

PROJECT UPDATE: ARTHROPODS OF CANADIAN PEATLANDS
THE WAGNER PEATLAND
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The following is an excerpt from a report prepared for the Invertebrate Zoology Program of the Provincial Museum of Alberta on the terrestrial fauna of Coleoptera collected in the Wagner peatland.

THE BEETLES OF THE WAGNER NATURAL AREA
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The Wagner peatland lies within the Wagner Natural Area, 9 km west of Edmonton, Alberta, Canada. Motivated by the paucity of entomological information available on Canadian peatlands, and the broad geographic extent of these habitats, the Invertebrate Program at the Provincial Museum of Alberta set out to sample one such area, as part of the project on "Arthropods of Canadian Peatlands" coordinated by the Biological Survey of Canada. From May 3 to September 30, 1985, insects were collected in both pan traps and a Malaise trap (for methods used and rationale for trap placement and trapping method, see Biological Survey of Canada (Terrestrial Arthropods) Newsletter 6(1): 8-15). From these samples, the Coleoptera were separated, pinned, and identified by specialists. It then fell to me to collect the data from these specimens, and perform what ecological analysis were possible on this dataset.

The purpose of this report is therefore to describe the beetle community of the Wagner Bog, in terms of habitat associations and phenology, grouping the beetles by taxonomic categories, trophic levels and size. It also considers the applicability of measures of diversity, and measures of similarity between trap sites, and between bogs. Finally, those aspects of the data which could be profitably elucidated by specialists on particular groups, but which were beyond the scope of this project, are discussed.

Trapping methods and the nature of the dataset

Date of capture, trap number, and species-level identification were available for each specimen. Further, the pan traps had been assigned to nine habitat types, based on vegetation, at the time they were set out. Conceivably, these data could give information on the distribution and abundance of each species represented in the sample.

Data from trapping programs are often misinterpreted by equating relative numbers of individuals with relative population size. At best, however, trapping gives a measure of relative activity: in passive trapping more active individuals are likely to be caught. At worst, traps attract individuals, so that what is measured is relative "trapability", which is of little use in ecological studies. Pan traps were chosen for this study because they collect large numbers of specimens (and are therefore highly valued by systematists) and because they do not, as far as is known, attract individuals from afar. Therefore one gets a large, highly localized, sample of insects.

Comparisons could be made between traps for a given species, between dates for a given species, and between species. Are these comparisons valid in a pan-trapping study? Between traps, if one assumes that relative numbers reflect the relative abundance and activity of individuals of a given species in the vicinity of each trap, comparisons can be made. Between

dates, however, relative numbers do not reflect relative abundances: changes in feeding, activity, or reaction to the trap as an attractant may occur within the adult life history of an individual. It is impossible to compare abundances between species for similar reasons. One species may be more attracted to traps, more active, or less able to avoid traps, and may thus appear to be much more common than an equally abundant species not sharing these characteristics. These biases are not simply theoretical. The buprestid *Anthaxia expansa* LeC. appears to be one of the most abundant beetles in the bog. However, this beetle feeds at dandelions, and is likely attracted to yellow pan traps at ground level. *Chrysobothris trinerva* (Kby), another buprestid, does not feed at flowers, and only one specimen was obtained. Which is the most abundant? We simply don't know. Further, to compare abundances between these buprestids and, for example, a carabid species would be impossible.

These difficulties affect our ability to quantify the diversity of the bog fauna. There are two components to diversity: the number of species present (species richness), and their relative abundances. Numerous indices of diversity have been proposed, which give high values when species richness is high and most species are relatively abundant. Low values result when there is low species richness or when a few species are very abundant while the rest are rare. Unfortunately, before choosing an appropriate index of diversity, one should know the shape of the species abundance curve. This is rarely possible without very careful sampling of an assemblage, or a complete census of the assemblage. In this study, sampling biases prevent the use of any indices of diversity, as explained above, since the relative abundances of beetle species are unknown.

Species richness is easier to estimate than diversity, and the Wagner peatland has produced, so far, 342 species of beetles. Comparisons between trap sites, or between bogs, should thus be based on the presence or absence of species, rather than on diversity, which contains a measure of relative abundance. Presence/absence data can be used to arrive at measures of similarity between two sites, and these can be used to compare sites within the bog, or to compare the Wagner peatland with other similarly sampled localities.

Habitat associations and species assemblages

The 14 trap sites were classified into 9 habitat types (including the Malaise trap as its own type) on an a priori basis at the time the traps were set out. This classification was tested by performing a cluster analysis, based on the presence or absence of beetle species from each trap site. This analysis calculates a similarity matrix between all trap sites, and presents the outcome in the form of a tree. Trap sites were clustered using an average distance algorithm, based on Jaccard's coefficient of similarity.

The result of this analysis is a classification of sites into three distinct habitats, plus the Malaise trap, which is distinctly different from all the pan trap sites. These habitats are 1) open marl flats, 2) the black spruce forest, and 3) sedge and shrub areas. This classification shows considerable correspondence to the *a priori* system, although it is much simpler. The marl flats habitat (1) includes both "marl flats" sites from the *a priori* classification, and one "shore of the marl flats" site. The two other sites from the latter category cluster with the sedge and shrub habitat, and thus this category is of little use in the *a priori* system. The spruce forest habitat (2) includes the "inner hedgerow", "outer hedgerow", and "black spruce forest" sites in the *a priori* classification. The sedge and shrub habitat (3) includes "pool edge", "wet sedge", "wet/dry sedge" and "shore of the marl flats" sites. These habitats could be used to classify different parts

of the peatland and could serve as the basis of an interesting hypothesis to be tested against similar cluster analyses using other taxa (for example the Hymenoptera).

Analysis by systematic group

Of the six series represented, the most speciose were the Staphyliniformia and the Cucujiformia, followed by the Carabiformia and the Elateriformia. The Eucinetiformia and Scarabaeiformia were represented by only a few species. This pattern was reflected in the numbers of individuals collected from each series, although the Eucinetiformia rose in rank considerably due to the large numbers of the helodid genus *Cyphon* (843 specimens, 2 species). Roughly equal proportions of species persisted throughout the season among the six series until the month of September, at which time all other groups disappeared and only the Staphyliniformia remained.

Numbers of species collected in each trap show that the Malaise trap collected by far the richest assortment of species.

At the other extreme, traps in the open marl flats habitat collected fewest species. Proportional contributions by the six series appear to be more or less comparable among the pan traps, but the Malaise trap collected proportionately more species of Cucujiformia and fewer of Carabiformia.

Conclusion and suggestions for further work

This report has attempted to elucidate broad ecological generalizations about the beetle fauna of the Wagner Bog, and to a great extent this effort has been a success. However, given the large numbers of species and individuals represented, the full potential of this dataset has yet to be realized. It is not unreasonable to state that the most useful biological category is that of the species, and that most ecological interactions can best be understood as population phenomena at the species by species level, or as species interactions at the community level.

Thus, to do full justice to this dataset, the phenology and habitat associations of each species should be considered, as should patterns that indicate interactions between species, although not all of the 342 species are represented by large enough samples to make this worthwhile. For some beetle groups (e.g. Carabidae), a great deal is known about the habitat associations and life histories of many species. For most others, this is not so, and here is an area where data such as the Wagner beetle collection may prove of great value to specialists on particular groups. Obscure, rarely collected species may be present, and the added information gained from continual trapping and habitat classification could provide clues to the ecological roles and life histories of these rarely seen organisms.

This project might expand into a second area involving comparisons of peatland sites throughout Alberta, Canada, or the world. As mentioned above, these comparisons could be used to help classify habitats, and to identify assemblages of beetle species over a broad geographic scale. Ideally, the same trapping methods should be used, but since the comparisons must involve presence or absence of species, and not relative abundances, any methods that ensure a more-or-less complete survey of the beetles present are acceptable.

Finally, results obtained using beetle data can be compared with those of other groups of insects. Are the habitats identified here by clustering comparable to those that could be identified by clustering on the basis of the Hymenoptera data, or data for Diptera? Hopefully, these sorts of questions will serve to emphasize the immense potential of this study, and to underscore the need

for careful focussing and prioritization of research goals and objectives in the study of peatland entomology.

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FUTURE RESEARCH ON THE WAGNER PEATLAND

As mentioned in the introduction to this article, the foregoing is an excerpt from the Acorn Report. The report is based on 5,232 specimens of Coleoptera collected in the peatland and presents much more detail than can be covered here. Future research on the Wagner peatland can be divided into three categories: 1) species inventory, 2) Hymenoptera comparison with Acorn's Coleoptera analysis, and 3) comparison of the Wagner peatland with another peatland.

Species inventory

As part of the agreement with the Wagner Natural Area Society, the Invertebrate Program at the Provincial Museum has agreed to provide an inventory of insects in return for permission to sample the fauna. This inventory will be as complete as possible so as to serve as a standard against which other peatlands may be compared. Emphasis in the coming year is on the identification of Hymenoptera, spiders and Diptera collected in our traps.

Hymenoptera comparison with Acorn's Coleoptera analysis

In light of the Acorn Report we are now able to reduce our sampling procedures for Coleoptera to four habitats. This greatly decreases the amount of repetition in sampling inherent in the *a priori* habitat classification and reduces the amount of sampling necessary for peatland comparisons. The Acorn Report poses the question - are the habitats identified here by clustering comparable (for Coleoptera) to those that could be identified by clustering on the basis of Hymenoptera data, or data for Diptera? Since it is beyond our resources to test the Coleoptera clustering against all groups of arthropods collected at Wagner we have selected one group, the Hymenoptera, to be used as a test of the Coleoptera habitat clusterings. The Hymenoptera comprise the largest group of parasitoids in the animal kingdom and as such their distribution reflects that of their hosts, most groups of insects including other Hymenoptera and spiders. The clustering of Hymenoptera, if any, into habitats should reflect that for most insects and spiders found in the peatland. The difficulties with using Hymenoptera are the size of the group, lack of specialists in many areas, lack of keys to many genera and species and size of the sample collected at Wagner peatland. Most of these difficulties have been overcome and 30,000 to 33,000 specimens have been mounted and are being identified as far as possible with present literature.

Comparison of the Wagner peatland with another peatland

In order to place the Wagner study in perspective, the final stage of this study will seek to compare the Wagner peatland with that of another peatland. Samples have been collected from Bistcho Lake in extreme northwestern Alberta during June, 1987. The bog site is characterized by open *Picea mariana* / *Ledum* / *Sphagnum* - *Cladina*. At the time of collection frost (permafrost?) was 25 cm below ground level. The fauna of the two peatlands will be compared for the same period.