	1993	1.08	.64	.04	.12	1.10	.41	3.64	.	.	.02	.02	.09	.26	.	.24
Ait.	1994	2.48	2.28	.02	1.06	1.81	3.21	3.71	2.95	.24	.32	1.00	.	.84	.59	1.35

Appendix I (continued)

		5 year old				15 year old			25 year old				40 year old				
		Natural		Planted		Natural	Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	
Cladoniaceae																	
Cladonia mitis	1993	.	.	.42	.	2.91	1.50	.40	3.61	4.14	.	.	.09	5.53	.02	9.14	
(Sandst.) Hustich	1994	.	.	.62	.	7.14	6.23	.30	8.43	2.11	.16	.02	.02	4.90	.	9.18	
Cladina rangiferina	1993	.	.	.	.02	6.86	11.70	2.55	10.75	.67	.	.02	.22	2.19	.20	2.92	
(L.) Nyl.	1994	.	.	.	.09	5.36	9.67	.91	7.74	1.55	.	.	.	2.92	.	5.88	
Cladonia spp.	1993	.	.	.	.	.	.08	.	.	.	.	.	.	.	.	.45	
	1994	.	.	.	.	6.06	3.13	.67	4.43	.53	.24	.	.	.78	.	.71	
Dicranaceae																	
Dicranum polysetum	1993	.	.	.	.04	.27	.14	.	.42	.15	.	.	.98	1.70	.27	.84	
Sw.	1994	.02	.88	.	.	.26	.86	.	.91	.42	1.02	.02	.16	2.09	1.59	.57	
Ceratodon purpureus	1993	1.97	1.89	.16	.44	.	.37	.04	.	.	.	.	.	.	.	.	
(Hedw.) Brid.	1994	4.93	2.28	.29	2.12	.69	.26	.08	.	.	.	.	.	.16	.	.	
Hylocomiaceae																	
Pleurozium schreberi	1993	.	.	.02	.02	2.85	.08	.22	8.16	5.51	2.11	1.94	19.13	17.72	24.96	7.59	
(Brid.) Mitt.	1994	.	.	.	.	3.80	.25	1.21	7.86	7.74	4.08	.43	28.78	20.86	30.40	7.60	
Dead Vegetation/	1993	53.25	53.67	42.66	43.88	27.01	38.80	32.83	27.86	27.70	37.30	31.73	31.89	13.01	18.49	39.34	
Bare Ground	1994	26.67	37.69	35.07	38.45	17.81	17.58	9.64	11.80	23.45	20.00	16.66	26.17	11.57	10.56	32.89	
																	SUM
∑ Number of Species	1993	36	36	35	44	39	42	43	43	39	41	44	46	36	32	33	91
	1994	31	32	27	27	30	34	35	34	35	32	35	35	36	30	27	69

Appendix II. Summary of butterfly and skipper collection data for all sites using both collection techniques, bait trapping and transect sampling (1993 & 1994).

		5 year old				15 year old				25 year old				40 year old				
		Natural		Planted		Natural		Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM	
Hesperiidae **Pyrginae**																		
Thorybes pylades	1993	0	0	0	0	0	0	1	1	1	0	0	0	0	0	2	5	
Scudder	1994	0	0	0	0	0	1	1	2	3	1	2	2	1	1	0	14	
Erynnis icelus	1993	2	0	0	0	0	3	0	0	0	0	0	1	0	0	0	6	
(Scudder and Burgess)	1994	3	0	1	0	1	1	0	0	2	0	0	0	0	0	0	8	
Erynnis brizo	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
(Boisduval and Leconte)	1994	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	3	
Erynnis juvenalis	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
(Fabricius)	1994	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
Erryni martialis	1993	0	0	0	0	0	1	1	0	2	1	0	0	0	0	0	5	
(Scudder)	1994	1	0	0	0	1	0	0	0	2	1	3	1	0	0	0	9	
Heteropterinae																		
Carterocephalus palaemon	1993	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	
(Pallas)	1994	0	0	0	0	0	0	0	0	2	0	0	0	2	0	0	4	
Hesperia comma	1993	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2	
(Scudder)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Poanes hobomok	1993	0	0	0	0	2	0	1	0	6	0	10	1	7	3	0	30	
(Harris)	1994	0	0	0	0	1	1	0	0	4	1	6	4	0	5	0	22	
Euphyes ruricola	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
(Boisduval)	1994	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	2	
Amblyscirtes vialis	1993	0	0	0	0	0	0	0	0	2	0	0	0	0	4	0	6	
(W.H. Edwards)	1994	0	0	1	0	1	1	1	2	2	0	1	5	1	2	0	17	

Appendix II. (Continued)

		5 year old				15 year old				25 year old				40 year old				
		Natural		Planted		Natural		Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Papilionidae																	
Papilionnae																	
Papilio glaucus	1993	0	0	0	0	1	0	1	0	1	0	0	1	1	0	3	8
Linnaeus	1994	0	0	0	0	0	0	0	1	2	0	0	0	1	0	0	4
Pieridae																	
Pierinae																	
Pieris napi	1993	0	0	0	0	0	0	2	0	2	0	3	1	2	1	0	11
(Linnaeus)	1994	0	0	0	0	1	0	1	1	2	0	3	3	1	1	1	14
Pieris rapae	1993	0	0	0	0	2	0	2	0	0	0	1	1	0	0	0	6
(Linnaeus)	1994	8	2	9	5	6	6	0	9	8	0	4	7	7	1	3	75
Anthocharinae																	
Euchloe ausonides	1993	1	1	1	3	0	2	15	1	4	1	3	0	0	0	1	33
(Lucas)	1994	0	0	0	0	1	3	7	2	1	0	1	2	2	0	0	19
Coliadinae																	
Colias philodice	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Godart	1994	0	0	0	0	0	0	1	0	3	0	0	0	0	0	0	4
Colias eurytheme	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Boisduval	1994	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	3
Colias interior	1993	1	1	0	4	26	13	2	17	18	0	2	1	13	6	7	111
Scudder	1994	10	5	1	5	68	21	8	29	12	0	14	0	27	6	6	212

Appendix II. (Continued)

		5 year old				15 year old				25 year old				40 year old				
		Natural		Planted		Natural		Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Lycaenidae **Liphyrinae**																	
Feniseca tarquinius	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Fabricius)	1994	0	0	0	0	0	0	0	0	1	0	1	2	0	0	0	4
Eumaeinae																	
Harkenclenus titus	1993	0	0	0	0	1	1	1	1	0	0	0	0	1	0	0	5
(Fabricius)	1994	5	0	0	1	0	1	11	0	0	0	6	0	1	1	0	26
Satyrium liparops	1993	0	0	0	0	0	1	1	1	0	3	10	0	0	0	0	16
(W.H. Edwards)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Callophrys augustus	1993	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
(W. Kirby)	1994	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Callophrys polios	1993	1	3	0	1	2	4	2	7	17	1	4	4	4	1	4	52
(Cook & Watson)	1994	0	0	0	1	6	13	1	7	13	0	1	1	6	0	5	54
Callophrys henrici	1993	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
(Grote & Robinson)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Callophrys niphon	1993	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	2
(Hübner)	1994	0	0	0	0	2	0	0	2	1	1	0	1	0	1	0	8

Appendix II. (Continued)

		5 year old				15 year old			25 year old				40 year old				
		Natural		Planted		Natural	Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Polyommatinae																	
Everes amyntula	1993	0	0	0	0	0	0	0	2	3	0	0	0	0	0	1	6
(Boisduval)	1994	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	6
Celastrina argiolus	1993	0	0	0	0	0	0	1	2	4	3	4	0	2	2	3	21
(Linnaeus)	1994	0	0	0	0	5	0	0	0	6	3	5	2	1	5	2	29
Glaucopsyche lygdamus	1993	1	1	0	0	3	0	3	4	6	2	1	5	1	1	8	36
(Doubleday)	1994	2	0	0	1	1	2	3	2	5	0	1	1	3	4	1	26
Nymphalidae **Nymphalinae**																	
Polygonia interrogationis	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Fabricius)	1994	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Polygonia comma	1993	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
(Harris)	1994	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Polygonia satyrus	1993	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
(W.H. Edwards)	1994	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Polygonia faunus	1993	0	0	0	0	0	0	0	0	1	0	0	2	1	1	1	6
(W.H. Edwards)	1994	0	0	0	0	0	0	0	0	3	0	0	1	1	0	0	5
Polygonia gracilis	1993	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
(Grote & Robinson)	1994	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	2
Polygonia progne	1993	0	0	0	0	2	0	0	0	2	0	0	0	0	0	2	6
(Cramer)	1994	0	0	0	0	0	1	1	0	6	0	0	0	0	1	2	11
Nymphalis vau-album	1993	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	2
(Dennis & Schiffermüller)	1994	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1

Appendix II. (Continued)

		5 year old				15 year old				25 year old				40 year old				
		Natural		Planted		Natural		Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Nymphalis antiopa (Linnaeus)	1993	0	0	1	0	0	1	0	0	5	0	4	0	0	0	0	11
	1994	1	3	0	0	1	1	4	0	18	0	0	0	0	0	0	28
Nymphalis milberti (Godart)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
	1994	9	1	1	0	0	0	2	0	0	0	0	0	0	0	0	13
Vanessa virginiensis (Drury)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1994	0	0	0	0	0	1	0	1	4	0	1	0	1	0	0	8
Vanessa cardui (Linnaeus)	1993	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
	1994	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Vanessa atalanta (Linnaeus)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1994	0	0	0	0	0	0	9	1	16	0	0	0	0	1	0	27
Argynninae																	
Euptoieta claudia (Cramer)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1994	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Speyeria cybele (Fabricius)	1993	1	0	0	0	0	0	2	1	0	1	2	0	0	1	0	9
	1994	3	1	0	0	7	4	27	4	2	0	20	0	9	2	0	79
Speyeria aphrodite (Fabricius)	1993	4	2	1	3	5	5	9	2	5	1	5	2	2	2	6	54
	1994	10	6	4	3	18	12	46	8	7	0	14	2	12	4	1	147
Speyeria callippe (Boisduval)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
	1994	0	0	0	0	0	0	3	1	0	0	2	0	1	0	0	7
Speyeria atlantis (W.H. Edwards)	1993	0	0	0	0	1	0	2	1	6	0	2	0	4	2	6	24
	1994	1	0	0	0	6	3	15	2	3	0	18	1	2	1	0	52
Speyeria electa (W.H. Edwards)	1993	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	2
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix II. (Continued)

		5 year old				15 year old			25 year old				40 year old				
		Natural		Planted		Natural	Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Beloria selene	1993	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
(Dennis & Schiffermüller)	1994	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Beloria bellona	1993	5	4	0	3	8	4	3	4	2	1	8	4	4	3	3	56
(Fabricius)	1994	3	2	4	10	17	3	12	15	15	2	11	0	14	6	5	119
Melitaeinae																	
Phyciodes tharos	1993	0	0	0	0	0	2	3	0	1	0	2	0	0	0	0	8
(Drury)	1994	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	3
Phyciodes batesii	1993	0	0	0	0	10	1	2	2	1	1	0	2	0	0	0	19
(Reakirt)	1994	0	0	0	0	1	0	1	1	2	0	0	1	0	0	0	6
Phyciodes morpheus	1993	0	0	0	0	0	0	1	1	2	0	0	0	0	0	0	4
(Fabricius)	1994	1	0	0	0	0	1	2	0	1	0	3	0	0	0	0	8
Limenitidinae																	
Limenitis arthemis	1993	0	0	0	0	0	1	5	3	10	3	13	7	2	2	0	46
(Drury)	1994	0	1	0	1	2	3	156	0	82	3	23	16	1	2	3	293
Limenitis archippus	1993	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
(Cramer)	1994	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Satyridae **Elymniinae**																	
Enodia anthedon	1993	0	0	1	0	0	0	0	3	11	73	157	10	2	44	9	308
(A.H. Clark)	1994	0	0	0	0	0	0	3	7	37	258	53	81	35	71	4	549
Megisto cymela	1993	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
(Cramer)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1

Appendix II. (Continued)

		5 year old				15 year old			25 year old				40 year old				
		Natural		Planted		Natural	Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Coenonympha tullia	1993	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
(Müller)	1994	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Cercyonis pegala	1993	2	1	12	9	1	5	14	2	2	0	3	0	1	2	0	54
(Fabricius)	1994	4	6	23	10	3	2	36	4	1	0	8	0	0	2	1	100
Oeneis macounii	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(W.H. Edwards)	1994	0	0	0	0	2	14	2	10	31	0	5	8	16	7	18	113
Danaidae **Danainae**																	
Danaus plexippus	1993	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0	3
(Linnaeus)	1994	0	0	0	0	0	1	1	0	3	0	2	0	0	0	0	7
Σ Number of Species	1993	10	8	5	6	13	16	24	19	33	13	20	15	15	18	15	48
	1994	13	10	11	9	20	29	27	22	40	9	27	19	22	21	14	55
Σ Number of Individuals	1993	19	14	16	25	64	45	78	57	133	92	234	45	40	78	48	988
	1994	61	28	45	37	153	104	359	114	308	271	210	141	146	125	54	2151

Total Number of Species Collected, Both Years: 58

Appendix III. Summary of butterfly and skipper collection dates for all sites using both collection techniques, bait trapping and transect sampling (1993 & 1994).

MONTH		APRIL				MAY				JUNE					JULY			AUGUST				SEPTEMBER		
WEEK[1]	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	SUM
Hesperiidae **Pyrginae**																								
Thorybes pylades	1993	0	0	0	0	0	0	0	1	3	1	0	0	0	0	0	0	0	0	0	0	0	0	5
Scudder	1994	0	0	0	0	0	0	0	5	6	2	0	1	0	0	0	0	0	0	0	0	0	0	14
Erynnis icelus	1993	0	0	0	0	0	3	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	6
(Scudder and Burgess)	1994	0	0	0	0	1	1	2	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	8
Erynnis brizo	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Boisduval and Leconte)	1994	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Erynnis juvenalis	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Fabricius)	1994	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Errynis martialis	1993	0	0	0	0	0	1	0	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	5
(Scudder)	1994	0	0	0	0	1	1	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
Heteropterinae																								
Carterocephalus palaemon	1993	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
(Pallas)	1994	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Hesperia comma	1993	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	2
(Scudder)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Poanes hobomok	1993	0	0	0	0	0	0	0	6	13	8	2	1	0	0	0	0	0	0	0	0	0	0	30
(Harris)	1994	0	0	0	0	0	0	4	4	9	3	0	2	0	0	0	0	0	0	0	0	0	0	22
Euphyes ruricola	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Boiduval)	1994	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2

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[1] first sampling date of 1993 = 20.IV.93; first sampling date of 1994 = 19.IV.94

Appendix III. (Continued)

MONTH		APRIL				MAY				JUNE					JULY			AUGUST				SEPTEMBER	
WEEK	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	SUM
Amblyscirtes vialis	1993	0	0	0	0	0	0	0	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	6
(W.H. Edwards)	1994	0	0	0	0	0	0	1	11	2	3	0	0	0	0	0	0	0	0	0	0	0	0	17
Papilionidae																								
Papilionnae																								
Papilio glaucus	1993	0	0	0	0	0	0	0	1	3	4	0	0	0	0	0	0	0	0	0	0	0	0	8
Linnaeus	1994	0	0	0	0	0	0	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Pieridae																								
Pierinae																								
Pieris napi	1993	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	4	3	0	0	0	0	0	11
(Linnaeus)	1994	0	0	1	2	1	2	0	0	0	0	0	0	3	3	1	1	0	0	0	0	0	0	14
Pieris rapae	1993	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3	1	0	6
(Linnaeus)	1994	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	4	62	7	0	0	0	75
Anthocharinae																								
Euchloe ausonides	1993	0	0	0	2	1	3	10	11	3	3	0	0	0	0	0	0	0	0	0	0	0	0	33
(Lucas)	1994	0	0	0	0	2	5	11	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	19
Coliadinae																								
Colias philodice	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Godart	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	4
Colias eurytheme	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Boisduval	1994	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	3
Colias interior	1993	0	0	0	0	0	0	0	0	0	0	0	0	22	6	29	18	20	12	4	0	0	0	111
Scudder	1994	0	0	0	0	0	0	0	0	0	0	3	48	52	45	23	19	6	16	0	0	0	0	212

Appendix III. (Continued)

MONTH		APRIL				MAY				JUNE					JULY			AUGUST				SEPTEMBER		
WEEK	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	SUM
Lycaenidae																								
Liphyrinae																								
Feniseca tarquinius	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Fabricius)	1994	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	1	0	0	4
Eumaeinae																								
Harkenclenus titus	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	0	1	0	0	5
(Fabricius)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	7	4	11	3	1	0	0	0	0	26
Satyrium liparops	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	1	13	1	0	1	0	0	0	0	16
(W.H. Edwards)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Callophrys augustus	1993	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(W. Kirby)	1994	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Callophrys polios	1993	0	0	0	20	5	2	10	12	3	0	0	0	0	0	0	0	0	0	0	0	0	0	52
(Cook & Watson)	1994	0	0	0	1	11	20	14	6	2	0	0	0	0	0	0	0	0	0	0	0	0	0	54
Callophrys henrici	1993	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(Grote & Robinson)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Callophrys niphon	1993	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
(Hübner)	1994	0	0	0	0	3	2	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	8
Polyommatinae																								
Everes amyntula	1993	0	0	0	0	0	0	0	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	6
(Boisduval)	1994	0	0	0	0	0	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
Celastrina argiolus	1993	0	0	0	7	1	2	7	1	2	0	0	0	0	0	1	0	0	0	0	0	0	0	21
(Linnaeus)	1994	0	0	1	0	23	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29

Appendix III. (Continued)

MONTH		APRIL				MAY				JUNE					JULY			AUGUST				SEPTEMBER		
WEEK	**YEAR**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**SUM**
Glaucopsyche lygdamus (Doubleday)	1993	0	0	0	5	2	1	10	12	4	2	0	0	0	0	0	0	0	0	0	0	0	0	36
	1994	0	0	0	1	0	6	10	5	4	0	0	0	0	0	0	0	0	0	0	0	0	0	26
Nymphalidae **Nymphalinae**																								
Polygonia interrogationis (Fabricius)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Polygonia comma (Harris)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Polygonia satyrus (W.H. Edwards)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Polygonia faunus (W.H. Edwards)	1993	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	1	0	0	6
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	1	0	0	0	0	5
Polygonia gracilis (Grote & Robinson)	1993	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2
Polygonia progne (Cramer)	1993	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	3	0	6
	1994	0	0	0	0	0	0	2	0	0	0	0	1	0	1	0	2	0	2	1	1	1	0	11
Nymphalis vau-album (Dennis & Schiffermüller)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	2
	1994	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Nymphalis antiopa (Linnaeus)	1993	0	0	0	0	0	1	0	0	0	0	0	1	0	1	2	3	1	1	0	1	0	0	11
	1994	0	0	0	0	0	0	0	0	0	0	0	0	3	2	11	2	2	3	0	4	1	0	28
Nymphalis milberti (Godart)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	6	4	0	0	0	13
Vanessa virginiensis (Drury)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1994	0	0	0	0	0	4	3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	8

Appendix III. (Continued)

MONTH		APRIL				MAY				JUNE					JULY			AUGUST				SEPTEMBER		
WEEK	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	SUM
Vanessa cardui	1993	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(Linnaeus)	1994	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Vanessa atalanta	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Linnaeus)	1994	0	0	0	0	0	1	0	0	0	2	0	0	0	0	12	3	0	5	0	4	0	0	27
Argynninae																								
Euptoieta claudia	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Cramer)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Speyeria cybele	1993	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3	4	0	1	0	0	0	0	9
(Fabricius)	1994	0	0	0	0	0	0	0	0	0	0	3	5	14	9	5	25	7	10	1	0	0	0	79
Speyeria aphrodite	1993	0	0	0	0	0	0	0	0	0	1	0	2	2	2	10	7	16	7	6	1	0	0	54
(Fabricius)	1994	0	0	0	0	0	0	0	0	2	2	0	15	22	11	13	41	15	18	5	2	1	0	147
Speyeria callippe	1993	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
(Boisduval)	1994	0	0	0	0	0	0	0	0	0	0	0	1	3	0	3	0	0	0	0	0	0	0	7
Speyeria atlantis	1993	0	0	0	0	0	0	0	0	0	1	0	2	11	2	2	2	2	0	1	1	0	0	24
(W.H. Edwards)	1994	0	0	0	0	0	0	0	0	0	0	0	3	4	5	7	5	16	11	0	1	0	0	52
Speyeria electa	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	2
(W.H. Edwards)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Boloria selene	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
(Dennis & Schiffermüller)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Boloria bellona	1993	0	0	0	0	0	0	1	8	11	8	0	0	0	0	1	6	7	9	5	0	0	0	56
(Fabricius)	1994	0	0	0	0	0	15	16	18	17	5	0	0	0	6	9	18	5	10	0	0	0	0	119
Melitaeinae																								
Phyciodes tharos	1993	0	0	0	0	0	0	0	0	0	0	0	1	2	3	1	0	1	0	0	0	0	0	8
(Drury)	1994	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	3

Appendix III. (Continued)

MONTH		APRIL				MAY				JUNE				JULY				AUGUST				SEPTEMBER		
WEEK	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	SUM
Phyciodes batesii (Reakirt)	1993	0	0	0	0	0	0	0	0	0	2	2	3	5	5	0	1	1	0	0	0	0	0	19
	1994	0	0	0	0	0	0	0	0	2	2	1	1	0	0	0	0	0	0	0	0	0	0	6
Phyciodes morpheus (Fabricius)	1993	0	0	0	0	0	0	0	0	0	0	0	0	3	0	1	0	0	0	0	0	0	0	4
	1994	0	0	0	0	0	0	0	1	0	2	0	2	1	1	1	0	0	0	0	0	0	0	8
Limenitidinae																								
Limenitis arthemis (Drury)	1993	0	0	0	0	0	0	0	0	1	5	4	7	4	9	5	9	2	0	0	0	0	0	46
	1994	0	0	0	0	0	0	0	0	4	23	61	108	38	16	23	7	2	1	3	7	0	0	293
Limenitis archippus (Cramer)	1993	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	2
	1994	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Satyridae **Elymniinae**																								
Enodia anthedon (A.H. Clark)	1993	0	0	0	0	0	0	0	0	0	0	0	2	13	36	92	135	25	3	1	1	0	0	308
	1994	0	0	0	0	0	0	0	0	0	0	11	79	94	207	130	27	1	0	0	0	0	0	549
Megisto cymela (Cramer)	1993	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
	1994	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Coenonympha tullia (Müller)	1993	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	1994	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Cercyonis pegala (Fabricius)	1993	0	0	0	0	0	0	0	0	0	0	0	1	0	14	6	17	13	0	3	0	0	0	54
	1994	0	0	0	0	0	0	0	0	0	0	0	0	14	40	25	18	1	2	0	0	0	0	100
Oeneis macounii (W.H. Edwards)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1994	0	0	0	0	0	1	12	48	30	21	0	1	0	0	0	0	0	0	0	0	0	0	113

Appendix IV. Summary of butterfly and skipper collection data for all sites using only bait traps (1993 & 1994).

		5 year old				15 year old			25 year old				40 year old				
		Natural		Planted		Natural	Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Hesperiidae **Heteropterinae**																	
Poanes hobomok	1993	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	9
(Harris)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lycaenidae **Eumaeinae**																	
Harkenclenus titus	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Fabricius)	1994	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	5
Nymphalidae **Nymphalinae**																	
Polygonia comma	1993	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
(Harris)	1994	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Polygonia satyrus	1993	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
(W.H. Edwards)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polygonia faunus	1993	0	0	0	0	0	0	0	0	1	0	0	2	0	1	1	5
(W.H. Edwards)	1994	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	3
Polygonia gracilis	1993	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
(Grote & Robinson)	1994	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	2
Polygonia progne	1993	0	0	0	0	2	0	0	0	1	0	0	0	0	0	2	5
(Cramer)	1994	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	3
Nymphalis antiopa	1993	0	0	1	0	0	0	0	0	3	0	2	0	0	0	0	6
(Linnaeus)	1994	0	0	0	0	0	0	6	0	12	0	0	0	0	0	0	18

Appendix IV. (Continued)

		5 year old				15 year old				25 year old				40 year old				
		Natural		Planted		Natural		Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Nymphalis milberti	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Godart)	1994	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Vanessa cardui	1993	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
(Linnaeus)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vanessa atalanta	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Linnaeus)	1994	0	0	0	0	0	0	9	0	12	0	0	0	0	0	0	21
Argynninae																	
Speyeria cybele	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Fabricius)	1994	0	0	0	0	0	0	18	0	0	0	0	0	0	0	0	18
Speyeria aphrodite	1993	0	0	0	0	0	1	0	0	2	0	1	0	0	0	0	4
(Fabricius)	1994	0	0	0	0	1	0	32	0	1	0	0	1	0	0	0	35
Speyeria atlantis	1993	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
(W.H. Edwards)	1994	0	0	0	0	0	0	5	0	0	0	6	0	0	0	0	11
Boloria bellona	1993	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	4
(Fabricius)	1994	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3
Limenitidinae																	
Limenitis arthemis	1993	0	0	0	0	0	0	2	0	9	7	12	5	0	0	0	35
(Drury)	1994	0	0	0	0	0	0	156	0	70	0	10	4	1	0	0	241
Satyridae **Elymniinae**																	
Enodia anthedon	1993	0	0	0	0	0	0	0	0	9	66	138	9	0	11	6	239
(A.H. Clark)	1994	0	0	0	0	0	0	3	4	37	107	36	30	26	38	2	283

Appendix IV. (Continued)

		5 year old				15 year old			25 year old				40 year old				
		Natural		Planted		Natural	Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Megisto cymela	1993	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
(Cramer)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Cercyonis pegala	1993	0	0	6	0	0	0	0	0	1	0	2	0	0	0	0	9
(Fabricius)	1994	0	0	0	0	0	0	10	0	2	0	0	0	0	0	0	10
Oeneis macounii	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(W.H. Edwards)	1994	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	2
∑ Number of Species	1993	0	0	2	0	1	1	2	0	11	2	9	3	0	2	3	15
	1994	0	0	0	0	1	0	13	1	11	1	3	4	2	2	1	17
∑ Number of Individuals	1993	0	0	7	0	2	1	1	0	30	73	170	16	0	12	9	321
	1994	0	0	0	0	1	0	250	4	142	107	52	36	27	39	2	660

Appendix V. Summary of moth collection data for all sites using light traps (1993 & 1994).

		5 year old				15 year old			25 year old				40 year old				
		Natural		Planted		Natural	Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Oecophoridae **Ethmiinae**																	
Ethmia monticola	1993	0	0	0	0	4	0	1	6	1	0	5	1	5	3	2	28
(Walsingham)	1994	0	0	0	0	4	0	1	13	3	0	0	0	4	0	1	26
Ethmia longimaculella	1993	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
(Walsingham)	1994	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	2
Antaeotricha leucillana	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Zeller	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tortricidae **Tortricinae**																	
Archips cerasivorana	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Fitch)	1994	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	2
Sparganothis sulfureana	1993	0	0	0	0	0	0	1	0	0	0	2	0	0	1	0	4
(Clemens)	1994	0	5	13	2	16	13	3	17	11	0	0	0	15	0	6	101
Pyralidae **Pyraustinae**																	
Ostrinia nubilalis	1993	1	0	10	14	1	3	10	0	0	0	0	0	14	3	0	56
(Hübner)	1994	0	0	1	0	1	1	0	2	1	0	0	0	1	0	0	7
Perispasta caeculalis	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zeller	1994	0	0	0	0	1	0	1	1	0	0	0	0	0	1	0	4
Pyrausta subsequalis	1993	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	2
(Guenée)	1994	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1

Appendix V. (Continued).

		5 year old				15 year old			25 year old				40 year old				
		Natural		Planted		Natural	Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Pyrausta scurralis	1993	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
(Hulst)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pyrausta socialis	1993	0	0	0	0	0	0	3	0	0	0	1	0	0	0	0	4
(Grote)	1994	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	3
Desmia funeralis	1993	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
(Hübner)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diasticis ventralis	1993	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
(Grote & Robinson)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crambinae																	
Crambus pascuellus	1993	0	0	0	2	0	0	0	1	0	0	0	0	6	2	1	12
(Linnaeus)	1994	0	0	1	1	4	1	0	1	0	0	0	0	2	0	2	12
Pyralinae																	
Herculia olinalis	1993	0	0	0	0	1	0	1	0	3	0	0	0	0	0	0	5
(Guenée)	1994	0	0	0	0	0	0	0	1	62	0	0	0	0	0	0	63
Thyatiridae **Thyatirinae**																	
Habrosyne scripta	1993	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	2
(Gosse)	1994	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Euthyatira pudens	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Guenée)	1994	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2

Appendix V. (Continued).

		5 year old				15 year old				25 year old				40 year old				
		Natural		Planted		Natural		Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Drepanidae																		
Drepaniinae																		
Drepana arcuata	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Walker	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drepana bilineata	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Packard)	1994	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Geometridae																		
Ennominae																		
Eumacaria latiferrugata	1993	0	1	0	0	0	0	0	1	3	0	0	2	0	0	1	8
(Walker)	1994	2	0	0	2	0	1	1	5	3	1	5	3	3	0	2	28
Itame occiduaria	1993	1	2	0	7	74	15	39	9	24	3	53	3	35	47	18	330
(Packard)	1994	0	4	34	44	80	29	60	167	34	0	60	24	60	23	45	664
Itame brunneata	1993	0	0	0	0	4	1	2	3	3	0	8	5	10	11	11	58
(Thunberg)	1994	0	0	0	0	54	3	1	106	14	6	34	35	78	90	63	494
Itame anataria	1993	0	0	0	4	0	0	15	9	6	1	21	5	7	1	1	70
(Swett)	1994	0	0	1	0	0	0	0	1	1	7	22	8	1	3	7	51
Semiothisa aemulataria	1993	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
(Walker)	1994	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	2
Semiothisa bicolorata	1993	0	0	0	0	0	0	3	1	6	3	2	0	0	0	2	17
(Fabricius)	1994	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Hesperumia sulphuraria	1993	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Packard	1994	0	0	0	0	0	0	4	0	0	0	1	0	0	0	0	5

Appendix V. (Continued).

		5 year old				15 year old				25 year old				40 year old				
		Natural		Planted		Natural		Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Anacamptodes ephyraria	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
(Walker)	1994	0	0	0	0	0	1	1	0	0	0	1	0	1	2	2	8
Iridopsis larvaria	1993	0	0	0	0	1	0	1	2	0	0	1	2	4	4	0	15
(Guenée)	1994	0	0	0	0	1	0	0	0	1	0	0	1	2	1	3	9
Ectropis crepuscularia	1993	0	0	0	0	1	0	0	1	2	0	0	0	0	2	0	6
(Dennis & Schiffermüller)	1994	0	0	0	0	0	0	0	3	5	1	1	0	0	7	2	19
Protoboarmia porcelaria	1993	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	2
(Guenée)	1994	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	2
Melanolophia signataria	1993	0	0	0	0	0	0	0	1	0	2	0	14	0	2	1	20
(Walker)	1994	0	0	0	0	0	0	0	1	0	0	0	11	6	4	2	24
Eufidonia notataria	1993	0	0	0	0	0	0	1	0	0	0	0	5	0	0	0	6
(Walker)	1994	0	0	0	0	0	0	1	0	0	0	0	2	2	1	1	7
Biston betularia	1993	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
(Linnaeus)	1994	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Lomographa semiclarata	1993	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	3
(Walker)	1994	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	3
Lomographa vestaliata	1993	0	0	0	0	0	1	0	1	1	0	1	6	0	0	0	10
(Guenée)	1994	0	0	0	0	0	0	3	46	13	0	1	13	7	3	9	95
Lomographa glomeraria	1993	0	0	0	0	0	0	0	0	0	0	0	2	1	2	0	5
(Grote)	1994	0	0	0	0	0	0	0	0	0	2	0	0	1	0	5	8
Cabera erythemaria	1993	0	0	0	0	0	0	0	0	2	0	1	7	3	4	4	21
Guenée	1994	0	0	0	0	5	3	1	7	8	3	1	39	6	4	1	78
Cabera variolara	1993	0	0	0	0	0	0	0	0	1	0	4	0	0	1	0	6
Guenée	1994	0	0	0	0	0	0	1	0	0	2	0	6	1	0	0	10

Appendix V. (Continued).

		5 year old				15 year old			25 year old				40 year old				
		Natural		Planted		Natural	Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Apodrepanulatrix liberaria	1993	1	1	0	0	20	2	14	6	9	2	56	0	3	3	4	121
(Walker)	1994	0	0	5	0	7	0	15	34	11	19	40	14	7	11	26	179
Erastria cruentaria	1993	0	0	0	0	0	1	0	1	3	1	0	1	1	1	2	11
Hübner	1994	0	0	0	0	0	0	0	2	2	0	0	0	3	1	2	10
Euchlaena obtusaria	1993	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	3
(Hübner)	1994	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	2
Euchlaena johnsonaria	1993	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	3
(Fitch)	1994	0	1	0	0	0	0	0	0	3	0	0	0	3	0	0	7
Euchlaena irraria	1993	0	0	0	0	2	3	1	3	1	0	3	3	6	1	5	28
(Barnes & McDunnough)	1994	0	0	0	1	1	3	0	11	3	0	3	5	11	4	8	50
Xanthotype sospeta	1993	0	0	0	0	0	0	0	2	0	0	1	0	5	3	0	11
(Drury)	1994	0	0	0	0	1	0	0	5	0	0	0	0	1	5	0	12
Pero honestaria	1993	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	4
(Walker)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Campaea perlata	1993	0	0	0	0	1	0	0	0	0	1	1	1	0	0	0	4
(Guenée)	1994	0	1	0	0	0	0	2	0	2	3	3	8	0	2	2	23
Petrophora divisata	1993	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	3
Hübner	1994	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	2
Selenia kentaria	1993	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	3
(Grote & Robinson)	1994	0	0	0	0	0	0	0	0	2	0	0	2	2	2	0	8
Metanema inatomaria	1993	0	0	0	0	0	1	0	0	0	0	0	2	1	2	1	7
Guenée	1994	0	0	0	0	0	0	0	0	0	0	0	1	3	2	0	6
Metanema determinata	1993	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	3
Walker	1994	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	3

Appendix V. (Continued).

		5 year old				15 year old			25 year old				40 year old				
		Natural		Planted		Natural	Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Metarranthis duaria	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Guenée)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Metarranthis hypocharia	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3
(Herrich-Schäffer)	1994	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	3
Anagoga occiduaria	1993	0	0	0	0	1	0	0	0	0	0	0	2	0	0	1	4
(Walker)	1994	0	0	0	0	0	0	0	2	2	0	0	3	1	2	1	10
Probole amicaria	1993	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	2
(Herrich-Schäffer)	1994	0	0	0	0	1	3	0	1	0	0	1	1	0	1	2	11
Probole alienara	1993	0	0	0	0	0	1	0	0	0	0	2	3	0	1	0	7
(Walker)	1994	0	0	0	0	0	0	0	0	2	0	0	1	1	0	0	4
Plagodis phlogosaria	1993	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	6
(Guenée)	1994	1	1	0	0	2	4	1	2	2	0	1	2	3	7	1	27
Plagodis alcoolaria	1993	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
(Guenée)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Caripeta divisiata	1993	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2
Walker	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Caripeta piniata	1993	0	0	0	0	0	0	1	0	1	0	3	0	1	0	3	9
(Packard)	1994	0	0	0	0	0	0	0	3	2	0	0	4	0	0	1	10
Caripeta angustiorata	1993	0	0	1	1	6	1	1	13	19	31	6	25	43	38	30	205
Walker	1994	0	0	0	2	9	4	4	17	40	55	26	31	40	54	34	316
Lambdina fiscellaria	1993	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	8
(Guenée)	1994	0	0	0	0	0	0	0	3	1	1	1	19	0	8	4	37
Nepytia canosaria	1993	0	0	0	0	3	1	0	7	2	0	2	6	5	23	10	59
(Walker)	1994	0	0	0	0	2	0	0	0	7	2	0	4	1	2	1	19

Appendix V. (Continued).

		5 year old				15 year old			25 year old				40 year old				
		Natural		Planted		Natural	Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Sicya macularia **(Harris)**	1993	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	3
	1994	0	0	0	7	0	1	0	1	0	0	2	0	2	0	0	15
Eusarca confusaria **Hübner**	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
	1994	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Tetracis cachexiata **Guenée**	1993	0	0	1	0	0	0	0	2	0	0	5	4	1	3	2	18
	1994	0	0	0	0	0	1	0	2	5	0	2	8	2	0	0	20
Eutrapela clemataria **(J.E. Smith)**	1993	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
	1994	0	0	0	0	0	0	0	0	5	0	0	1	0	1	0	7
Prochoerodes transversata **(Drury)**	1993	0	0	0	0	0	0	0	1	3	1	11	3	1	1	1	22
	1994	0	0	0	0	4	0	22	2	6	0	12	8	2	5	1	62
Nematocampa limbata **(Haworth)**	1993	0	0	0	0	2	0	0	0	0	0	0	1	0	2	3	8
	1994	0	0	0	0	0	0	0	1	3	5	0	2	1	0	0	12
Geometrinae																	
Nemoria rubrifrontaria **(Packard)**	1993	0	0	0	0	0	1	1	0	0	0	0	1	1	0	0	4
	1994	1	0	0	1	0	0	0	0	1	0	0	2	0	0	0	5
Sterrhinae																	
Cyclophora pendulinaria **(Guenée)**	1993	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	4
	1994	0	0	1	0	0	0	0	0	0	8	0	3	1	1	0	14
Scopula limboundata **(Haworth)**	1993	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2
	1994	0	0	0	0	3	0	0	1	4	3	8	3	5	5	1	33
Scopula inductata **(Guenée)**	1993	0	1	0	0	1	0	0	0	1	0	9	0	2	12	0	26
	1994	1	0	0	1	3	0	1	17	7	8	0	2	6	31	13	90

Appendix V. (Continued).

		5 year old				15 year old			25 year old				40 year old				
		Natural		Planted		Natural	Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Larentiinae																	
Dystroma hersiliata (Guenée)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
	1994	0	0	0	0	1	0	0	1	3	0	0	1	1	8	3	18
Eulithis diversilineata (Hübner)	1993	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eulithis explanata (Walker)	1993	0	0	0	0	23	16	5	52	10	9	14	32	72	282	111	626
	1994	0	0	1	1	196	37	17	140	31	69	53	51	119	80	86	879
Hydriomena transfigurata Swett	1993	0	0	0	0	0	1	0	2	0	0	0	2	0	2	5	12
	1994	0	0	0	0	0	0	0	1	1	0	0	5	1	0	0	8
Coryphista meadii (Packard)	1993	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydria prunivorata (Ferguson)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rheumaptera subhastata (Linnaeus)	1993	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mesoleuca ruficillata (Guenée)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
	1994	0	0	0	0	0	0	0	3	0	0	0	2	3	0	1	9
Anticlea vasiliata Guenée	1993	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	1994	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2
Xanthorhoe algidata (Möschler)	1993	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
	1994	0	0	0	0	0	0	0	0	2	0	0	1	0	2	3	8
Xanthorhoe ferrugata (Clerck)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1994	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1

Appendix V. (Continued).

		5 year old				15 year old				25 year old				40 year old				
		Natural		Planted		Natural	Planted			Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Epirrhoe alternata	1993	0	0	0	0	1	6	0	0	0	0	0	1	0	3	0	11
(Müller)	1994	0	0	0	0	0	1	0	0	2	1	0	0	1	0	1	6
Orthonama centrostrigaria	1993	0	0	0	0	0	0	0	2	1	1	1	1	1	0	0	7
(Wollaston)	1994	0	0	0	0	0	1	0	2	1	3	0	2	0	1	0	10
Eubaphe mendica	1993	0	0	0	0	0	1	0	0	0	0	2	0	0	0	1	4
(Walker)	1994	0	0	0	0	0	0	0	4	0	0	2	2	0	1	0	9
Horisme intestinata	1993	0	0	0	0	3	0	1	3	0	0	1	0	9	1	1	18
(Guenée)	1994	0	0	0	0	1	0	0	4	2	0	1	2	1	1	1	13
Eupithecia pseudotsugata	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MacKay	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
Eupithecia spp.	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Curtis	1994	0	0	0	0	3	0	0	4	1	0	0	1	0	1	0	10
Cladara limitaria	1993	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2
(Walker)	1994	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	2
Lobophora nivigerata	1993	0	0	0	0	0	0	0	3	0	0	0	1	0	2	8	14
Walker	1994	0	0	0	0	2	1	0	1	0	0	0	1	1	1	0	7
Sphingidae																	
Sphinginae																	
Ceratomia undulosa	1993	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(Walker)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sphinx canadensis	1993	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Boisduval	1994	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1

Appendix V. (Continued).

		5 year old				15 year old			25 year old				40 year old				
		Natural		Planted		Natural	Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Lapara bombycoides	1993	0	0	0	0	2	1	0	13	1	2	0	6	3	9	12	49
Walker	1994	0	0	0	0	0	0	0	2	1	0	1	0	2	2	6	14
Smerinthus cerisyi	1993	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Kirby	1994	0	0	0	0	1	0	1	1	0	0	0	1	0	0	0	4
Paonias myops	1993	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
(J.E. Smith)	1994	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	3
Pachysphinx modesta	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
(Harris)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Macroglossinae																	
Amphion floridensis	1993	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
B.P. Clark	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Darapsa pholus	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Cramer)	1994	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	2
Notodontidae																	
Clostera albosigma	1993	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Fitch	1994	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	2
Nadata gibbosa	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
(J.E. Smith)	1994	0	0	0	0	0	0	0	0	4	0	0	0	1	0	0	5
Pheosia rimosa	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Packard	1994	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Odontosia elegans	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Strecker)	1994	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1

Appendix V. (Continued).

		5 year old				15 year old				25 year old				40 year old				
		Natural		Planted		Natural		Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Gluphisia avimacula	1993	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	3
Hudson	1994	0	0	0	0	0	0	0	2	0	0	0	1	0	0	3	6
Arctiidae																	
Lithosiinae																	
Eilema bicolor	1993	0	0	0	0	1	4	1	2	3	0	1	5	21	13	10	61
(Grote)	1994	0	0	0	0	2	3	0	16	23	1	7	19	21	14	23	129
Hypoprepia fucosa	1993	0	0	0	0	0	0	0	0	1	0	0	1	2	1	1	6
Hübner	1994	0	0	0	0	0	0	0	1	3	0	0	0	1	1	0	6
Clemensia albata	1993	0	0	0	0	0	0	0	5	0	0	0	9	8	19	3	44
Packard	1994	0	0	0	0	0	0	0	4	30	3	0	3	9	7	19	75
Arctiinae																	
Holomelina laeta	1993	0	0	0	0	2	0	0	0	0	0	0	0	2	2	3	9
(Gùerin-Méneville)	1994	0	0	0	0	0	0	0	0	3	0	0	0	4	3	3	13
Holomelina aurantiaca	1993	0	1	0	1	13	3	3	5	2	0	11	2	18	19	7	85
(Hübner)	1994	0	0	1	0	9	0	0	33	3	4	5	0	21	17	13	106
Holomelina ferruginosa	1993	0	2	0	0	0	0	0	4	0	0	1	0	0	6	0	13
(Walker)	1994	0	0	7	1	0	0	7	0	7	2	7	0	0	7	14	52
Spilosoma congrua	1993	0	0	0	0	2	0	1	2	0	0	0	0	4	0	1	10
Walker	1994	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	2
Spilosoma virginica	1993	0	0	0	0	0	0	0	0	0	0	0	3	0	0	8	11
(Fabricius)	1994	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2
Phragmatobia assimilans	1993	0	0	0	0	0	0	0	0	0	0	0	3	1	0	1	5
Walker	1994	0	0	0	0	0	0	0	2	0	0	0	1	1	0	0	4

Appendix V. (Continued).

		5 year old				15 year old				25 year old				40 year old				
		Natural		Planted		Natural		Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Platarctia parthenos	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Harris)	1994	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	4
Grammia parthenice	1993	0	2	0	2	3	2	0	3	2	0	0	0	0	0	0	14
(Kirby)	1994	0	3	0	0	1	6	2	4	3	0	0	1	0	0	2	22
Grammia virgo	1993	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	2
(Linnaeus)	1994	0	1	1	0	0	0	5	3	0	0	14	4	0	0	2	30
Cycnia tenera	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Hübner)	1994	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Cycnia oregonensis	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Stretch)	1994	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	2
Ctenuchinae																	
Ctenucha virginica	1993	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
(Esper)	1994	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	3
Lymantriidae **Orgyiinae**																	
Dasychira dorsipennata	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Barnes & McDunnough)	1994	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Noctuidae **Herminiinae**																	
Idia americalis	1993	0	0	0	0	2	0	1	2	2	0	0	0	4	3	0	14
(Guenée)	1994	0	0	0	2	1	1	1	1	3	0	0	0	3	2	1	15
Renia flavipunctalis	1993	0	0	0	0	1	0	1	0	3	0	0	0	0	0	0	5
(Geyer)	1994	0	1	0	0	2	0	0	0	1	0	0	1	0	0	1	6

Appendix V. (Continued).

		5 year old				15 year old				25 year old				40 year old				
		Natural		Planted		Natural		Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Palthis angulalis	1993	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	2
(Hübner)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Hypeninae																	
Bomolocha abalienalis	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Walker)	1994	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	4
Catocalinae																	
Scoliopteryx libatrix	1993	0	0	0	0	0	0	0	0	2	0	1	0	1	0	1	5
(Linnaeus)	1994	0	0	0	0	0	0	0	0	0	2	0	0	2	3	0	7
Synedoida adumbrata	1993	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
(Grote)	1994	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Synedoida grandirena	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Haworth)	1994	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Zale lunata	1993	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	2
(Drury)	1994	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Zale aeruginosa	1993	0	0	0	0	1	0	0	1	1	2	2	2	0	0	1	10
(Guenée)	1994	0	0	0	4	0	0	0	0	2	0	0	1	2	0	1	10
Zale duplicata	1993	0	0	0	0	2	0	0	0	2	2	3	4	2	4	1	20
(Bethune)	1994	0	0	0	0	0	0	0	1	0	11	0	0	7	1	0	20
Zale helata	1993	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	3
(Smith)	1994	0	0	0	4	0	0	0	1	0	5	0	5	2	2	1	19
Zale horrida	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hübner	1994	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1

Appendix V. (Continued).

		5 year old				15 year old			25 year old				40 year old				
		Natural		Planted		Natural	Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Euclidia cuspidea	1993	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	3
(Hübner)	1994	1	0	0	0	0	0	0	1	1	0	0	0	0	1	0	4
Caenurgina crassiuscula	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Haworth)	1994	4	0	0	0	0	0	1	0	2	0	0	0	0	0	0	7
Argyrostrotis anilis	1993	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	2
(Drury)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Catocala relicta	1993	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Walker	1994	0	0	0	0	0	0	4	0	5	0	0	0	0	0	0	9
Catocala unijuga	1993	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
Walker	1994	0	0	0	0	0	0	1	0	9	0	0	3	0	0	0	13
Catocala briseis	1993	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	3
Edwards	1994	0	0	0	0	0	0	7	0	8	0	0	1	0	0	0	16
Catocala concumbens	1993	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
Walker	1994	0	0	0	0	0	0	0	0	4	0	0	3	0	0	0	7
Catocala ultronia	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
(Hübner)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Catocala manitoba	1993	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	3
Beutenmüller	1994	0	0	0	0	1	0	1	0	1	1	1	2	1	1	0	9
Catocala blandula	1993	0	0	0	0	1	0	0	0	1	0	5	2	0	2	1	12
Hulst	1994	0	0	0	0	0	0	4	1	1	2	0	3	1	1	0	13
Plusiinae																	
Allagrapha aerea	1993	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
(Hübner)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1

Appendix V. (Continued).

		5 year old				15 year old			25 year old				40 year old				
		Natural		Planted		Natural	Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Pseudeva purpurigea (Walker)	1993	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	4
	1994	0	0	0	0	0	0	0	1	0	0	2	0	1	0	0	4
Chrysanympha formosa (Grote)	1993	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	4
	1994	0	0	0	0	0	0	0	0	0	1	0	2	0	1	2	6
Autographa bimaculata (Stephens)	1993	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	1994	0	0	0	0	0	0	6	0	0	0	1	0	1	0	0	8
Autographa mappa (Grote & Robinson)	1993	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	3
	1994	0	0	0	1	0	0	1	0	0	0	0	4	0	0	2	8
Anagrapha falcifera (Kirby)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1994	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Syngrapha altera (Ottolengui)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Syngrapha epigaea (Grote)	1993	0	0	0	1	0	0	0	0	0	0	3	1	0	0	0	5
	1994	0	0	0	0	0	0	8	1	0	0	1	0	0	0	0	10
Syngrapha viridisigma (Grote)	1993	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	3
	1994	1	0	0	0	1	0	1	1	2	0	0	0	0	0	0	6
Plusia aeroides Grote	1993	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	2
	1994	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	3
Sarrothripinae																	
Nycteola frigidana Walker	1993	4	0	15	9	20	0	4	16	37	8	1	37	42	28	27	248
	1994	3	10	2	12	19	11	4	34	19	4	12	9	23	18	15	195

Appendix V. (Continued).

		5 year old				15 year old			25 year old				40 year old				
		Natural		Planted		Natural	Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Acontiinae																	
Lithacodia carneola	1993	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
(Guenée)	1994	0	0	0	0	0	0	0	3	0	0	0	0	1	0	1	5
Pantheinae																	
Panthea acronyctoides	1993	0	0	0	0	1	0	0	0	0	0	0	1	2	0	2	6
(Walker)	1994	0	0	0	0	0	1	0	0	2	0	1	0	1	4	2	11
Acronictinae																	
Acronicta americana	1993	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Harris	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acronicta innotata	1993	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Guenée	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acronicta tritona	1993	0	0	2	0	1	0	0	0	2	0	0	1	3	0	0	9
(Hübner)	1994	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Acronicta grisea	1993	0	0	0	0	0	2	0	1	0	0	0	0	0	0	1	4
Walker	1994	0	0	0	0	0	0	0	0	1	0	1	0	1	5	0	8
Acronicta quadrata	1993	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
(Grote)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acronicta superans	1993	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Guenée	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
Acronicta furcifera	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Guenée	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Acronicta hasta	1993	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	3
Guenée	1994	0	0	0	0	0	0	2	0	0	0	2	1	0	1	0	6

Appendix V. (Continued).

		5 year old				15 year old				25 year old				40 year old				
		Natural		Planted		Natural		Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Acronicta fragilis	1993	0	0	0	3	3	0	0	1	1	0	2	6	3	2	7	28
(Guenée)	1994	1	0	1	0	0	0	0	2	0	0	1	9	6	3	6	29
Acronicta retardata	1993	0	0	0	0	0	0	0	0	1	0	0	0	3	0	0	4
(Walker)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriopodes teratophora	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Herrich-Schäffer)	1994	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
Amphyipyrinae																	
Apamea nigrior	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Smith)	1994	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Apamea amputatrix	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Fitch)	1994	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
Apamea commoda	1993	0	2	0	0	0	0	0	0	0	0	3	0	0	0	0	5
(Walker)	1994	0	2	0	0	0	1	1	3	1	0	1	0	1	0	0	10
Agroperina cogitata	1993	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
(Smith)	1994	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Bremobina claudens	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Walker)	1994	0	0	0	0	0	0	0	1	1	0	0	0	2	0	0	4
Oligia mactata	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Guenée)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
Oligia illecata	1993	0	0	0	0	0	0	0	0	0	0	0	4	0	1	1	6
(Walker)	1994	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	4
Amphipoea interoceanica	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Smith)	1994	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1

Appendix V. (Continued).

		5 year old				15 year old			25 year old				40 year old				
		Natural		Planted		Natural	Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Papaipema pterisii	1993	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	2
Bird	1994	0	0	0	0	0	0	1	2	0	0	0	16	0	4	0	23
Euplexia benesimilis	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
McDunnough	1994	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Phlogophora iris	1993	0	0	0	0	0	0	1	0	0	0	2	2	1	0	0	6
Guenée	1994	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Conservula anodonta	1993	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
(Guenée)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Enargia decolor	1993	9	5	16	13	8	1	0	4	6	0	2	17	11	9	3	104
(Walker)	1994	33	57	137	17	52	4	13	51	34	0	4	29	40	45	50	566
Dypterygia rozmani	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Berio	1994	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Hyppa xylinoides	1993	0	0	0	0	0	0	0	0	3	0	6	2	0	1	1	13
(Guenée)	1994	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	3
Amphipyra pyramidoides	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Guenée	1994	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	2
Platysenta videns	1993	0	0	0	0	1	7	10	2	2	7	0	0	2	0	1	32
(Guenée)	1994	0	1	8	0	0	10	13	2	8	0	0	5	0	0	0	47
Cuculliinae																	
Xylena nupera	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Lintner)	1994	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0	3
Xylena curvimacula	1993	0	1	0	0	0	0	0	0	2	0	1	0	0	0	0	4
(Morrison)	1994	0	0	0	0	0	0	3	0	1	0	0	0	0	0	0	4

Appendix V. (Continued).

		5 year old				15 year old				25 year old				40 year old				
		Natural		Planted		Natural		Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Xylena cineritia	1993	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
(Grote)	1994	0	0	2	0	1	1	0	0	0	0	0	0	2	0	0	6
Lithomoia solidaginis	1993	0	0	1	0	0	5	0	0	0	0	0	0	0	0	1	7
(Hübner)	1994	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	3
Lithophane unimoda	1993	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
(Lintner)	1994	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Eucirroedia pampina	1993	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0	3
(Guenée)	1994	0	0	0	0	0	0	1	1	3	0	1	0	0	0	0	6
Platypolia anceps	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Stephens)	1994	0	0	0	0	0	0	8	0	0	8	0	0	0	0	0	16
Xylotype acadia	1993	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Barnes & Benjamin	1994	0	0	0	0	0	0	0	1	0	3	0	0	0	0	0	4
Brachionycha borealis	1993	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
(Smith)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apharetra purpurea	1993	4	0	6	3	0	1	0	0	3	0	2	4	0	3	0	26
McDunnough	1994	0	0	1	4	0	0	11	1	0	0	2	0	0	0	1	20
Homohadena infixa	1993	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
(Walker)	1994	0	0	0	0	0	0	0	0	0	5	2	0	1	1	0	9
Oncocnemis piffardi	1993	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
(Walker)	1994	0	3	0	4	0	0	0	0	0	0	0	0	0	0	0	7
Sympistis funesta	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Paykull)	1994	0	0	0	0	0	3	0	0	0	0	0	0	0	1	0	4

Appendix V. (Continued).

		5 year old				15 year old			25 year old				40 year old				
		Natural		Planted		Natural	Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Hadeninae																	
Sideridis maryx	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Guenée)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Polia nimbosa	1993	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	2
(Guenée)	1994	0	0	0	0	0	3	3	0	0	2	0	4	0	0	0	12
Polia imbrifera	1993	0	0	4	0	0	0	0	0	0	0	2	2	0	2	0	10
(Guenée)	1994	1	2	0	0	0	0	0	0	1	0	0	4	0	0	0	8
Polia purpurissata	1993	0	0	0	0	0	1	5	0	1	2	46	0	0	0	0	55
(Grote)	1994	0	1	0	2	1	8	5	9	0	6	6	0	4	0	1	43
Polia adjuncta	1993	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	3
(Boisduval)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Polia grandis	1993	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	3
(Boisduval)	1994	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Polia lutra	1993	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
(Guenée)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polia segregata	1993	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
(Smith)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lacinipolia lustralis	1993	0	0	0	1	2	0	3	0	0	0	0	0	0	1	0	7
(Grote)	1994	0	0	0	0	0	0	0	6	0	0	4	0	0	0	0	10
Lacinipolia lorea	1993	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	9
(Guenée)	1994	0	0	0	0	0	0	0	4	0	4	0	1	1	1	3	14
Lacinipolia olivacea	1993	0	0	0	0	0	0	0	2	0	0	8	0	0	0	0	10
(Morrison)	1994	0	0	2	0	0	0	0	0	4	9	0	3	0	0	0	18

Appendix V. (Continued).

		5 year old				*15 year old*			*25 year old*				*40 year old*				
		Natural		Planted		Natural	Planted		Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Leucania commoides	1993	0	0	3	3	0	0	3	0	1	0	0	0	0	0	0	10
Guenée	1994	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	5
Orthosia revicta	1993	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	3
(Morrison)	1994	1	0	1	1	3	1	0	0	1	1	0	4	1	1	2	17
Morrisonia evicta	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Grote)	1994	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
Orthodes crenulata	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Butler)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Noctuinae																	
Agrotis mollis	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Walker	1994	0	0	0	0	0	0	0	0	3	1	0	0	0	6	0	10
Agrotis patula	1993	0	0	0	0	0	2	0	0	0	0	2	0	0	0	1	5
Walker	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Feltia jaculifera	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Guenée)	1994	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Euxoa mimallonis	1993	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	7
(Grote)	1994	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Spaelotis clandestina	1993	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
(Harris)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eurois astricta	1993	0	0	0	1	1	1	0	3	2	2	11	4	1	12	4	42
Morrison	1994	0	2	6	2	6	8	8	3	2	16	6	14	4	14	16	127
Amathes collaris	1993	0	0	0	0	0	1	2	8	0	4	6	4	3	0	4	32
(Grote & Robinson)	1994	1	1	0	0	2	0	0	10	0	1	0	0	0	1	1	17

Appendix V. (Continued).

		5 year old				15 year old				25 year old				40 year old				
		Natural		Planted		Natural	Planted			Natural		Planted		Natural		Planted		
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM
Eugraphe opacifrons (Grote)	1993	0	0	0	0	2	0	0	11	2	0	1	0	1	2	6	25
	1994	0	0	0	0	0	0	3	2	5	8	0	0	6	2	19	45
Paradiarsia littoralis (Packard)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1994	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Metalepsis fishii (Grote)	1993	1	1	0	0	0	5	7	1	4	4	20	2	1	6	0	52
	1994	0	0	1	0	4	6	9	4	8	11	0	5	15	7	6	76
Aplectoides condita (Guenée)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1994	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Anaplectoides prasina (Schiffermüller)	1993	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	2
	1994	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2
Anaplectoides pressus (Grote)	1993	0	0	16	4	0	1	0	2	1	1	0	3	1	3	3	36
	1994	0	0	0	1	3	0	2	11	8	31	9	4	15	20	19	123
Euaretagrotis attenta (Grote)	1993	0	0	0	0	0	0	0	0	1	0	1	0	0	4	4	10
	1994	0	0	0	0	1	0	1	3	16	1	2	0	3	1	7	35
Heptagrotis phyllophora (Grote)	1993	0	1	0	0	0	0	0	0	2	0	0	0	0	8	0	11
	1994	0	0	0	0	0	1	0	0	1	0	0	1	2	1	0	6
Cryptocala acadiensis (Bethune)	1993	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	2
	1994	0	0	0	0	0	0	1	3	0	0	0	0	0	1	0	5
Abagrotis alternata (Grote)	1993	5	3	1	5	0	0	7	1	3	1	6	1	0	0	3	36
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
Abagrotis placida (Grote)	1993	8	2	0	0	0	0	0	4	3	1	0	0	0	0	1	19
	1994	0	0	0	0	2	0	0	3	0	0	0	0	0	1	1	7
Abagrotis apposita (Grote)	1993	0	0	0	1	7	4	1	3	0	0	0	0	5	1	4	26
	1994	0	2	1	0	1	0	0	2	1	0	0	0	1	1	1	10

Appendix V. (Continued).

		5 year old				15 year old				25 year old				40 year old				
		Natural		Planted		Natural	Planted		Natural		Planted		Natural		Planted			
	YEAR	B05A	B05B	P05A	P05B	B15A	P15A	P15B	B25A	B25B	P25A	P25B	B40A	B40B	P40A	P40B	SUM	
Rhynchagrotis anchocelioides	1993	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	
(Guenée)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
∑ Number of Species	1993	15	19	16	25	45	40	43	54	67	31	72	78	59	70	75	193	
	1994	19	24	23	25	48	40	59	96	100	51	51	91	97	86	74	206	
∑ Number of Individuals	1993	39	32	80	82	233	104	160	238	212	99	399	306	392	640	373	3389	
	1994	62	116	228	124	530	192	279	891	598	339	369	515	618	594	589	6018	

Appendix VI. Summary of moth collection dates for all sites using light traps (1993 & 1994).

MONTH		APRIL				MAY				JUNE					JULY			AUGUST			SEPTEMBER		
WEEK	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	SUM
Oecophoridae Ethmiinae																								
Ethmia monticola	1993	0	0	0	1	3	4	7	4	6	2	1	0	0	0	0	0	0	0	0	0	0	0	28
(Walsingham)	1994	0	0	0	0	1	2	4	8	10	1	0	0	0	0	0	0	0	0	0	0	0	0	26
Ethmia longimaculella	1993	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(Walsingham)	1994	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Antaeotricha leucillana	1993	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Zeller	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tortricidae Tortricinae																								
Archips cerasivorana	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Fitch)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
Sparganothis sulfureana	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	0	0	0	4
(Clemens)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	22	20	34	22	1	0	0	0	0	101
Pyralidae Pyraustinae																								
Ostrinia nubilalis	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	23	15	4	0	0	0	56
(Hübner)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	3	0	0	0	0	0	7
Perispasta caeculalis	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zeller	1994	0	0	0	0	0	0	0	0	1	0	2	0	1	0	0	0	0	0	0	0	0	0	4
Pyrausta subsequalis	1993	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
(Guenée)	1994	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Appendix VI. (Continued).

MONTH		APRIL				MAY				JUNE					JULY			AUGUST				SEPTEMBER		
WEEK	**YEAR**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**SUM**
Pyrausta scurralis	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
(Hulst)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pyrausta socialis	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	0	0	0	0	4
(Grote)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	3
Desmia funeralis	1993	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
(Hübner)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diasticitis ventralis	1993	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(Grote & Robinson)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crambinae																								
Crambus pascuellus	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	6	2	0	0	12
(Linnaeus)	1994	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	3	1	2	2	0	0	0	12
Pyralinae																								
Herculia olinalis	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1	0	0	0	0	0	0	0	5
(Guenée)	1994	0	0	0	0	0	0	0	0	0	0	1	10	19	32	1	0	0	0	0	0	0	0	63
Thyatiridae **Thyatirinae**																								
Habrosyne scripta	1993	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
(Gosse)	1994	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Euthyatira pudens	1993	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(Guenée)	1994	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2

Appendix VI. (Continued).

MONTH		APRIL				MAY				JUNE					JULY			AUGUST			SEPTEMBER		
WEEK	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	SUM
Drepanidae **Drepaniinae**																								
Drepana arcuata	1993	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Walker	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drepana bilineata	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Packard)	1994	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Geometridae **Ennominae**																								
Eumacaria latiferrugata	1993	0	0	0	0	0	0	0	0	0	3	3	1	1	0	0	0	0	0	0	0	0	0	8
(Walker)	1994	0	0	0	0	0	1	1	1	7	10	0	1	2	1	0	4	0	0	0	0	0	0	28
Itame occiduaria	1993	0	0	0	0	0	0	0	0	0	0	0	0	2	33	30	137	60	49	18	1	0	0	330
(Packard)	1994	0	0	0	0	0	0	0	0	0	0	2	7	70	231	85	224	29	16	0	0	0	0	664
Itame brunneata	1993	0	0	0	0	0	0	0	0	0	0	2	4	6	25	12	3	6	0	0	0	0	0	58
(Thunberg)	1994	0	0	0	0	0	0	0	0	0	0	83	321	76	12	0	2	0	0	0	0	0	0	494
Itame anataria	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	5	20	31	12	2	0	0	70
(Swett)	1994	0	0	0	0	0	0	0	0	0	0	0	0	12	31	3	1	4	0	0	0	0	0	51
Semiothisa aemulataria	1993	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(Walker)	1994	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Semiothisa bicolorata	1993	0	0	0	0	0	0	0	0	0	0	0	4	6	3	3	1	0	0	0	0	0	0	17
(Fabricius)	1994	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Hesperumia sulphuraria	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Packard	1994	0	0	0	0	0	0	0	0	0	0	0	1	1	1	2	0	0	0	0	0	0	0	5

Appendix VI. (Continued).

MONTH			APRIL				MAY				JUNE					JULY			AUGUST			SEPTEMBER		
WEEK	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	SUM
Anacamptodes ephyraria (Walker)	1993	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
	1994	0	0	0	0	0	0	1	0	1	1	3	0	2	0	0	0	0	0	0	0	0	0	8
Iridopsis larvaria (Guenée)	1993	0	0	0	0	0	0	0	0	0	0	0	5	4	1	3	2	0	0	0	0	0	0	15
	1994	0	0	0	0	0	0	0	0	0	1	3	2	0	0	3	0	0	0	0	0	0	0	9
Ectropis crepuscularia (Dennis & Schiffermüller)	1993	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	6
	1994	0	0	0	0	0	0	5	1	6	2	2	2	1	0	0	0	0	0	0	0	0	0	19
Protoboarmia porcelaria (Guenée)	1993	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
	1994	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	2
Melanolophia signataria (Walker)	1993	0	0	0	2	5	7	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20
	1994	0	0	0	0	0	3	5	4	9	0	3	0	0	0	0	0	0	0	0	0	0	0	24
Eufidonia notataria (Walker)	1993	0	0	0	0	0	2	1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	6
	1994	0	0	0	0	0	0	0	4	1	2	0	0	0	0	0	0	0	0	0	0	0	0	7
Biston betularia (Linnaeus)	1993	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
	1994	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Lomographa semiclarata (Walker)	1993	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	1994	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Lomographa vestaliata (Guenée)	1993	0	0	0	0	0	0	3	0	2	5	0	0	0	0	0	0	0	0	0	0	0	0	10
	1994	0	0	0	0	0	0	16	61	7	9	0	2	0	0	0	0	0	0	0	0	0	0	95
Lomographa glomeraria (Grote)	1993	0	0	0	0	0	2	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	5
	1994	0	0	0	2	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
Cabera erythemaria Guenée	1993	0	0	0	0	0	0	0	0	0	0	0	3	7	4	4	3	0	0	0	0	0	0	21
	1994	0	0	0	0	0	0	0	5	27	14	1	15	8	8	1	0	0	0	0	0	0	0	78
Cabera variolare Guenée	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	0	0	0	0	0	6
	1994	0	0	0	0	0	0	0	0	0	0	2	1	0	4	0	2	1	0	0	0	0	0	10

Appendix VI. (Continued).

MONTH		APRIL				MAY			JUNE					JULY				AUGUST			SEPTEMBER		
WEEK	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	SUM
Apodrepanulatrix liberaria (Walker)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	12	46	41	17	3	121
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	119	21	7	0	0	179
Erastria cruentaria Hübner	1993	0	0	0	0	0	0	0	0	3	1	2	4	1	0	0	0	0	0	0	0	0	0	11
	1994	0	0	0	0	0	0	1	0	2	0	5	2	0	0	0	0	0	0	0	0	0	0	10
Euchlaena obtusaria (Hübner)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3
	1994	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
Euchlaena johnsonaria (Fitch)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	3
	1994	0	0	0	0	0	0	0	0	0	0	0	2	3	2	0	0	0	0	0	0	0	0	7
Euchlaena irraria (Barnes & McDunnough)	1993	0	0	0	0	0	0	0	0	0	6	4	4	6	3	5	0	0	0	0	0	0	0	28
	1994	0	0	0	0	0	0	1	0	9	9	14	7	10	0	0	0	0	0	0	0	0	0	50
Xanthotype sospeta (Drury)	1993	0	0	0	0	0	0	0	0	0	7	4	0	0	0	0	0	0	0	0	0	0	0	11
	1994	0	0	0	0	0	0	0	0	0	0	0	11	1	0	0	0	0	0	0	0	0	0	12
Pero honestaria (Walker)	1993	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	4
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Campaea perlata (Guenée)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	4
	1994	0	0	0	0	0	0	0	0	0	0	0	5	7	6	3	2	0	0	0	0	0	0	23
Petrophora divisata Hübner	1993	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
	1994	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
Selenia kentaria (Grote & Robinson)	1993	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	1994	0	0	0	0	0	1	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
Metanema inatomaria Guenée	1993	0	0	0	0	0	3	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
	1994	0	0	0	0	0	0	1	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	6
Metanema determinata Walker	1993	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3
	1994	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	3

Appendix VI. (Continued).

MONTH		APRIL				MAY				JUNE					JULY			AUGUST				SEPTEMBER		
WEEK	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	SUM
Metarranthis duaria (Guenée)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1994	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Metarranthis hypocharia (Herrich-Schäffer)	1993	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
	1994	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	3
Anagoga occiduaria (Walker)	1993	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	4
	1994	0	0	0	0	0	0	0	3	2	3	2	0	0	0	0	0	0	0	0	0	0	0	10
Probole amicaria (Herrich-Schäffer)	1993	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	1994	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	5	4	0	0	0	0	0	11
Probole nepiasaria (Walker)	1993	0	0	0	0	0	0	0	0	3	2	2	0	0	0	0	0	0	0	0	0	0	0	7
	1994	0	0	0	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	4
Plagodis phlogosaria (Guenée)	1993	0	0	0	0	0	0	0	0	1	2	2	0	1	0	0	0	0	0	0	0	0	0	6
	1994	0	0	0	0	0	0	0	4	11	5	3	2	1	0	0	1	0	0	0	0	0	0	27
Plagodis alcoolaria (Guenée)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Caripeta divisata Walker	1993	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	2
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Caripeta piniata (Packard)	1993	0	0	0	0	0	0	0	0	3	3	1	2	0	0	0	0	0	0	0	0	0	0	9
	1994	0	0	0	0	0	0	0	0	6	4	0	0	0	0	0	0	0	0	0	0	0	0	10
Caripeta angustiorata Walker	1993	0	0	0	0	0	0	0	0	0	0	0	0	37	77	41	45	4	1	0	0	0	0	205
	1994	0	0	0	0	0	0	0	0	0	2	10	92	122	71	11	3	1	4	0	0	0	0	316
Lambdina fiscellaria (Guenée)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	8
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	10	17	4	37
Nepytia canosaria (Walker)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	20	12	0	59
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4	10	1	19

Appendix VI. (Continued).

MONTH			APRIL				MAY			JUNE					JULY			AUGUST			SEPTEMBER	
WEEK	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	SUM
Sicya macularia	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	3
(Harris)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	2	9	0	4	0	0	0	0	0	15
Eusarca confusaria	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hübner	1994	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Tetracis cachexiata	1993	0	0	0	0	0	0	0	3	8	4	2	1	0	0	0	0	0	0	0	0	0	0	18
Guenée	1994	0	0	0	0	0	0	0	7	5	4	4	0	0	0	0	0	0	0	0	0	0	0	20
Eutrapela clemataria	1993	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
(J.E. Smith)	1994	0	0	0	0	0	0	0	4	2	1	0	0	0	0	0	0	0	0	0	0	0	0	7
Prochoerodes transversata	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5	12	0	0	22
(Drury)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	2	21	15	2	4	0	62
Nematocampa limbata	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	4	1	0	0	0	0	8
(Haworth)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	4	0	1	1	0	0	0	12
Geometrinae																								
Nemoria rubrifronaria	1993	0	0	0	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	4
(Packard)	1994	0	0	0	0	0	0	0	1	1	2	0	0	0	1	0	0	0	0	0	0	0	0	5
Sterrhinae																								
Cyclophora pendulinaria	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Guenée)	1994	0	0	0	0	0	0	3	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	4
Scopula limboundata	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2
(Haworth)	1994	0	0	0	0	0	0	0	0	0	0	2	6	17	4	2	2	0	0	0	0	0	0	33
Scopula inductata	1993	0	0	0	0	0	0	0	0	0	6	3	7	2	8	0	0	0	0	0	0	0	0	26
(Guenée)	1994	0	0	0	0	0	0	0	0	0	0	13	49	21	4	0	2	1	0	0	0	0	0	90

Appendix VI. (Continued).

MONTH		APRIL				MAY				JUNE					JULY			AUGUST			SEPTEMBER		
WEEK	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	SUM
Larentiinae																								
Dystroma hersiliata (Guenée)	1993	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
	1994	0	0	0	0	0	0	0	0	0	0	0	14	0	4	0	0	0	0	0	0	0	0	18
Eulithis diversilineata (Hübner)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eulithis explanata (Walker)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	4	64	134	369	45	5	5	0	0	626
	1994	0	0	0	0	0	0	0	0	0	0	0	1	20	360	151	211	91	33	3	4	5	0	879
Hydriomena transfigurata Swett	1993	0	0	0	0	0	0	4	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	12
	1994	0	0	0	0	0	0	0	1	0	4	2	0	1	0	0	0	0	0	0	0	0	0	8
Coryphista meadii (Packard)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydria prunivorata (Ferguson)	1993	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rheumaptera subhastata (Linnaeus)	1993	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mesoleuca ruficillata (Guenée)	1993	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2
	1994	0	0	0	0	0	0	0	1	5	1	2	0	0	0	0	0	0	0	0	0	0	0	9
Anticlea vasiliata Guenée	1993	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	1994	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Xanthorhoe algidata (Möschler)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	0	2	0	0	8
Xanthorhoe ferrugata (Clerck)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1994	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Appendix VI. (Continued).

MONTH		APRIL				MAY				JUNE					JULY			AUGUST			SEPTEMBER		
WEEK	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	SUM
Xanthorhoe sospeta	1993	0	0	0	0	0	0	0	0	0	7	4	0	0	0	0	0	0	0	0	0	0	0	11
(Drury)	1994	0	0	0	0	0	0	0	0	0	0	0	11	1	0	0	0	0	0	0	0	0	0	12
Epirhoe alternata	1993	0	0	0	0	0	0	0	0	0	3	3	5	0	0	0	0	0	0	0	0	0	0	11
(Müller)	1994	0	0	0	0	0	0	0	0	0	0	3	1	1	0	0	1	0	0	0	0	0	0	6
Orthonama centrostrigaria	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	2	0	0	0	7
(Wollaston)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	3	1	1	0	0	2	1	10
Eubaphe mendica	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	0	0	0	0	0	4
(Walker)	1994	0	0	0	0	0	0	0	0	0	0	0	5	0	3	0	1	0	0	0	0	0	0	9
Horisme intestinata	1993	0	0	0	0	0	0	0	0	5	10	0	0	3	0	0	0	0	0	0	0	0	0	18
(Guenée)	1994	0	0	0	0	0	0	0	5	2	2	1	3	0	0	0	0	0	0	0	0	0	0	13
Eupithecia pseudotsugata	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MacKay	1994	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Eupithecia spp.	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Curtis	1994	0	0	0	0	0	0	0	2	0	8	0	0	0	0	0	0	0	0	0	0	0	0	10
Cladara limitaria	1993	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
(Walker)	1994	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Lobophora nivigerata	1993	0	0	0	0	0	0	0	0	7	3	2	2	0	0	0	0	0	0	0	0	0	0	14
Walker	1994	0	0	0	0	0	0	0	1	0	4	1	1	0	0	0	0	0	0	0	0	0	0	7
Sphingidae																								
Sphinginae																								
Ceratomia undulosa	1993	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
(Walker)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sphinx canadensis	1993	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Boisduval	1994	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Appendix VI. (Continued).

MONTH		APRIL				MAY				JUNE					JULY			AUGUST				SEPTEMBER		
WEEK	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	SUM
Lapara bombycoides	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	16	11	13	5	4	0	0	0	0	49
Walker	1994	0	0	0	0	0	0	0	0	0	0	0	1	12	0	0	1	0	0	0	0	0	0	14
Smerinthus cerisyi	1993	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Kirby	1994	0	0	0	0	0	0	0	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	4
Paonias myops	1993	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(J.E. Smith)	1994	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	3
Pachysphinx modesta	1993	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
(Harris)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Macroglossinae																								
Amphion floridensis	1993	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
B.P. Clark	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Darapsa pholus	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Cramer)	1994	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
Notodontidae																								
Clostera albosigma	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Fitch	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	2
Nadata gibbosa	1993	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(J.E. Smith)	1994	0	0	0	0	0	0	0	0	2	1	1	1	0	0	0	0	0	0	0	0	0	0	5
Pheosia rimosa	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Packard	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Odontosia elegans	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Strecker)	1994	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Gluphisia avimacula	1993	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Hudson	1994	0	0	0	0	2	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6

Appendix VI. (Continued).

MONTH		APRIL				MAY				JUNE					JULY			AUGUST				SEPTEMBER	
WEEK	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	SUM
Arctiidae **Lithosiinae**																								
Eilema bicolor	1993	0	0	0	0	0	0	0	0	0	0	0	0	12	9	9	17	13	1	0	0	0	0	61
(Grote)	1994	0	0	0	0	0	0	0	0	0	0	3	13	26	62	8	21	19	2	0	0	0	0	129
Hypoprepia fucosa	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0	0	6
Hübner	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	2	0	0	0	0	6
Clemensia albata	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	4	8	14	9	9	0	0	0	0	44
Packard	1994	0	0	0	0	0	0	0	0	0	2	5	5	31	22	1	6	3	0	0	0	0	0	75
Arctiinae																								
Holomelina laeta	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	4	0	1	0	0	0	0	9
(Güerin-Méneville)	1994	0	0	0	0	0	0	0	0	0	0	0	1	2	0	8	2	0	0	0	0	0	0	13
Holomelina aurantiaca	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	30	21	25	6	3	0	0	0	0	85
(Hübner)	1994	0	0	0	0	0	0	0	0	0	0	0	7	44	36	3	13	3	0	0	0	0	0	106
Holomelina ferruginosa	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	6	6	1	0	0	0	0	0	0	13
(Walker)	1994	0	0	0	0	0	0	0	0	0	0	0	11	24	10	5	0	2	0	0	0	0	0	52
Spilosoma congrua	1993	0	0	0	0	0	0	0	0	0	4	2	3	1	0	0	0	0	0	0	0	0	0	10
Walker	1994	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
Spilosoma virginica	1993	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	11
(Fabricius)	1994	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2
Phragmatobia assimilans	1993	0	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Walker	1994	0	0	0	0	0	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Platarctia parthenos	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Harris)	1994	0	0	0	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	4

Appendix VI. (Continued).

MONTH		APRIL				MAY				JUNE					JULY			AUGUST				SEPTEMBER		
WEEK	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	SUM
Grammia parthenice	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	7	1	1	1	0	14
(Kirby)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	11	1	0	1	0	0	22
Grammia virgo	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
(Linnaeus)	1994	0	0	0	0	0	0	0	0	0	0	0	0	2	13	0	1	1	0	0	0	0	0	17
Cycnia tenera	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Hübner)	1994	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Cycnia oregonensis	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Stretch)	1994	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
Ctenuchinae																								
Ctenucha virginica	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
(Esper)	1994	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	3
Lymantriidae **Orgyiinae**																								
Dasychira dorsipennata	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Barnes & McDunnough)	1994	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Noctuidae **Herminiinae**																								
Idia americalis	1993	0	0	0	0	0	0	0	0	0	0	0	6	3	2	3	0	0	0	0	0	0	0	14
(Guenée)	1994	0	0	0	0	0	0	0	0	0	1	0	0	7	1	0	2	0	4	0	0	0	0	15
Renia flavipunctalis	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	5
(Geyer)	1994	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	1	1	0	0	0	0	6
Palthis angulalis	1993	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	2
(Hübner)	1994	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Appendix VI. (Continued).

MONTH		APRIL			MAY				JUNE				JULY					AUGUST			SEPTEMBER		
WEEK	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	SUM
Hypeninae																								
Bomolecha abalienalis	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Walker)	1994	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	4
Catocalinae																								
Scoliopteryx libatrix	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1	0	0	0	0	0	5
(Linnaeus)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	3	0	0	0	0	0	7
Synedoida adumbrata	1993	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
(Grote)	1994	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Synedoida grandirena	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Haworth)	1994	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Zale lunata	1993	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
(Drury)	1994	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Zale aeruginosa	1993	0	0	0	3	4	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
(Guenée)	1994	0	0	0	0	0	1	4	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	10
Zale duplicata	1993	0	0	0	0	0	0	3	14	2	1	0	0	0	0	0	0	0	0	0	0	0	0	20
(Bethune)	1994	0	0	0	0	0	8	5	6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	20
Zale helata	1993	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
(Smith)	1994	0	0	0	0	0	4	3	4	7	1	0	0	0	0	0	0	0	0	0	0	0	0	19
Zale horrida	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hübner	1994	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Euclidia cuspidea	1993	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	3
(Hübner)	1994	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	4
Caenurgina crassiuscula	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Haworth)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	4	3	0	0	0	0	0	0	0	7

Appendix VI. (Continued).

MONTH			APRIL				MAY			JUNE					JULY			AUGUST				SEPTEMBER		
WEEK	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	SUM
Argyrostrotis anilis	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2
(Drury)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Catocala relicta	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Walker	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	2	1	9
Catocala unijuga	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2
Walker	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	8	0	0	0	0	13
Catocala briseis	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	3
Edwards	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	8	3	0	0	0	16
Catocala concumbens	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
Walker	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	4	0	0	7
Catocala ultronia	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
(Hübner)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Catocala manitoba	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	3
Beutenmüller	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	4	0	0	0	9
Catocala blandula	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	5	1	0	0	0	12
Hulst	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	4	0	4	0	0	0	13
Plusiinae																								
Allagrapha aerea	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
(Hübner)	1994	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Pseudeva purpurigea	1993	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	0	0	0	0	0	0	0	4
(Walker)	1994	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	1	0	0	0	0	0	4
Chrysanympha formosa	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	0	0	0	0	0	4
(Grote)	1994	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	2	0	0	1	0	0	0	6

Appendix VI. (Continued).

MONTH		APRIL				MAY				JUNE					JULY			AUGUST			SEPTEMBER		
WEEK	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	SUM
Autographa bimaculata	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
(Stephens)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	1	2	0	0	0	0	0	8
Autographa mappa	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	3
(Grote & Robinson)	1994	0	0	0	0	0	0	0	0	0	5	2	1	0	0	0	0	0	0	0	0	0	0	8
Anagrapha falcifera	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Kirby)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Syngrapha altera	1993	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
(Ottolengui)	1994	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Syngrapha epigaea	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	0	0	0	0	0	5
(Grote)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	1	0	2	1	0	0	0	10
Syngrapha viridisigma	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	3
(Grote)	1994	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	4	0	1	0	0	6
Plusia aeroides	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2
Grote	1994	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	3
Sarrothripinae																								
Nycteola frigidana	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	96	52	34	23	16	0	248
Walker	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	1	10	50	33	42	21	22	10	6	195
Acontiinae																								
Lithacodia carneola	1993	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(Guenée)	1994	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	1	0	0	0	0	0	0	5
Pantheinae																								
Panthea acronyctoides	1993	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	0	6
(Walker)	1994	0	0	0	0	0	0	0	1	2	0	4	2	1	1	0	0	0	0	0	0	0	0	11

Appendix VI. (Continued).

MONTH		APRIL				MAY				JUNE					JULY			AUGUST				SEPTEMBER		
WEEK	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	SUM
Acronictinae																								
Acronicta americana	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Harris	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acronicta innotata	1993	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Guenée	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acronicta tritona	1993	0	0	0	0	0	0	0	0	0	0	0	0	1	4	2	2	0	0	0	0	0	0	9
(Hübner)	1994	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Acronicta grisea	1993	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	4
Walker	1994	0	0	0	0	0	0	0	0	1	3	3	1	0	0	0	0	0	0	0	0	0	0	8
Acronicta quadrata	1993	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
(Grote)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acronicta superans	1993	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Guenée	1994	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	2
Acronicta furcifera	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Guenée	1994	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Acronicta hasta	1993	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	3
Guenée	1994	0	0	0	0	0	0	0	1	1	0	0	0	2	1	1	0	0	0	0	0	0	0	6
Acronicta fragilis	1993	0	0	0	0	0	0	0	0	3	4	12	7	2	0	0	0	0	0	0	0	0	0	28
(Guenée)	1994	0	0	0	0	0	0	4	6	6	1	2	5	3	1	1	0	0	0	0	0	0	0	29
Acronicta retardata	1993	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4
(Walker)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriopodes teratophora	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Herrich-Schäffer)	1994	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2

Appendix VI. (Continued).

MONTH		APRIL				MAY				JUNE					JULY			AUGUST			SEPTEMBER		
WEEK	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	SUM
Amphyipyrinae																								
Apamea nigrior	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Smith)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Apamea amputatrix	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Fitch)	1994	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
Apamea commoda	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	1	0	5
(Walker)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	3	0	1	0	2	10
Agroperina cogitata	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
(Smith)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Eremobina claudens	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Walker)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	4
Oligia mactata	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Guenée)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
Oligia illecata	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	6
(Walker)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	0	4
Amphipoea interoceanica	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Smith)	1994	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Papaipema pterisii	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
Bird	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	3	23
Euplexia benesimilis	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
McDunnough	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Phlogophora iris	1993	0	0	0	0	0	0	0	0	2	1	3	0	0	0	0	0	0	0	0	0	0	0	6
Guenée	1994	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Appendix VI. (Continued).

MONTH		APRIL				MAY				JUNE				JULY				AUGUST			SEPTEMBER			
WEEK	**YEAR**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**SUM**
Conservula anodonta (Guenée)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Enargia decolor (Walker)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	27	47	28	0	104
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	14	46	214	106	173	556
Dypterygia rozmani Berio	1993	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
	1994	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Hyppa xylinoides (Guenée)	1993	0	0	0	0	0	0	0	0	0	5	2	1	3	2	0	0	0	0	0	0	0	0	13
	1994	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	3
Amphipyra pyramidoides Guenée	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	2
Platysenta videns (Guenée)	1993	0	0	0	0	0	0	0	0	0	2	8	12	7	3	0	0	0	0	0	0	0	0	32
	1994	0	0	0	0	0	0	0	0	7	0	5	20	14	1	0	0	0	0	0	0	0	0	47
Cuculliinae																								
Xylena nupera (Lintner)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1994	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Xylena curvimacula (Morrison)	1993	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
	1994	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	4
Xylena cineritia (Grote)	1993	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	1994	0	0	0	0	2	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	6
Lithomoia solidaginis (Hübner)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	2	0	0	7
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3
Lithophane unimoda (Lintner)	1993	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	1994	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Appendix VI. (Continued).

MONTH		APRIL				MAY				JUNE					JULY			AUGUST			SEPTEMBER		
WEEK	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	SUM
Eucirroedia pampina	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3
(Guenée)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	0	6
Platypolia anceps	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Stephens)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	16
Xylotype acadia	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Barnes & Benjamin	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	4
Brachionycha borealis	1993	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(Smith)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apharetra purpurea	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	10	6	4	1	0	0	26
McDunnough	1994	0	0	0	0	0	0	0	0	0	0	0	0	6	4	0	2	8	0	0	0	0	0	20
Homohadena infixa	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
(Walker)	1994	0	0	0	0	0	0	0	0	0	0	0	0	3	3	1	1	0	0	1	0	0	0	9
Oncocnemis piffardi	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
(Walker)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	2	2	0	0	0	7
Sympistis funesta	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Paykull)	1994	0	0	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Hadeninae																								
Sideridis maryx	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Guenée)	1994	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Polia nimbosa	1993	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2
(Guenée)	1994	0	0	0	0	0	0	0	0	0	0	0	1	2	2	4	0	0	3	0	0	0	0	12
Polia imbrifera	1993	0	0	0	0	0	0	0	0	0	0	0	0	7	3	0	0	0	0	0	0	0	0	10
(Guenée)	1994	0	0	0	0	0	0	0	0	0	0	0	1	0	3	1	2	0	0	1	0	0	0	8

Appendix VI. (Continued).

MONTH		APRIL			MAY				JUNE					JULY			AUGUST			SEPTEMBER			
WEEK	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	SUM
Polia purpurissata (Grote)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	27	16	4	8	0	0	0	0	0	55
	1994	0	0	0	0	0	0	0	0	0	0	1	9	4	7	6	9	7	0	0	0	0	0	43
Polia adjuncta (Boisduval)	1993	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	3
	1994	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Polia grandis (Boisduval)	1993	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	3
	1994	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Polia lutra (Guenée)	1993	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polia segregata (Smith)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lacinipolia lustralis (Grote)	1993	0	0	0	0	0	0	0	0	0	0	6	1	0	0	0	0	0	0	0	0	0	0	7
	1994	0	0	0	0	0	0	0	0	0	5	4	0	0	0	0	0	0	0	1	0	0	0	10
Lacinipolia lorea (Guenée)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	3	0	0	0	0	0	0	9
	1994	0	0	0	0	0	0	0	0	0	0	0	0	9	4	0	1	0	0	0	0	0	0	14
Lacinipolia olivacea (Morrison)	1993	0	0	0	0	0	0	0	0	1	4	1	3	1	0	0	0	0	0	0	0	0	0	10
	1994	0	0	0	0	0	0	0	0	3	0	0	4	9	0	0	2	0	0	0	0	0	0	18
Leucania commoides Guenée	1993	0	0	0	0	0	0	0	0	0	0	0	0	3	4	3	0	0	0	0	0	0	0	10
	1994	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	1	0	0	0	0	0	0	5
Orthosia revicta (Morrison)	1993	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	1994	0	0	0	2	5	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17
Morrisonia evicta (Grote)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1994	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Orthodes crenulata (Butler)	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1994	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Appendix VI. (Continued).

MONTH		APRIL				MAY				JUNE					JULY			AUGUST			SEPTEMBER		
WEEK	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	SUM
Noctuinae																								
Agrotis mollis	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Walker	1994	0	0	0	0	0	0	0	0	0	0	0	6	4	0	0	0	0	0	0	0	0	0	10
Agrotis patula	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	1	0	0	0	0	0	0	5
Walker	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Feltia jaculifera	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Guenée)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Euxoa mimallonis	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	1	0	0	7
(Grote)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Spaelotis clandestina	1993	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(Harris)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eurois astricta	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	14	17	3	2	0	0	0	42
Morrison	1994	0	0	0	0	0	0	0	0	0	0	0	0	1	2	10	59	34	16	1	2	1	1	127
Amathes collaris	1993	0	0	0	0	0	0	0	0	0	0	0	0	3	0	5	6	6	12	0	0	0	0	32
(Grote & Robinson)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	6	4	1	17
Eugraphe opacifrons	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	8	0	5	5	1	0	0	25
(Grote)	1994	0	0	0	0	0	0	0	0	0	0	0	0	11	22	6	1	3	0	1	1	0	0	45
Paradiarsia littoralis	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Packard)	1994	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Metalepsis fishii	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	10	6	15	0	0	0	52
(Grote)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	10	9	23	9	11	7	2	76
Aplectoides condita	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Guenée)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1

Appendix VI. (Continued).

MONTH			APRIL			MAY				JUNE					JULY			AUGUST			SEPTEMBER		
WEEK	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	SUM
Anaplectoides prasina	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
(Schiffermüller)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	2
Anaplectoides pressus	1993	0	0	0	0	0	0	0	0	0	0	0	0	12	14	8	2	0	0	0	0	0	0	36
(Grote)	1994	0	0	0	0	0	0	0	0	0	0	2	10	44	49	12	4	2	0	0	0	0	0	123
Eueretagrotis attenta	1993	0	0	0	0	0	0	0	0	0	0	0	0	4	3	1	1	1	0	0	0	0	0	10
(Grote)	1994	0	0	0	0	0	0	0	0	0	0	0	14	1	5	3	1	5	0	0	0	6	0	35
Heptagrotis phyllophora	1993	0	0	0	0	0	0	0	0	0	3	2	1	0	4	1	0	0	0	0	0	0	0	11
(Grote)	1994	0	0	0	0	0	0	0	0	0	0	0	1	0	2	1	0	2	0	0	0	0	0	6
Cryptocala acadiensis	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
(Bethune)	1994	0	0	0	0	0	0	0	0	0	0	0	0	3	1	1	0	0	0	0	0	0	0	5
Abagrotis alternata	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	16	10	5	1	1	36
(Grote)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2
Abagrotis placida	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	7	6	3	0	0	0	19
(Grote)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	0	1	0	0	0	7
Abagrotis apposita	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	12	4	2	2	26
(Grote)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	1	0	3	0	0	10
Rhynchagrotis anchocelioides	1993	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2
(Guenée)	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
∑ Number of Species	1993	0	0	0	8	7	11	12	11	28	45	31	22	34	43	41	42	34	34	30	25	12	4	193
	1994	0	0	0	5	10	15	29	36	48	48	41	51	64	60	45	58	44	33	27	24	21	15	206
∑ Number of Individuals	1993	0	0	0	18	20	27	34	39	73	124	80	89	160	282	301	554	724	323	257	190	86	8	3389
	1994	0	0	0	8	18	41	73	165	176	133	206	704	679	1060	394	743	374	352	158	310	209	215	6018